**MOBISTYLE**
**MOtivating end-users Behavioral change by combined ICT based modular Information on energy use, indoor environment, health and lifeSTYLE**

**Contract No.: 723032**

**Report:** Evaluation of the effectiveness of the deployed tools, apps and combined information service

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## Executive Summary

Deliverable D6.4 is a report, due at the end of MOBISTYLE project, month 45, 30 June 2020, consisting of the overall validation of the tools and services, improvements and their roadmap to the optimization for a future exploitation.

The main intention of the work reported in this deliverable is to validate the effectiveness of each of the IT tools developed and deployed in MOBISTYLE project. The content of the presented information, the effectiveness of the combination of the information in the campaigns is addressed within D6.3 Evaluation on the effectiveness of the combined information and feedback campaigns, while technical aspects as verification of working deployment or front end usability, are addressed in this D6.4 document.

Some of the MOBISTYLE objectives related to the ICT-tools are addressed in this deliverable in order to explain how the result had been achieved.

Due to the extension of MOBISTYLE project, which had been funded only for some of the IT partners, the validation of the tools had been completed in different months, from the 30th of March 2020 till 30th June 2020.

The deliverable is structured in chapters, one for each of the MOBISTYLE IT tools validated:

- MOBISTYLE Dashboard,
- MOBISTYLE Game,
- MOBISTYLE Expert tool,
- MOBISTYLE Office APP,
- MOBISTYLE Open Users Platform.

Being the solutions at different TRL, they have been necessarily approached in different ways. Introductory paragraph for each chapter, will describe how the validation had been carried on, the validation methodology adopted and the results obtained.

The five tools are deployed on a modular information structure, which is described with the Architecture chart. The Modular Information Structure is used at every access of a user, as it is the outstanding IT structure where information flows.

The five tools have been tested in five demo cases, as in detail:

- MOBISTYLE Dashboard, in non-residential buildings: Italian and Slovenian demo cases
- MOBISTYLE Game, in residential buildings: Danish and Polish demo cases
- MOBISTYLE Expert tool, in all demo cases, for experts analysis
- MOBISTYLE Office APP in offices: Dutch demo case
- MOBISTYLE Open User Platform for external developers interested in accessing aggregated data about all MOBISTYLE connected buildings.

For usability analysis with respect to the Dashboard, Game and Expert tool, external experts have been involved and their work and findings is reported in this deliverable.

## Abbreviations

| | |
|---|---|
| API | Application Program Interface |
| Dx.x | MOBISTYLE Deliverable number x.x |
| DB | Data Base |
| GUI | Graphical User Interface |
| IEQ | Indoor Environmental Quality |
| IOT | Internet of Things |
| ISQTB | International Software Testing Qualifications Board |
| KPI | Key Performance Indicator |
| MCAB | MOBISTYLE Consumers Advisory Board |
| MOUP | MOBISTYLE Open Users Platform |
| MQTT | Message Queuing Telemetry Transport |
| SUS | System Usability Scale |
| TRL | Technology Readiness Level, defined as<br>TRL 1 – basic principles observed<br>TRL 2 – technology concept formulated<br>TRL 3 – experimental proof of concept<br>TRL 4 – technology validated in lab<br>TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)<br>TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)<br>TRL 7 – system prototype demonstration in operational environment<br>TRL 8 – system complete and qualified<br>TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space) |
| UI | User Interface |
| UX | User eXperience |
| V&V | Verification and Validation |
| WP | Work Packages |

## Introduction

WP6 is dedicated to validate the MOBISTYLE approach through its application at different demo cases. Task 6.5 is dedicated to the validation of the IT solutions developed in the project and used by demo cases during the monitoring phase of the project.

Deliverable D6.4 is structured starting from the information collected from previous activities performed during the MOBISTYLE project. In detail, other Work Packages and other Tasks of WP6 have guided the activities:

- Work Package 2, where the methodology has been defined: focus groups have developed the firsts rounds of tests made on the MOBISTYLE tools by users.
- Work Package 4, where the solutions have been developed and reported.
- Work Package 5, where the exploitation has been defined and the MOBISTYLE Open User Platform tool has been developed and reported.
- Work Package 6, other tasks: Users' feedbacks and focus groups are described into Task 6.4 through Deliverable 6.3, in parallel to this D6.4 deliverable. This information has to be used to develop the roadmap, considering the users' needs and comments as a driver to define the relevance and the order in which the technical suggestions from experts and externals will be approached.

Accordingly, while the D6.3 addresses the users' point of view, the D6.4 reports the validation of the IT solutions from a technical point of view.

For the platform validation we refer to the software engineering verification and validation (V&V), that, as defined by the IEEE (Institute of Electrical and Electronics Engineering) standards (IEEE 2012), the process of checking that a software system meets specifications and that it fulfills its intended purpose. It may also be referred to as software quality control. The V&V process carried out for the testing of the software components of MOBISTYLE platform refers to verification of functional requirements as well as non-functional requirements.
As MOBISTYLE tools are available at different stages of readiness, in following paragraphs it will be explained how software verification and validation employs review, analysis, and testing techniques to determine whether a software product and its intermediate deliverables comply with requirements.

The five IT tools developed in MOBISTYLE whose technical validation is reported here are: Dashboard, for both desktop and APP versions, Game, Office App, Experts tool and MOBISTYLE Open Users Platform.

Externals have been involved to validate the solution:

- IT solutions: Usability Experts in the cases of IT tools at TRL at least 7,
- External Advisors: Experts in the specific domain for common users and companies, and
- External Experts: Developers for the testing of the Open APIs of the MOBISTYLE Open Users Platform.

Some validation activities have been interrupted as of 5$^{th}$ March 2020, due to the COVID-19 outcome across Europe. This aspect had been addressed by the entire project and by all project partners. For

D6.4 the unexpected pandemic situation did not affect the technical validation made by usability experts, as done before March 2020, nor the third party developers validation as done as planned during the month of March autonomously by externals.

The MOBISTYLE Consortium Advisory Board (MCAB) has also been involved as experts through series of MCAB webinars where each tool was technically addressed by the different members of the board.

## 1. MOBISTYLE Objectives addressed

In Deliverable D6.4 the validation of the tools will touch also part of the MOBISTYLE objectives, explaining how they had been achieved thanks to the MOBISTYLE ICT-tools.

The objectives addressed in D6.4 are the following:

1. **90% of end users find the GUI usable and attractive.**

The usability and attractiveness from the users' point of view has been analysed during the focus groups through a SUS (System Usability Scale) validation methodology. This methodology has been described in depth in D3.3 Evaluation method to test the effectiveness of the combined feedback campaigns and reported in D6.3 Evaluation on the effectiveness of the combined information and feedback campaigns.
The questions are:

- *"I thought the system was easy to use"*
- *"I would imagine that most people would learn to use this system very quickly"*

The results are reported into the corresponding paragraphs in D6.4.

As the involved end users for the usability analysis were few, the ICT partners opted for the involvement of a Usability Expert. The analysis of three of the ICT-tools solutions has been done with an expert: MOBISTYLE Dashboard, MOBISTYLE Game, MOBISTYLE Expert tool. The other two tools, the Office App, and the Open Platform, did not reach a minimum TRL to have an effective and useful expert analysis. The respective usability reports from the external experts are briefly addressed in the following chapters, while the detailed results are to be found in the Annexes.

2. **90% of end users find the modular information services usable and attractive and are willing to use the services in future.**

The willing to use again the service in the future is given by a question in the SUS validation.
The question is:

- *"I think that I would like to use this system frequently"*

The results are reported into the corresponding paragraphs in D6.4.

3. **50% of end users actually use the modular structure in an active way during the validation.**

According to the given definition of Modular Information Service, reported in the "MOBISTYLE terminology document", the MOBISTYLE platform is modular by definition and by implementation. This means that all the users of the MOBISTYLE platform are actively using the modularity. Details are in chapter 2 of D6.4.
Additionally, all MOBISTYLE solutions are available to be requested for a demo from the MOBISTYLE website at the ICT access tools web page.

4. **Platform operational and used by 25 key organizations by the end of the project.**

This objective results are also explained in D5.5 as it had been reached thanks to validation with externals: MOBISTYLE consumers advisory board (MCAB) for the dashboard, game, office app and expert tool, and 5 external developers for the MOBISTYLE Open Users Platform.

## 2. Final version of MOBISTYLE architecture

The MOBISTYLE architecture has been defined and explained in D4.3 Software modules for user interfaces on mobile devices for the Dashboard, Game and Expert tool, D4.4 Systematic data exchange approach for energy performance, for the office app, and D5.3 Operational MOBISTYLE Open Users Platform, for the MOUP. Here it is reported in a complete and final version including all tools and modules.

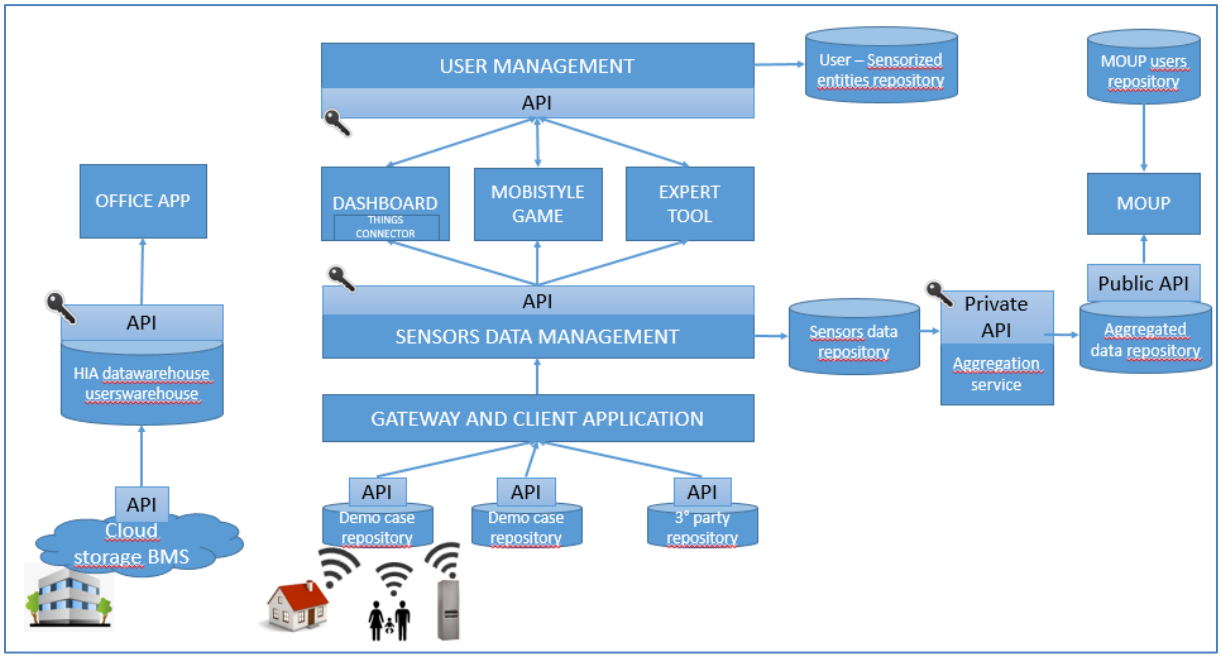



Fig. 1 MOBISTYLE architecture - final version

As shown, the MOBISTYLE architecture is modular as it is made of different modules inter-connected. The architecture diagram shows how a user, once connected, flows across different modules, adopting by definition a Modular Information Service approach:

- User management module to check access permissions.
- One front end tool, considering that tools are specific for different target users, and that a user can have access to more than one tool if he wants.
- Sensors data management module which collects all data from all connected buildings.
- Gateway application module.
- Many data warehouse with different scopes and aggregations of information.
- Buildings modules to collects data from sensors and save them in local repositories.

All the tools make use of sensors data collected from the demonstration cases. Sensors data are related to energy data (both from commercial buildings, apartments and appliances) and Indoor Environmental Quality (IEQ) data. These data are then interpreted in different ways in the four tools and made available to the end users. The MOUP accesses aggregated information through two levels of authentication public and private.

The Dashboard, the Game and the Office App make use also of users' data and comply with the GDPR requirements as indicated in D5.2 and D5.6.

Additionally, what is noteworthy is that the solution is thought to be scalable with the addition of new ICT-tools which can be embedded in the platform as the Dashboard, the Game and the Expert tool are, or can be external but created on the Open Data given by the MOUP.

## 3. MOBISTYLE Dashboard description and validation path

The Dashboard is a tool that allows different kind of users to receive information about the buildings they interact with, through specific authentication, with customized data and information. Different kinds of parameters are received by the building through sensors, and they are shown into the tool through dedicated dashboards which can be personalized by user type for each single building. The Dashboard tool is elaborately described in D4.3, to which D6.4 refers for details.

The purposes of the dashboard are to:

1. Actively involve users;
2. Raise awareness in users;
3. Motivate behaviour change;
4. Stimulate energy usage reduction and IEQ improvement;
5. Give as much contextual information as possible;
6. Create a feedback loop that improves knowledge and awareness into users.

The development of the MOBISTYLE Dashboard has defined following features, which will be explained further on:

A. Customizable sensorized entity structure
B. Articulated users/actors structure
C. Customizable suggestions management

The sensors have been grouped based on the location and provided information in “sensorized entities” (e.g. a hotel room, an office, etc.), from which can be retrieved the current status of the entities and their history. The sensorized entities belong to the demonstration case holder (owner/manager), which have the possibility to decide which information to show to the users and how. Data provided are about: energy usage, appliances consumption, data about Indoor Environment Quality, state of building elements as windows open, occupancy, consumption, and tips about health related parameters.
Information can be given through simple data monitoring, historical trend analysis, specific widgets, and ad hoc suggestions.

An example of a dashboard is the following:

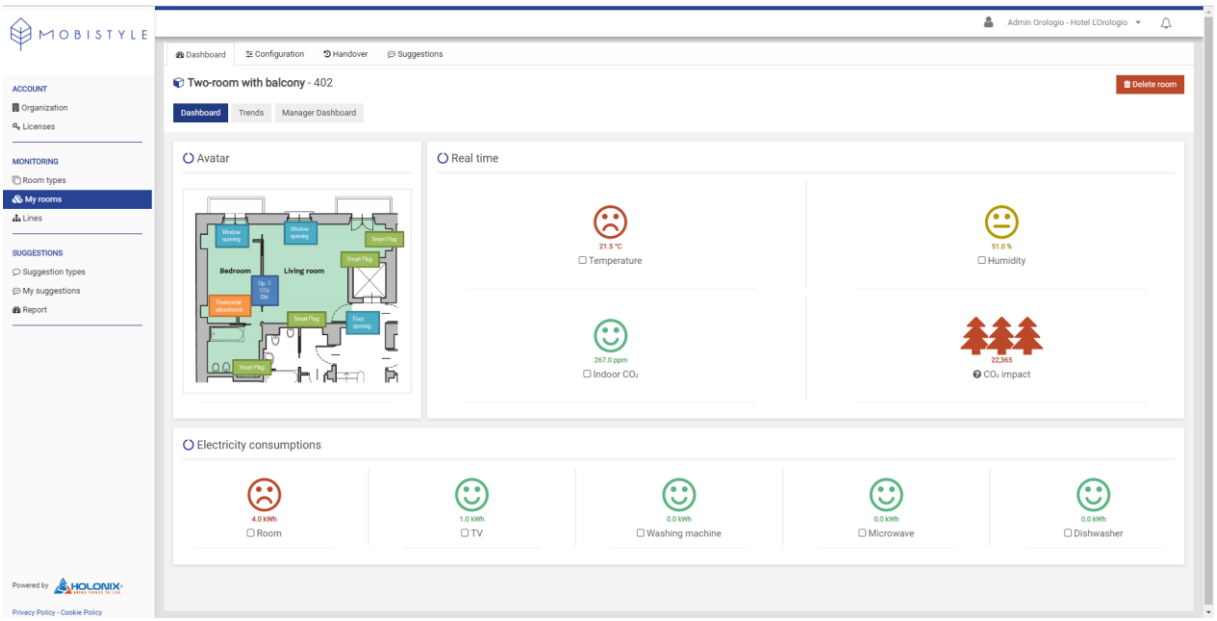



Fig. 2 MOBISTYLE dashboard overview example

***TRL obtained***

The dashboard has been developed in a desktop version which has reached **TRL 7**, and in a mobile APP version, which has reached **TRL 6**. Further exploitation, according to the business models defined in D5.4 will allow the dashboard to reach TRL 8 for both desktop and mobile version.

***Validation path***

For the MOBISTYLE dashboard tool in the desktop version the **validation path** decided is the following. The methodology and the results obtained are reported into chapter 3.1.

1. Step 1: Usability Expert analysis. As the data and the logic which are behind both versions are the same, but the APP version had been considered not enough ready for an external usability test, so the expert usability analysis had been prepared only for the desktop version.
2. Step 2: users' feedback. At demo cases the APP had been used by final users, professors and other office occupants in SI and guests in IT, while the desktop by managers and receptionists. Their feedback has been reported in D6.3 and is summarized here in chapter 3.2.
3. Step 3: external organizations validation. To externals advisors, experts of the specific domain, both solutions had been presented using a video, as the COVID-19 stop has not allowed Italian and Slovenian case to have live data from the month of February 2020 on.

## 3.1. Usability Expert validation

The final version of the HMI was evaluated by heuristic analysis by an ergonomics expert at month37 and month38 of the project by PhD. Doc. Caterina Calefato.

Following the User Centered Design method, once prototypes or artefacts have been developed, their usability and efficiency are evaluated in order to validate them. What shall be considered when conducting an evaluation? The following list pinpoints the main issue that must be investigated:

- is it engaging?
- is it efficient?
- is it easy to learn?
- is it equally usable by different groups?
- what problems do users have?

According to the UX literature, **Usability Assessment Techniques** are divided into:

- evaluation techniques with experts (heuristic evaluation)
- evaluation techniques with users (usability tests)
- mixed techniques between experts and users (cognitive walkthrough)

For this analysis the evaluation with experts was chosen and the expert of Usability and Ergonomics Doc. Caterina Calefato[1] that collaborates with Holonix had been chosen. Methodology details are provided in the next paragraph.

### *Methodology*

Heuristics describe common properties of usable interfaces; it is a "hands-on" learning process. It takes into account the cognitive and behavioural features of users interacting with a system.

Heuristic evaluation (HE) is a **usability engineering method[2].** It is used to identify usability issues in interface design. These issues can then be addressed in the iterative design process. HE employs usability specialists to establish whether each element of a user interface follows a list of established usability criteria. The UX/ergonomics expert examines the interface and judges its compliance with recognized usability principles (the "heuristics"). Additionally, the evaluator considers additional usability principles or results that may be relevant for any specific issue.

Then, evaluators go through the UI at least twice: 1) to get acquainted with the system; 2) to evaluate specific UI elements (information organization, general task flow, mechanisms provided or lack of them; visual characteristics).

Evaluators typically are not domain experts or real users. They have a short time frame to target the most critical usability problems. Identified usability problems are normally restricted to the interface module which is reasonably easy to demonstrate, such as colors, layout and information structuring, consistency of the terminology and interaction mechanisms.

The HE is not suitable to detect usability problems related to the interaction logic of the user, instead. These are detected only by involving end users.

As every scientific method, the HE has a **workflow** to be followed during the analysis. The workflow is shortly presented below. Such a workflow literature prescribes the involvement of the IT-Design team

[1] https://www.linkedin.com/in/caterina-calefato-ui-ux-designer/

[2] Nielsen, J. , 1994, Enhancing the explanatory power of usability heuristics. Proc. ACM CHI'94 Conf. (Boston, MA, April 24-28), pp.152-158.

1. **Pre-evaluation training**: give evaluators needed domain knowledge and information on the scenarios
2. **Evaluation**: individuals evaluate and then aggregate results
3. **Severity rating**: determine how severe each problem is (priority)
4. **Debriefing**: discuss the outcome with design team

The set of Heuristics used into this analysis is the Nielsen Heuristics[3], shown in the figure below.


Fig. 3 One heuristic for each digit (Nielsen Heuristics)

1. **Visibility of system status**: The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
2. **Match between system and the real world**: The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
3. **User control and freedom**: Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
4. **Consistency and standards**: Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
5. **Error prevention**: Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.
6. **Recognition rather than recall**: Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
7. **Flexibility and efficiency of use**: Accelerators — unseen by the novice user — may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

[3] Nielsen, J. (1995). 10 usability heuristics for user interface design. Nielsen Norman Group, 1(1).

8. **Aesthetic and minimalist design**: Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.
9. **Help users recognize, diagnose, and recover from errors**: Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
10. **Help and documentation**: Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

### *Analysis results report*

During this type of usability inspection, usability experts always find many criticalities that are not self-evident during the design phase. The usefulness is exactly these: to find as many problems as possible early in the development of working prototypes, in order to address them before going to the market. More problems are discovered, more useful and effective was the analysis. Hence the huge number of yellow or red criticalities highlighted during the analysis shall not be considered in a negative way. They are rather a chance to improve. The involvement of an Interaction Designer into the design team is suggested for every further future development.

Let's start our analysis report with a quote by Steve Krug that is a reference author into the usability domain:

> "A person of average (or even below average) ability and experience can figure out how to use the thing to accomplish something without it being more trouble than it's worth. Take my word for it: It's really that simple."
>
> Steve Krug – Don't make me think

According to Krug's consideration the following evaluation has been expressed for the tool (shown in figure 2).

The user interface is very complex. It is clear that it reflects the complexity of the software and its function, but the complexity shall not come to the surface. This problem must be considered and solved for successfully approaching the market after the project end.

A way to improve the UI (user interface) is to redefine the **information architecture**, carefully taking into account the user journey, the navigation and the function mapping. The first benefit will drive to a better structured home-page.

In the examined version, the **Help section** is missing: it is strongly recommended to add it, because Help section will support users in solving troubles: tutorial, online manual and FAQS.

The **graphic design** is missing. A proper **design system** is not just a mere issue of aesthetics. It supports the usability, improving affordances, visual cues, icons, labels and buttons, dimensioning fonts and managing the visual hierarchy.


Fig. 4 Expert overall consideration about usability

Then usability analysis focusses specific aspect, giving a priority to the detected criticalities (red-yellow-green), as shown in the following picture.

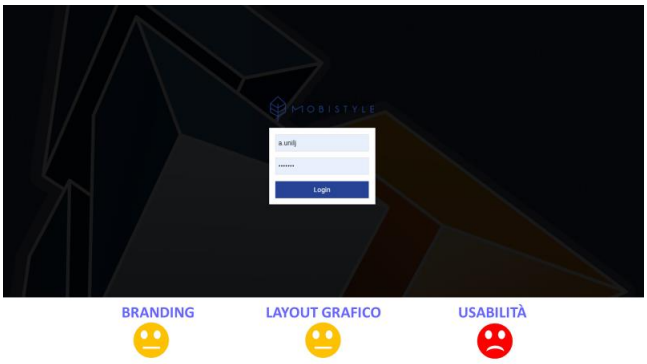



Fig. 5 Example of different priorities in detected criticalities.

For the authentication and login features the following features were evaluated: **1) branding; 2) graphics layout; 3) usability.**

For all the other functions the following features were evaluated: 1**) layout; 2) infographics; 3) usability**. The functions examined are:

1. My rooms/card 1
2. My rooms/card 2
3. Dashboard
4. My rooms/new room
5. Organization

6. Suggestion type
7. Rules
8. My suggestions
9. Search
10. Report
11. Modify profile
12. Roles and operations
13. Users and permissions
14. Licenses

Generally speaking, for each function usability problems were detected (problem). For each criticality, a quick tip of redesign was proposed (solution). The analysis (available into the annex A) is very detailed; hence we propose here the most critical issue to be addressed.

Table 1 Home page analysis

| THE HOME PAGE | |
|---|---|
| PROBLEM | A clear self-evident home page is missing: it seems to be “my rooms”, but it is not sure and clear. Without a home page, users feel lost: “Where am I? If I feel lost, how can return to the home?” |
| SOLUTION | To provide a clear home page, with controlled tasks, standard navigation and controls (e.g. back/forward) |
| PROBLEM | Graphic layout: widgets have all different size; the final effect is of untidy screen. Font are very small, not readable, unit of measure are sometimes missing |
| SOLUTION | Make standard widget, use bigger font to increase comfort readability, use always the proper unit of measure for each indicator |
| PROBLEM | The way to navigate among rooms is clumsy. What does the number state for? The floor? The progression of rooms? |
| SOLUTION | Reinforce navigation with clear indication to avoid the user gets lost |
| PROBLEM | Use of color code not consistent. There is the smile indicator that uses also color (green, yellow, red). Users expect that also the tree indicator uses colors. But it doesn’t change. |
| SOLUTION | Be consistent in creating indicators and their behavior in order to follow user’s expectations |

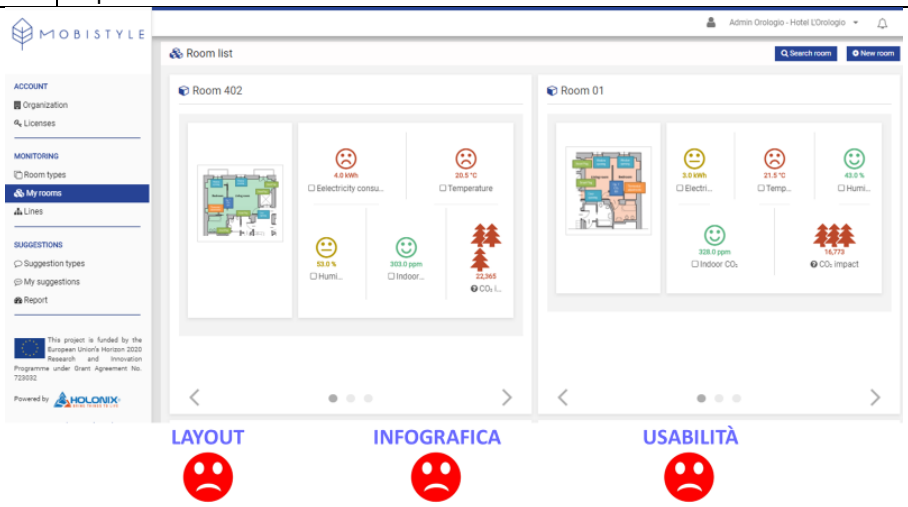



Fig. 6 MOBISTYLE dashboard home page

Table 2 Dashboard analysis

| DASHBOARD | |
|---|---|
| PROBLEM | In the upper level the cards were selectable by clicking, hence the user expects to do the same also in this level |
| SOLUTION | Be consistent in designing the behavior of the components of the screen, in order to follow user's expectations |
| PROBLEM | Label are very small |
| SOLUTION | Increase font |
| PROBLEM | There are checkboxes that do not work |
| SOLUTION | Be consistent in using UI components: checkbox is used for a multiple-choice list, not as placeholder. |
| PROBLEM | There is another indicator that uses smile and color (grey face) whose meaning is not so clear (not working? Switched off? Data connection lost?) |
| SOLUTION | Be consistent in creating indicators and their behavior in order to follow user's expectations |

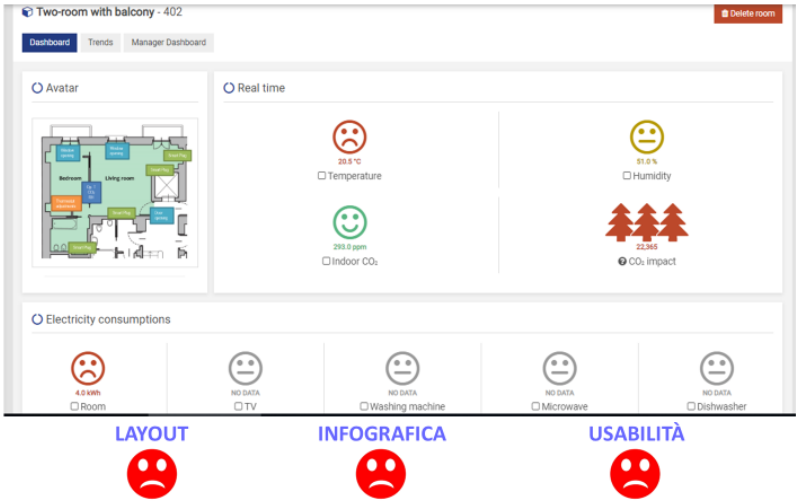



Fig. 7 MOBISTYLE dashboard example

Table 3 Suggestion type and rules analysis

| SUGGESTION TYPE AND RULES | |
|---|---|
| PROBLEM | There is not a self-evident hierarchy model for rules. It is hard to understand how they can be organized. |
| SOLUTION | A visual hierarchy can support the understanding of rule organization. |
| PROBLEM | The effect of adding/removing conditions is not evident. |
| SOLUTION | Add examples or online help to explain which are the effects/consequences |
| PROBLEM | The mechanism to create rules uses a syntax very close to coding conventions, very difficult to be understood by common people |
| SOLUTION | Use plain words for labels |
| PROBLEM | There are not reference for value settings (e.g. min and max value, most used, or average) |
| SOLUTION | Add always scale reference to support user orienting in choosing values |

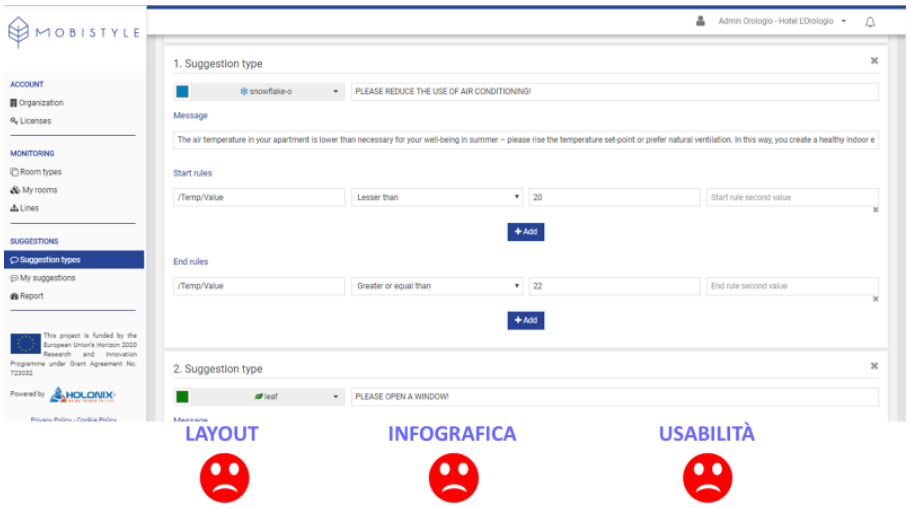



Fig. 8 Suggestion and rules

The expert analysis ends with some **final consideration**, with the aim of wrapping up the deep analysis work that was carried out.


Fig. 9 Final consideration into the analysis report.

The expert final suggestion was to create a **consistent and persistent navigation** that support users in exploring the contents, having always command and controls at their disposal to go back and forth, level-down, level-up.

What is important to manage is not the exact number of clicks a user should perform (3 or 4), but the quantity of reasoning the user needs at each step (i.e. to do each click).

The expert gave us also a simple and effective checklist to be used to evaluate the redesign work. When a page or a software screen is usable and well designed, it will be possible to answer easily to the following questions:

- Which type of site or service is it?
- In which page am I?

- Which are the main functions of this tool? Or which are the main sections of this site?
- Which options have I at this level?
- Where am I positioned into the tool/site hierarchy? (e.g. first level, second level, etc.)
- How can do a search?

The above-mentioned checklist is suited to be used during a cognitive walkthrough[4] test with users, after the project end.

### 3.2. Demo cases feedback collected

#### Italian case

Hereinafter the comments from real users collected in the Italian demo case are report. They are subdivided for target group (staff members and guests) and for mock-up version and final version of the dashboard and App.

**Target group: Staff Members**

**MOCK-UP (testing: Sept2018)**

**Tool: Dashboard**

According to the staff opinion, the Dashboard mock-up is consistent and not cumbersome, and its usage does not require technical support or particular skills. Even if they affirm that the tool is not unnecessarily complex, they are neutral when asked if most people could learn to use the dashboard quickly. However, they feel confident using the tool. Indeed, they think it is easy to use, but none of them has a strong position in affirming that she would be willing to use it. They have a neutral or a weak agreement upon the good integration of the different functions.

**Tool: App**

The staff members are less sure that they would be willing to use the App with respect to what they affirmed for the Dashboard. However, their position of disagreement about too much complexity and of agreement about a good integration in the different functions is stronger when addressed to the App compared to the Dashboard. They have opposite opinion about the capability of people to quickly learn to use the tool.

**FINAL VERSION (testing: Jan2020)**

**Tool: Dashboard**

The Dashboard in its final version results consistent, not unnecessarily complex, not cumbersome and has a good integration of the different functions. Both staff members completely agree about the user-friendliness of the Dashboard, not requiring support or particular technical skills. They agree that people would learn to use the Dashboard quickly. As for the mock-up version, they feel confident using the Dashboard. Despite it is easy to use, they have a positive but not too strong position in affirming that they are willing to actively use it.

[4] Mahatody, T., Sagar, M., & Kolski, C. (2010). State of the art on the cognitive walkthrough method, its variants and evolutions. Intl. Journal of Human–Computer Interaction, 26(8), 741-785.

**Tool: App**
They find the App version quite similar to the web Dashboard, but their user experience is scars because they are not willing to use it in their role of receptionists. As they spend a lot of time using the laptop, they prefer to use the Dashboard.

Reported feedback about attractiveness:

- Preference in using the web version of the tool.
- Lack of perception upon the tools as something which help them to handle daily tasks in their small business setting.
- Relevance of displayed information, but willingness to have also different ones, where the infrastructure allows it (e.g. lighting on/off in the rooms, entrance door openings, etc.).
- Possible willingness in using the Dashboard in future if it were integrated with other services (e.g. direct communication on check-in, request for reviews, etc.) that could make their job faster.

### Target group: Guests

### MOCK-UP (testing: Sept2018) - dummy guests for testing purposes

**Tool: Dashboard**
Three dummy guests feel confident using the mock-up of the Dashboard and they think that most people would be able to learn quickly how to use it. They think it is easy to use and that functions are well integrated and internally consistent. They do not think that it is cumbersome, unnecessarily complex or that requires more knowledge and technical support in its usage. Nevertheless, they have different opinions about the frequency with which they would be willing to use the Dashboard.

**Tool: App**
The usage of the mobile version produces more agreement among the guests in affirming their opinions, which are similar to the ones expressed for the Dashboard. However, dummy guests are surer that they would be willing to use the App compared to the Dashboard.

### FINAL VERSION – 1 guest

**Tool: Dashboard**
No personal feedback. Only one concern: finalization of the handover procedure via email is not transparent; automatic email can seem spam.

**Tool: App**
No personal feedback. Only one concern: timing of the feedbacks. For example, receiving pop-up about poor quality of indoor air by night because of high concentrations of $CO_2$ is not relevant and appreciated.

## Slovenian case

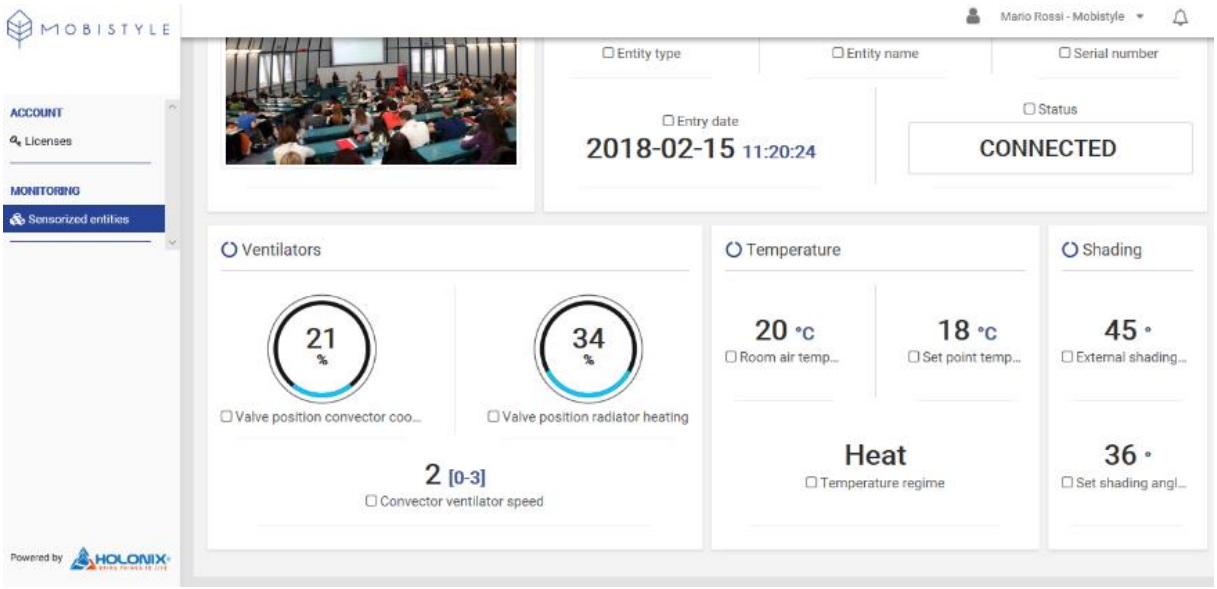
Below comments from real users collected in the Slovenian demo (university buildings) are reported.

### MOCK-UP (testing: March 2018)

**Tool: Dashboard**

Participant of the focus group testing were diverse, from professor, students, care taker, person responsible for maintenance and safety systems. Among comments reported in focus groups report, are e.g. suggested symbol for intuitive understanding of comfort could be a smiling face. It was noted, that the massage must not be wrong, otherwise the trust is lost. Each advice given (advice texts were tested as well) has the context and the best channel (e.g. use of stairs instead of elevators). It was concluded, that no SMS but push massages are preferred. There should be not more than 2 per day and possibility of disabling them.

Participants agreed that the interface is beautiful and clear. They see it is intended for facility management.




**FINAL VERSION (October 2019)**

Four people that took part of final testing focus group participant were the same the whole process, and those were the users of the platform and app (responsible for maintenance and safety systems in the building, occupational safety specialist, professor, assistant). The ICT solutions in focus were: dashboard use on phone (as an app) and desktop PC via web page.

**Dashboard (ICT tools) use**

They did not use the app very much; more in the beginning, than less. They stated that they do not need the ICT tools, but would like to keep the device on the wall (LED sensor). There was quite poor interest in ICT tools. They managed to login, then: ''*I forgot the URL and password...and I give up*.'' Interesting remark was that parameters are roughly constant, daily trends were the same, once they followed them. It was interesting to see the parameters when in the office, however, if they get notification to ventilate the office when at home, this makes no sense.

It seems that ICT tools represent too much of an additional cognitive burden to the room users. They look at them in the beginning and later they tend to lose interest. Information needs to be presented

in the *context*; one should be aware of poor air quality when he or she is in the room and not somewhere else.

Sensors should be regularly checked and calibrated in order to make trustworthy measurements, since equipment can always fail. Push notifications should not be sent too often – only when urgent or necessary. IAQ parameters are mostly constant, thus not so interesting. Parameters, such as temperature, humidity and $CO_2$/VOC concentrations could be shown on the sensor itself. Identifying the right reason for poor air quality is critical so that the measures are effective (robes, shoes, cleaning chemicals, etc.). Colours from green to red are suitable.

### 3.3. External Experts Advisors feedback

On the 11th of June 2020, Holonix has presented the Dashboard solution to the Consumers Advisory Board. In this webinar Holonix has explained the activities that conducted to the completion of the ICT-tool for MOBISTYLE. The requirements collected, the solution implemented, the technicalities, specific features and a demo of the solution. Impacts and an overview of the business model had been presented too. The audience asked questions about the exploitation roadmap and the possibility to connect additional buildings, which was satisfied with positive answers. The screenshots from the incoming final version had been presented.

Five organizations participated to the MCAB webinar: REHVA, Bgrid Solutions, EHPA (European Heat Pump Association), Active House and ESD. Due to confidential nature of the discussions, only pitch recording is available: https://youtu.be/os0D6L_XDUg.

At the 23rd of June 2020 a presentation was given at the BUILDUP platform, see recording: https://www.youtube.com/watch?v=H9JW6BdbUME&feature=youtu.be.

## Literature review

In order to have a more complete picture of the effectiveness of the eco-feedback provision through monitors (e.g. in-home screens, dashboards etc.) and to investigate future developments of the dashboard, a literature review concerning previous scientific studies related to these topics, especially in hotels, was developed by POLITO. The results are reported in the following.

Ambient displays, web-based and mobile dashboards can be defined as information systems aimed at visualizing energy-related information in order to infer building occupants' behaviour, usually in order to reduce buildings energy consumption or to ameliorate indoor spaces environmental quality. In literature, such interfaces are usually identified as eco-feedback technologies, and their use is based on the hypothesis that building occupants are usually unaware of the energy impact of their actions through the building (Froehlich *et al.*, 2010). Therefore, these interfaces are usually used to inform or even influence energy-relevant choices made by building occupants, sometimes having as a target not only the users of a single building, but a community (Pierce, Odom and Blevis, 2008). The information provided by these interfaces can be various in terms of typology (e.g. energy consumption, indoor environment conditions), elaboration (e.g. raw data, indicators) and representation methods (e.g. scientific representations, abstract or metaphorical) (Kim, Magerko and Hong, 2010). These instruments can integrate different services, which can go from data visualization to action advices (which require actions on a separated device) and direct management of households or other end uses (Van Dam, Bakker and Van Hal, 2010).

Dashboards and other types of energy-visualization displays are more studied in residential contexts (Hargreavesn, Nye and Burgess, 2010; Costanza, Ramchurn and Jennings, 2012; Van Dam, Bakker and Van Hal, 2012; Vassileva *et al.*, 2013; Schultz *et al.*, 2015; Asensio and Delmas, 2016; Wood *et al.*, 2019) than in other building typologies, such as office buildings, public spaces and university campuses (Timm and Deal, 2016; Petersen *et al.*, 2017; Sanguinetti, Dombrovski and Sikand, 2018; Zhuang and Wu, 2019). This phenomenon is mainly dependent on what Pierce et al. defined "use-context", which is strictly related the objectives that the use of these instrument can permit in different building typologies. Indeed, building typologies determine different degrees of occupants' energy-related control potential. For example, normally home owners have a quite high control over their own energy use, while in public buildings, e.g., the most energy use is handled by third parties (Pierce, Odom and Blevis, 2008). In dormitories and hotels, based on single cases specificities, building occupants could have a higher or lower control potential, which should be taken into account when defining the objective of implementing an energy-visualization interface. Indeed, offering behavioural cues or creating awareness on the impact of energy-relevant actions, should be done only referred to actions that can be directly performed by occupants. For this reason, some research show that in buildings in which occupants have a low level of control energy visualization tools can be addressed only to promote sustainable lifestyles and values to raise public awareness on the topic (Pierce, Odom and Blevis, 2008).

Based on these elements, the efficacy of energy visualization tools should be contextualized to building typologies and to the objectives that such instruments can realistically pursue. In a hotel, which is the one of the case study of this work, the definition of the objectives connected to the use of a dashboard should be based on the real control potential of the different personas present in the building (guests, receptionists and building manager) and their energy control opportunities, which could require a different design of the interface in terms of functionalities, behavioural cues and feedback typologies and appearance. In the following, based on the comments gathered from different users of the MOBISTYLE dashboard and evidences from the literature, fragilities and opportunities for future enhancement of this interface are outlined.

The first aspect that emerged from the comments of the receptionists and the guests is that the use of the dashboard requires a strong motivation from the occupants. This element is confirmed, in general, by the literature, from which it emerges that, especially if the visualization tool does not permit a direct action on the device, it will obtain the attention only of people previously interested in sustainability (Vassileva *et al.*, 2013). From all the three personas perspectives, the biggest fragility of the MOBISTYLE dashboard is that the feedback alone (both in terms of behavioural cue and data analysis) is not sufficient to trigger occupants' interest on the device, because they do not perceive a direct benefit in using it. From the perspective of the hotel guest, for example, the visualization of energy consumption data profiles could not be interesting per se, since he would not directly benefit of an energy expenditure reduction. Moreover, as mentioned by (Hargreavesn, Nye and Burgess, 2010), occupants' usually change their energy-related behaviour (e.g. use of appliances) only once they understood which is the "baseline" energy consumption of the building, which requires a certain amount of time that would probably be not sufficient for hotel guests. Therefore, in designing an efficient dashboard for guests, the most difficult point will be to find a method to configure it in a way that it can be perceived as an additional service offered by the hotel. In fact, the only provision of a

feedback has been found as not effective by Schultz et al. and could, indeed, make occupants feel as "subjects of an experiment", inducing the so-called Hawthorne effect (Schultz *et al.*, 2015; Wagner and O'Brien, 2018). In order to design a dashboard that will be perceived as an "additional service" for the hotel guest, two main evidences emerged from the literature. First, that especially in non-residential buildings, the presence of feedback and control (actuator) in the same device is best, because i) otherwise a higher effort is asked to the user and ii) this way they will more efficiently relate their actions to their impact on energy and environmental terms (Yang *et al.*, 2016; Zhuang and Wu, 2019). For example, if a message will be shown in the dashboard asking to the guest to lower the temperature set-point on the thermostat, the best would be that this action can be directly performed on the same device. The second aspect, emerging from several researches, is that especially if the energy visualization tool will be used by non-experts, the aesthetic of the device, its position and the way information is provided is crucial to determine its efficacy (Rodgers and Bartram, 2011). In this direction, Kim et al. listed a series of design features that feedbacks should have to be more efficient and attractive, highlighting that iconic and metaphorical images are more efficient in triggering occupants' awareness in respect to indexical representations (Kim, Magerko and Hong, 2010). For example, Pierce et al. mentioned the potential of informative art, which is intended as a "decorative information visualization" in the sense that it is easily readable and aesthetically attractive, but it does not miss its informative value (Pierce, Odom and Blevis, 2008). In terms of information type, beyond energy consumption and indoor environmental parameters, Asesio and Delmas reported the effectiveness of providing health-based feedback (Asensio and Delmas, 2016). However, in order to be effective, there are two characteristics of feedback provision emerging from the literature which should be considered for future enhancement of the MOBISTYLE dashboard. The first is the relevance of providing data with the shortest delay possible (or possibly real-rime), since usually occupants are not aware of their energy-relevant actions (e.g. the use of most appliances) after a long interval of time (Rodgers and Bartram, 2011). The second is the "quantity" of feedback and information provided, which should be carefully chosen in order to avoid an information overload, leading to an inefficient comprehension of the visualized data (Strengers, 2011; Sanguinetti, Dombrovski and Sikand, 2018).

From the perspective of the workers of the hotel, a distinction should be done between the dashboard for the receptionists and the "manager" configuration, even if in both cases the way to trigger their use of the dashboard would be i) to offer a facilitation of their work (e.g. reduction of time to perform some actions) or ii) to offer a service that could be appreciated by guests. Considering the receptionists, the considerations to be made will be very similar to the ones related to hotel guests, with a few additional thoughts to be made about the possibility of losing interest in the device after a certain period of time, which would be particularly probable especially if its use will not be perceived as useful for their daily work (Van Dam, Bakker and Van Hal, 2010; Strengers, 2011). In this direction, also for receptionists' dashboard, the inclusion of direct control possibilities on the interface (e.g. adjustment of thermostats or management of appliances such as printers) will be crucial. Also adopting the perspective of the "manager", the possibility of adding control possibilities to the dashboard interface could represent an interesting enhancement. Indeed, if for the guest the inclusion of controls represents an additional mean to make the dashboard perceived as an additional service of the hotel, for the manager this feature would represent an opportunity to i) avoid energy wasting (e.g. having the possibility of directing switch off lights or appliances erroneously left on by guests), ii) detect failures on systems (Timm and Deal, 2016) and iii) offer an additional service to guests (e.g. using the

environmental monitoring in order to learn their preferences in terms of indoor temperature and setting thermostats accordingly).

### 3.4. Synthesis and list of optimizations to be applied

The redesign phase followed the well-consolidated Norman approach to the user centred design[5].
The Norman design principles are presented in the following:

- **To provide visibility:** (to make functions visible)
- **To provide a good mapping** (to create logic – spatial links between controls and the effects of their use)
- **To provide invitation and constraints to use** (to use affordances and constraints to guide the interaction)
- **To provide feedback** (to provide feedback as a consequence of each action)
- **To provide a good conceptual model** (to make sure that the system provides the information essential to understand the structure and the functioning.

The redesign phases addressed as many as possible tips received from the usability expert. The result of the redesign work is presented in next paragraphs. Pages and functions that underwent the revision process were the same presented in the previous paragraph.
In next section a detail of the implemented modifications will be presented.

#### Login

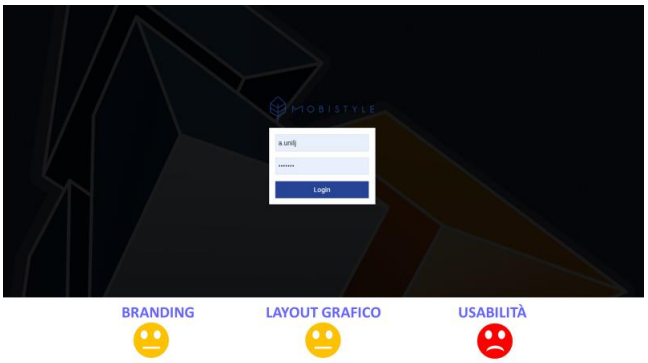



Fig. 10 Login page before the redesign

[5] Norman Donald, A., 1988, The Psychology of Everyday Things, Basic Books, Inc., Publishers, New York.

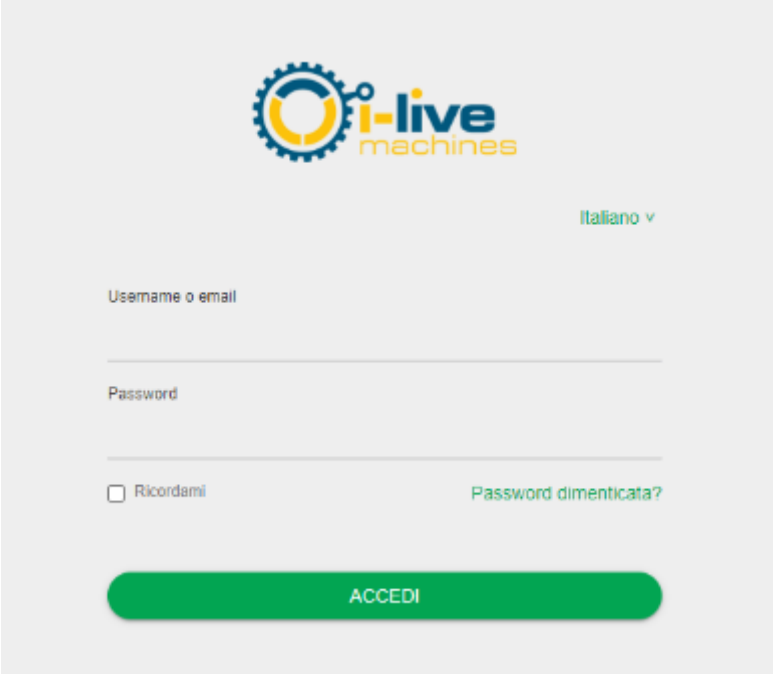



Fig. 11 Login page after the redesign

The redesign encompassed the following issues:

- The look and feel is compliant with the whole graphics of the tool
- Utilities for memorizing and retrieving credential has been added
- It is possible to change the language before logging in
- Each input field has an appropriate label
- The login button is big and clear
- The branding of the tool is consistent and highlighted

### The Home Page

The redesign encompassed the following issues:

- A more effective and standard navigation has been implemented: the navigation is managed by a list and it positively affect the orientation of the user, reducing possible situations of feeling lost
- The list reduces also the latency time of data upload: considering that the user before navigates the list and then chooses the dashboard, data will be requested to the system less frequently, hence the user has to wait a bit just when s/he has chosen the page

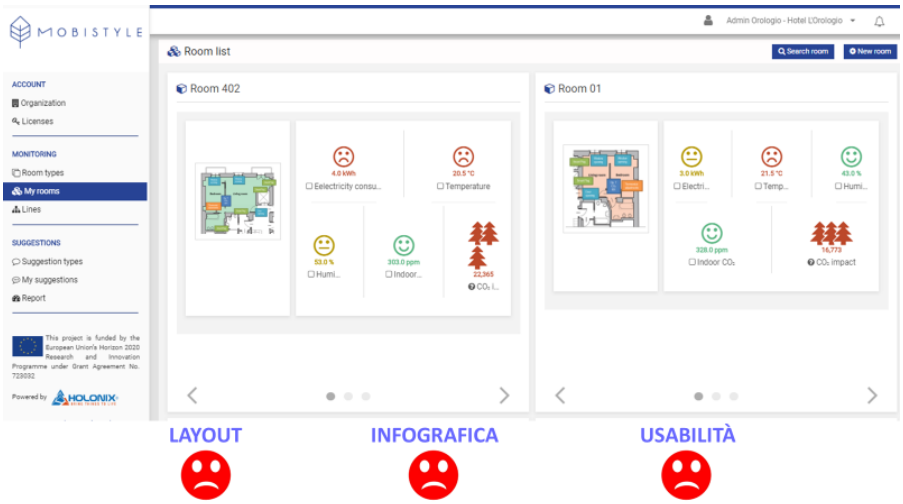



Fig. 12 Home page before the redesign

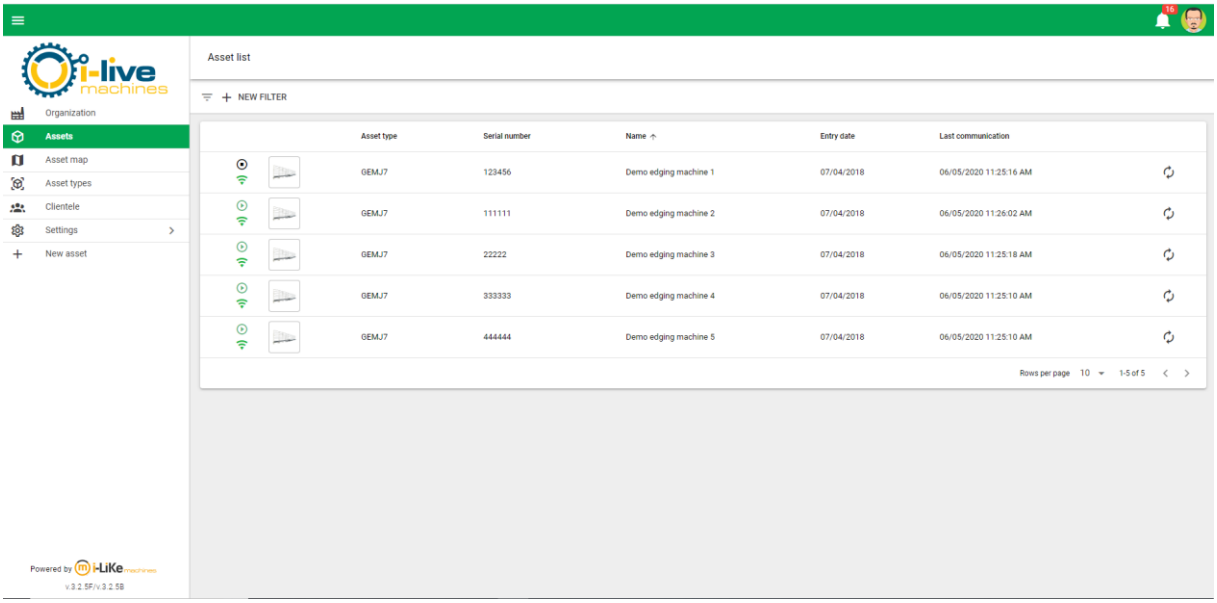



Fig. 13 Home page after the redesign

## Dashboard

The redesign encompassed the following issues:

- The excessive number of graphics layers were removed
- It is possible to filter the information presented into the dashboard according to the date
- The behavior of the UI components is more consistent now
- Placeholder resembling checkbox were removed
- The color code has been remapped following well-known conventions and a legend has been provided, improving user comfort
- The unit of measure can be customized and hidden, if the user chooses this option into the settings, but the default option is set to show the unit of measure, that is a standard behavior

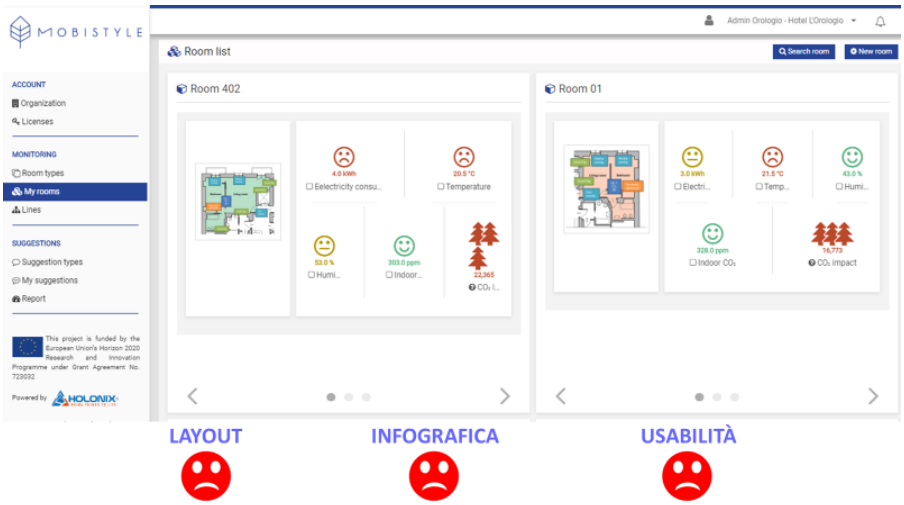



Fig. 14 Dashboard before the redesign

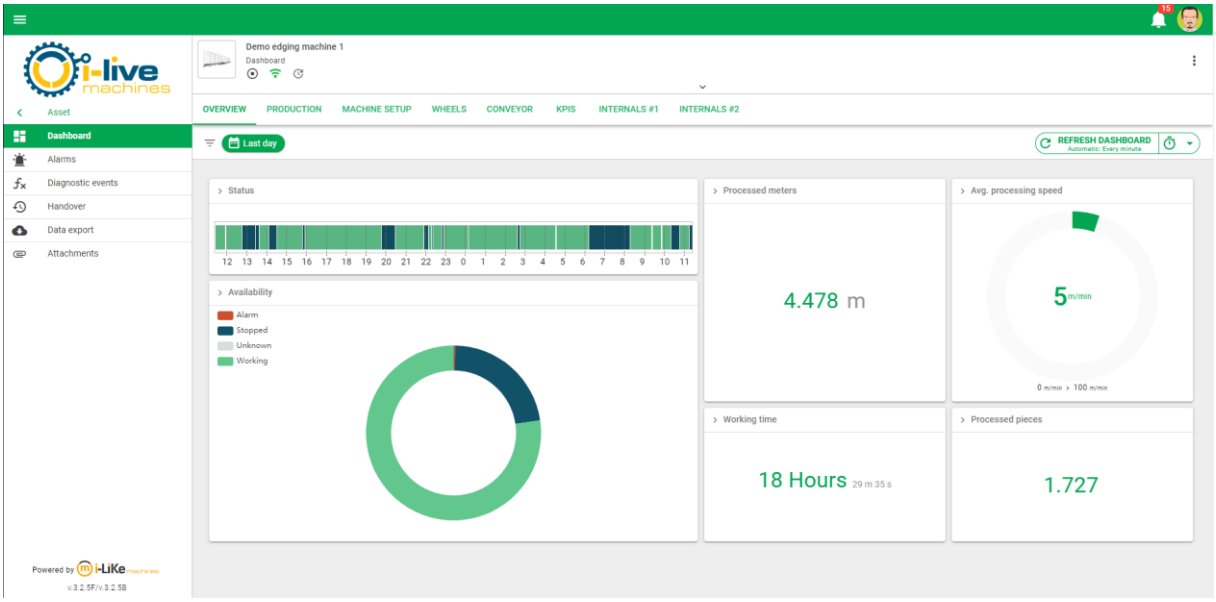



Fig. 15 Dashboard after the redesign phase

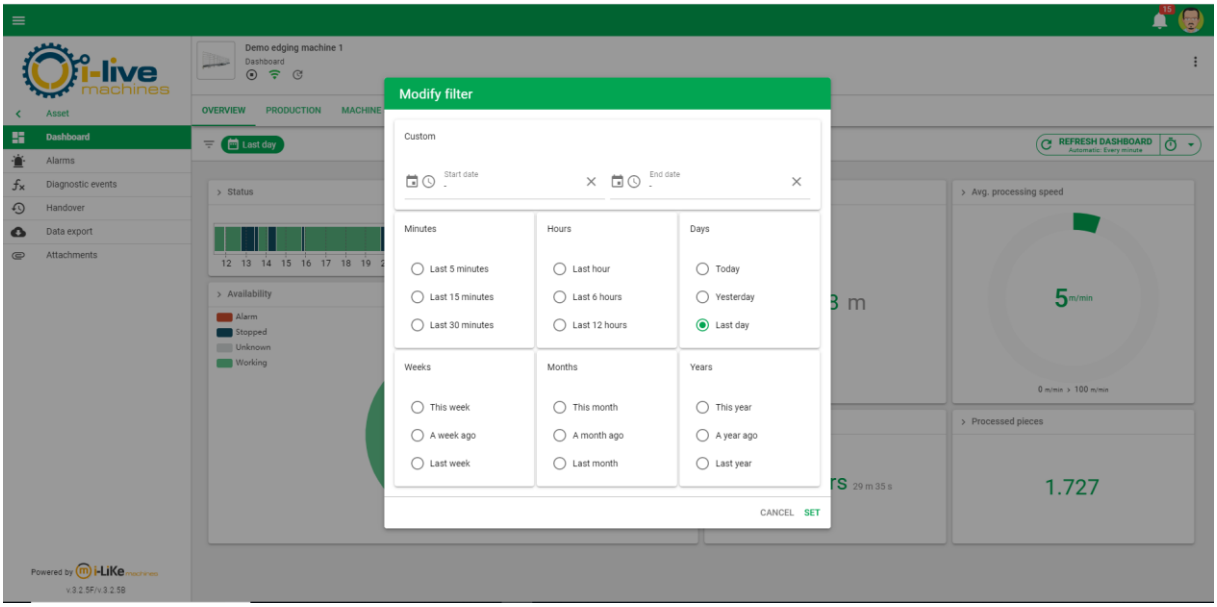



Fig. 16 Dashboard filter after the redesign phase

## Suggestion

The redesign encompassed the following issues:

- The logic to manage the notification has been improved. It is possible to customize the timing, in order to avoid users to receive notification in not suitable times
- Considering the complexity and importance of the rules setting, this function will not be managed by the end-user, but only by technicians/admin (that have the permissions)
- The navigation of the rule is the managed by a list, as in the home page
- Once an item is chosen a modal allow to set parameters
- Parameters have been enriched with more values and options.

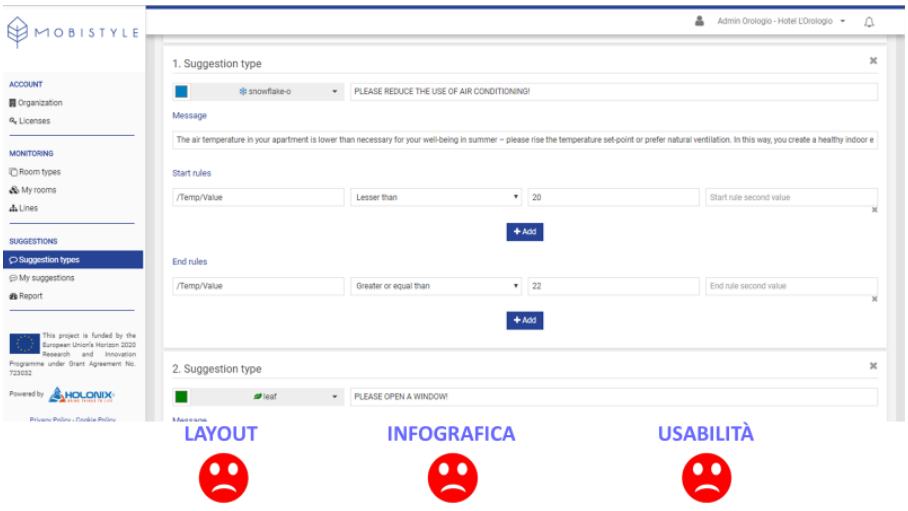



Fig. 17 Rules before the redesign

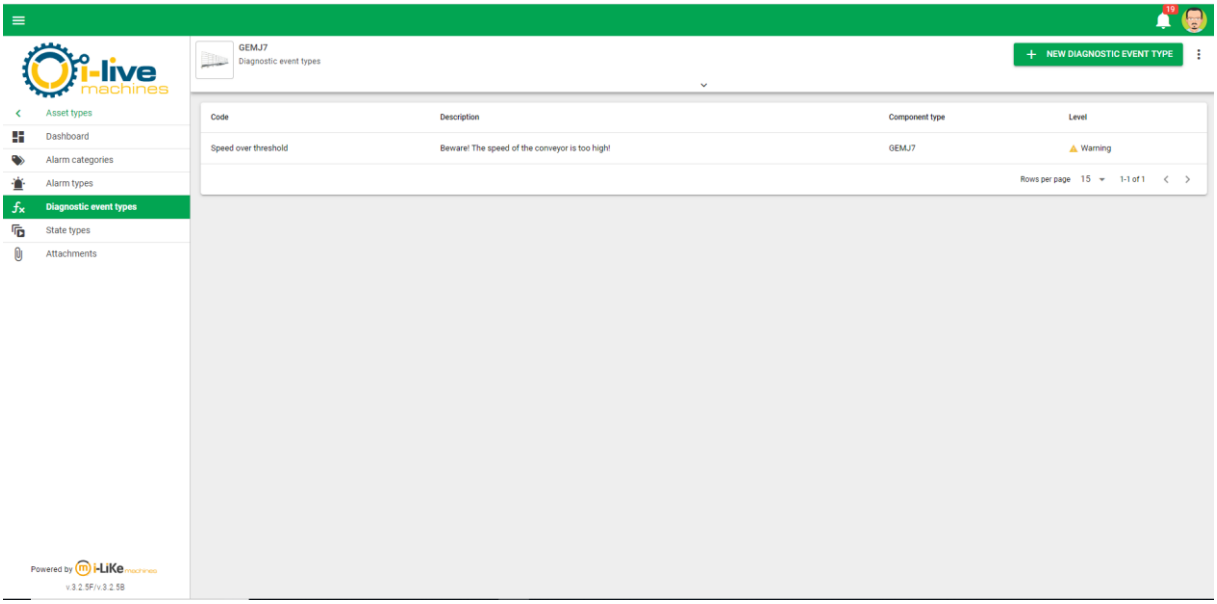



Fig. 18 Rules after the redesign

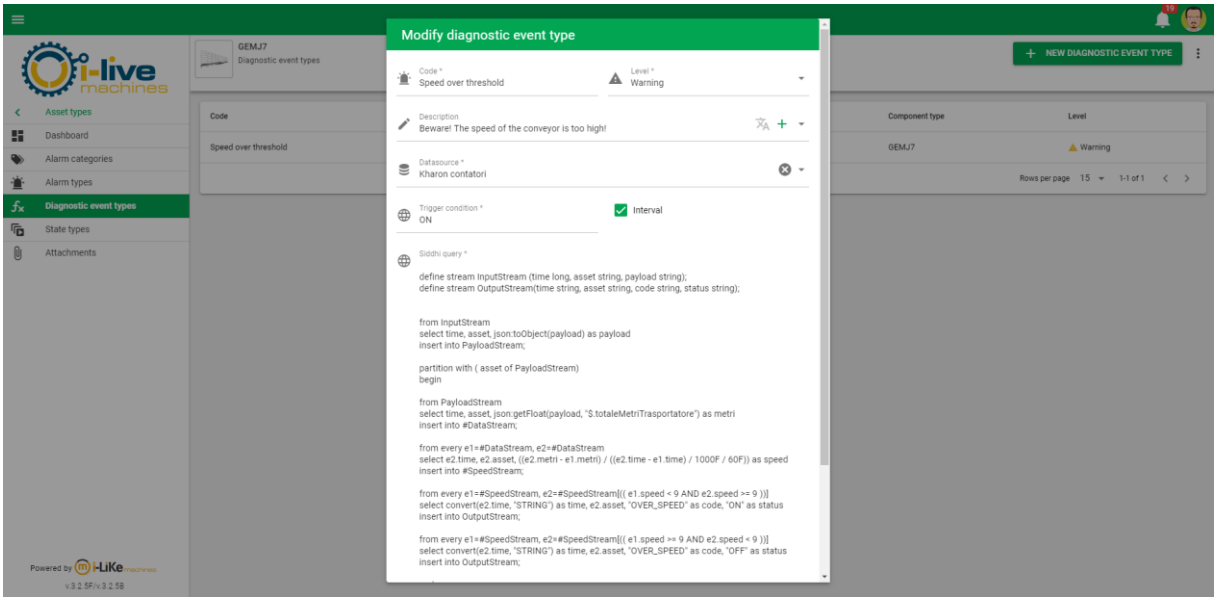



Fig. 19 Rules (modify diagnostic event) after the redesign

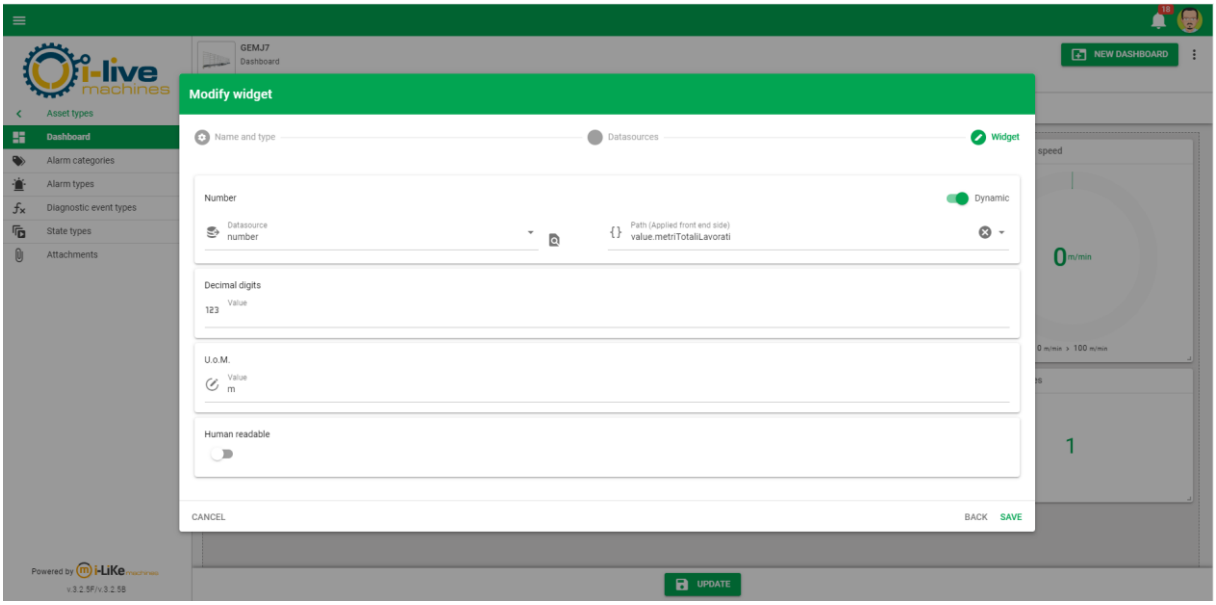



Fig. 20 Rules (modify widget) after the redesign

## 3.5. Improvements roadmap to exploitation

The expected exploitation of the MOBISTYLE dashboard, according also to what explained in T5.4 and T5.5, aims at selling the solution completed in about one year from the project ends. The alfa version is under development at the moment, as explained in paragraph 3.4. The demo cases of MOBISTYLE can be used as testimonials to show to show how the solution had been tested and piloted, to potential customers.

Agreements with Experts are a must have, actually under discussion with three partners: DMO, IRI-UL and POLITO. The involvement of experts is a need to ensure the accuracy and efficacy of the information proposed to the customer. This will be the key element to raise satisfaction in real users.

A high level of customization is expected, according to the customer's specific nature and needs.

The solution will be supported by a dedicated web page, materials, web presence, and ad hoc marketing campaign.

# 4. MOBISTYLE Game description and validation path

The MOBISTYLE Game App is a gamified app for behavioural change regarding energy use and also for awareness creation on associated health benefits. The development of the Game App followed the project's people centric approach and relies on the operationalization of positive energy use behaviours in measurable actions that can be captured by sensors within the environment. Based on the analysis of the captured data, the Game App provides incentives in the form of recognition, achievements and suggestions with the ultimate goal to encourage the users to adopt and sustain the desired behaviours towards better energy efficiency and also create awareness through providing useful health tips.

***TRL obtained***

The MOBISTYLE Game App reached **TRL 7** in the duration of the project. The final system prototype was demonstrated in the two residential use cases in Denmark and in Poland with end users.

***Validation path***

The validation approach that was adopted for the MOBISTYLE Game App was in line with the project's people centric approach and comprised of two parts:

- The Game App addresses the two residential demonstration cases (PL and DK) hence there was a close collaboration with the demonstration case holders and support from the energy experts (AAU, POLITO). During the development of the solution several feedback loops informed its design. A set of mock-ups and interactive mock-ups were used to collect feedback on the user experience from the residential demo cases (see D4.3).
- In addition to the feedback received from end users, a usability evaluation was conducted by an external expert.

## 4.1. Usability Expert validation

### *Methodology*

A heuristics approach was adopted for the usability evaluation of the MOBISTYLE Game App by an external expert. The expert compiled a detailed report analyzing the Game App, using a color code system to reflect the importance of the impact on user experience. In detail, the following codes were used:

- **Critical issue**: user may not be able to continue navigating, access to the information or understand the information showed.
- **Major issue**: user may not be blocked in the app but finding the way to use it may be too difficult.
- **Minor issue**: user may be able to continue using the app normally, but it is not a right use of the interaction patterns and/or may interfere with a professional look and feel.
- **Good design** decisions and elements that works well.

### *Analysis results report*

The usability report covered several aspects of the solution, such as information architecture, navigation, visual design, information display, gamification, consistency, feedback and notifications, semantic colors and texts. The detailed report is available in Annex 2. In this section we'll provide a summary of the results of the usability report.

**Overall Evaluation**

The MOBISTYLE Game App strong points are information architecture and the usefulness of the content it is offering. For the user it is easy and effortless to receive the relevant information.

The visual appearance could be improved in order to achieve a more appealing final product.

Regarding the navigation and interaction with the Game App, small fixes could be implemented to achieve a better experience. The main navigation is very well ideated and with the implementation of some small tweaks an excellent experience could also be achieved in this area.

Finally, regarding the gaming feel, the Game App could benefit from additional features that would result in a more involved and engaged user.

It's worth noting that the amount of gamification options is limited by the design objectives of the MOBISTYLE Game, where the relevance of the recommendations is a core goal and is interlinked with the availability of relevant installed sensors to enable the corresponding rules.

## 4.2. Demo cases feedback collected

During the deployment period, the use case representatives reported issues that were found either by their technical teams in validation and as deployment progressed. Reported technical issues that were considered as bugs in the Game App were addressed and resolved, including updates necessary to support newer versions of Android OS. Corrections of the app were released to the Google play store, to be automatically updated according to each user update settings. In addition, a number of improvements on the UI elements of the app were introduced as direct feedback from the use case.

## 4.3. External Experts Advisors feedback

On the 18th on June, HighSkillz presented the Game solution to the Consumer Advisory Board. In this webinar HSZ presented the activities conducted and the core results of the Game solution.

The audience asked about the possibilities of having the Game being used as the basis for a broader-scope app used to directly manage sensors and smart plugs at home, to which it was answered that the Game and related services were not the best candidate for a generalist sensor management application, as they were not developed with that scenario in mind, and that they would be better suited to process data to be used by existing 3rd party sensor-native apps (such as the one that Lerta provided for the users of the PL use case).

Five organizations participated to the MCAB webinar: REHVA, Bgrid Solutions, EHPA (European Heat Pump Association), Active House and ESD. Due to confidential nature of the discussions, only pitch recording is available: https://youtu.be/Kp-imr0_pG4.

At the 23rd of June 2020 a presentation was given at the BUILDUP platform, see recording: https://www.youtube.com/watch?v=H9JW6BdbUME&feature=youtu.be.

### 4.4. Synthesis and list of optimizations to be applied

In terms of the MOBISTYLE Game design and UX, the following actions could help address the usability and adoption concerns that were identified:

- The navigation system of the application could be simplified and made more intuitive;
- The presentation of data should indicate more clearly if data is stale and create different visualizations for those situations; For instance, if data is more than 15 min old, it could either be hidden or marked with an unequivocal label;
- The Good Home score concept and the achievements should have additional information to allow the user to map them to the underlying compounding factors;
- Provide onboarding videos explaining the concept of missions, and how it is different from alerts based on thresholds; this could also be a good vehicle to explain the usefulness of correct sensor installation and classification.

However, for the reasons explained above, we believe the single most impactful improvement in terms of user engagement should be in reduction of data flow latency, from the current 15 to 30 minutes to below 30 sec to 1 min, in order to allow the user to receive immediate feedback from their actions.

### 4.5. Improvements roadmap to exploitation

The current exploitation scenario aims at licensing the core gamification mechanisms for integration on organizations with a currently deployed client mobile app. The specific integration roadmap will depend heavily on the consumer organization's data architecture and technical requirements.

## 5. MOBISTYLE Expert Tool description and validation path

A preliminary description of the Expert tool was already provided in chapter 5 of deliverable report D4.1 'Applicable hardware and software solutions for sensing technologies'.

The Expert Tool is first used by the MOBISTYLE experts in WP3 and WP6 in order to be able to access sensors' data from the different demonstration cases. With these data the experts will perform data analysis and evaluation on energy, comfort and health.

The Expert Tool is built as part of the RE Monitoring, a software application integrated in the commercial software solution RE Suite developed by the consortium partner DMO.

The Expert Tool has three main purposes:

- **Data management**: the expert has access to the data for visualization, filtering and validation purposes.
- **KPI calculation**: the expert will be able to visualize and download KPIs on energy, comfort and health.
- **Support the needs of third parties tools**: the expert will be able to export the data in the most suitable format. This functionality guarantees the interoperability between the Expert Tool and the other software programs used by the expert for evaluation and analysis purposes.

The expert tool aims to supply experts (WP3 and WP6) with the dataset(s) they need. Its purpose is not high-level analysis, but rather offering experts access to data for use in their own tools.

As such, a simple retrieve-and-save-to-disk operation would fulfill the basic theoretical requirements. Within MOBISTYLE, the Expert Tool was meant to offer dataset constraints through the use of filtering conditions, quick verification through visualisation of dataset summaries and giving insight in data sources and their current status. Finally, it should export a verified dataset in some format that is useful to the expert's tools.

Currently, the Expert Tool is a client application with an interface, which connects to an API back-end on the data server with access to all MOBISTYLE Data.

The base retrieve-and-store functionality is implemented as follows:

- A download button retrieves data from the server into the tool;
- An export button writes data loaded into the tool into a file.

For data management purposes the following functionalities have been implemented in the Expert Tool:

1. Data retrieval
2. Data filtering
3. Data visualization
4. Data export
5. Sensor status validation

More elaborated information on each of these functionalities can be reviewed in D4.4 'Systematic data exchange approach for energy performance'.

***TRL obtained***

Within MOBISTYLE demonstration the targeted TRL was for the development and testing of the tool at TRL7 which had been reached. Further exploitation of the MOBISTYLE Expert Tool should lead to a development and implementation at TRL8.

*See deliverable D5.4 for the Expert Tool developed business model introduction.*

***Validation path***

After internal testing of the prototype, the Expert Tool was made available to selected consortium members. During their use of the tool feedback was collected and used to enhance future user experience (UX). After sufficient time had elapsed an external User Experience expert was asked to perform an analysis. PhD. Doc. Caterina Calefato performed a heuristics analysis following the same methodology used for analysis of the dashboard developed by Holonix. For the methodology, see Chapter 3.1.

## 5.1. Usability Expert validation

### *Methodology*

The expert in question, Caterina Calefato performed a Heuristics analysis using the same methodology used for the Holonix dashboard. For brevity the methodology is not repeated. See Chapter 3.1 for more details.

### *Analysis results report*

A detailed analysis report is appended as Annex 3. It is summarized in the following figure:

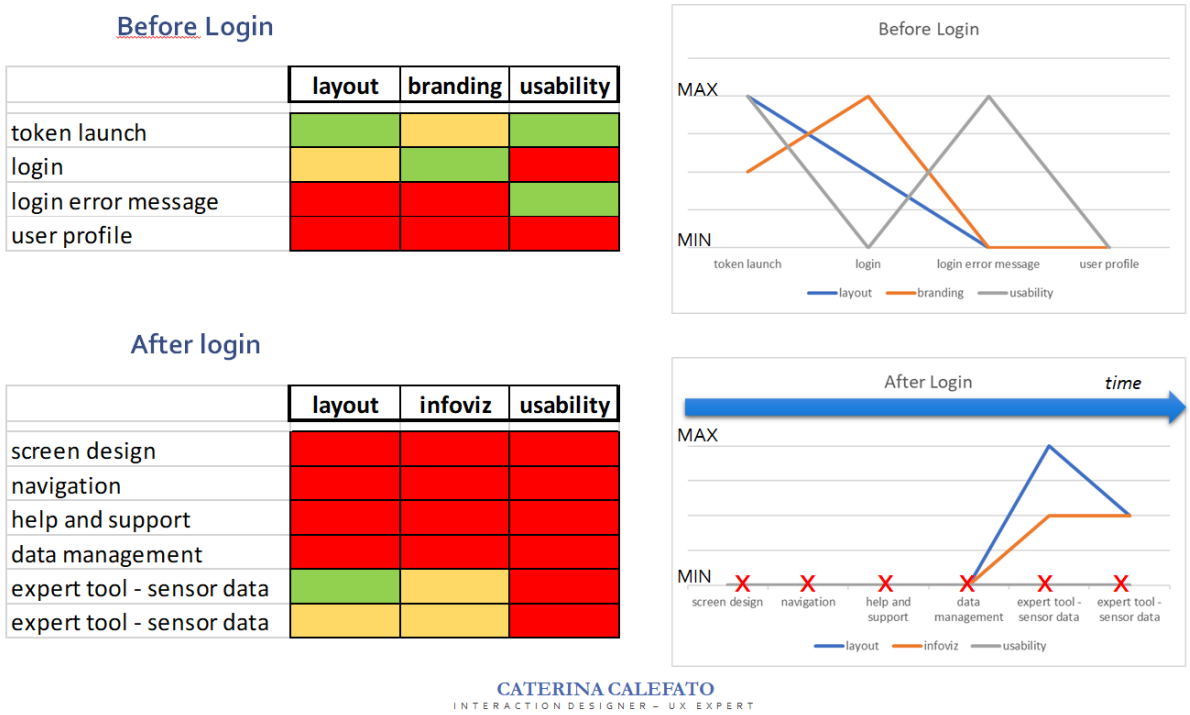



Fig. 21 Summary of the UX report for users

The major problems identified are listed below, grouped by category. Suggested solutions are included.

Table 4 User profile problems

| USER PROFILE | |
|---|---|
| PROBLEM | Once logged in a user does not know who they are or which permissions they have |
| SOLUTION | Clarify who user is and what they can and cannot do |
| PROBLEM | Missing user profile functions: name, company, permissions |
| SOLUTION | Add typical user profile functions |
| PROBLEM | Missing account management functions: creating accounts, giving permission |
| SOLUTION | Add account management functions |
| PROBLEM | Feeling trapped: no logout |
| SOLUTION | Add a clear logout |

Table 5 Home page problems

| HOME PAGE | |
|---|---|
| PROBLEM | User can feel lost, how do they return home |
| SOLUTION | Add a clear home page, recommendation: combination of visual and textual information |

Table 6 Screen design problems

| SCREEN DESIGN | |
|---|---|
| PROBLEM | Lack of home page/main dashboard |
| SOLUTION | Add a clear home page with a combination of visual and textual information |
| PROBLEM | Visual hierarchy does not clearly support element interdependencies |
| SOLUTION | Redesign visual hierarchy for better ease of navigation and insight into interdependencies |

| | |
|---|---|
| PROBLEM | Potential and limitation of the tool is unclear |
| SOLUTION | Add visual elements to textual information |
| PROBLEM | Problems in mapping functions to areas |
| SOLUTION | Add a starting point (e.g. home page or dashboard) |

Table 7 Navigation problems

| NAVIGATION | |
|---|---|
| PROBLEM | It is impossible to identify the whole tool content in advance in terms of functions and related info |
| SOLUTION | Use navigation affordances such as breadcrumbs, paging, etc, limit quantity of information |
| PROBLEM | It is impossible to have a quick first synthetic impression of the data quantity |
| SOLUTION | Add obvious metrics for quick insight |
| PROBLEM | Too many scrollbars |
| SOLUTION | Reduce number to single vertical scrollbar |
| PROBLEM | Navigation has start and end-point but not they are not self-evident. Missing commands: home, back, forward, refresh |
| SOLUTION | Add navigation commands to simulate web-page like navigation |
| PROBLEM | Illustrations suggest utility button functions |
| SOLUTION | Make customer/company logo point to web page |
| PROBLEM | File > Close disguises logout functionality |
| SOLUTION | Clearly label logout function; ask for confirmation |
| PROBLEM | Navigation menu on the left is duplicated on the top |
| SOLUTION | Clarify a singular visual hierarchy |

Table 8 Data management problems

| DATA MANAGEMENT | |
|---|---|
| PROBLEM | There are 6 different steps to explore the whole data structure |
| SOLUTION | Do not expect a rigid reading order; support in formulating cause & effect reasoning |
| PROBLEM | Pages are all the same without visual hints to help user recognize where he/she is |
| SOLUTION | Use a meaningful dashboard to show results of data management exploration |
| PROBLEM | No summaries provided |
| SOLUTION | Provide multiple levels of detail |
| PROBLEM | Large amounts of text |
| SOLUTION | Preserve data to graphic dimensionality; integrate text wherever relevant |
| PROBLEM | Illustrations suggest utility button functions |
| SOLUTION | Make customer/company logo point to web page |
| PROBLEM | File > Close disguises logout functionality |
| SOLUTION | Clearly label logout function; ask for confirmation |
| PROBLEM | Navigation menu on the left is duplicated on the top |
| SOLUTION | Clarify a singular visual hierarchy |

Table 9 Sensors data problems

| EXPERT TOOL – SENSOR DATA | |
|---|---|
| PROBLEM | No discriminating operative environment from the layout (Data management vs Expert Tool) |
| SOLUTION | Better discriminate environments |
| PROBLEM | Interdependencies among filters are not evident by graphics |

| | |
|---|---|
| SOLUTION | Use icons |
| PROBLEM | No data overview or sum up |
| SOLUTION | Concretise relationships among data/variables |
| PROBLEM | No additional information if dataset/graph remains empty |
| SOLUTION | Explain what happened to the user |
| PROBLEM | Field functionalities are not self-evident |
| SOLUTION | Add explanation, help, manual references; consider a wizard-based approach |
| PROBLEM | Data aggregation granularity is limited |
| SOLUTION | Add six-month data aggregation granularity |
| PROBLEM | KPI data representation lacks context |
| SOLUTION | Add ranges for success/unsuccess; preserve data to graphic dimensionality |
| PROBLEM | Export function lacks metrics |
| SOLUTION | Add file size, downloading time |
| PROBLEM | Non-standard file save dialog |
| SOLUTION | User a standard way to save, asking user to choose a local folder |

Table 10 Sensors status problems

| **EXPERT TOOL - SENSOR STATUS** | |
|---|---|
| PROBLEM | Context is not obvious |
| SOLUTION | Add list of sub-objects, add context header |
| PROBLEM | No filter/timespan selection options |
| SOLUTION | Allow to select/filter sensors |
| PROBLEM | No export option |
| SOLUTION | Allow saving to local file |
| PROBLEM | Colour code is clear and standard but borderline values are difficult to assess |
| SOLUTION | Add Infoviz |
| PROBLEM | Statistics / utilities are missing |
| SOLUTION | Add Infoviz |

The expert added a secondary summary of the analysis, distinguishing between generic users and ‘experts’.

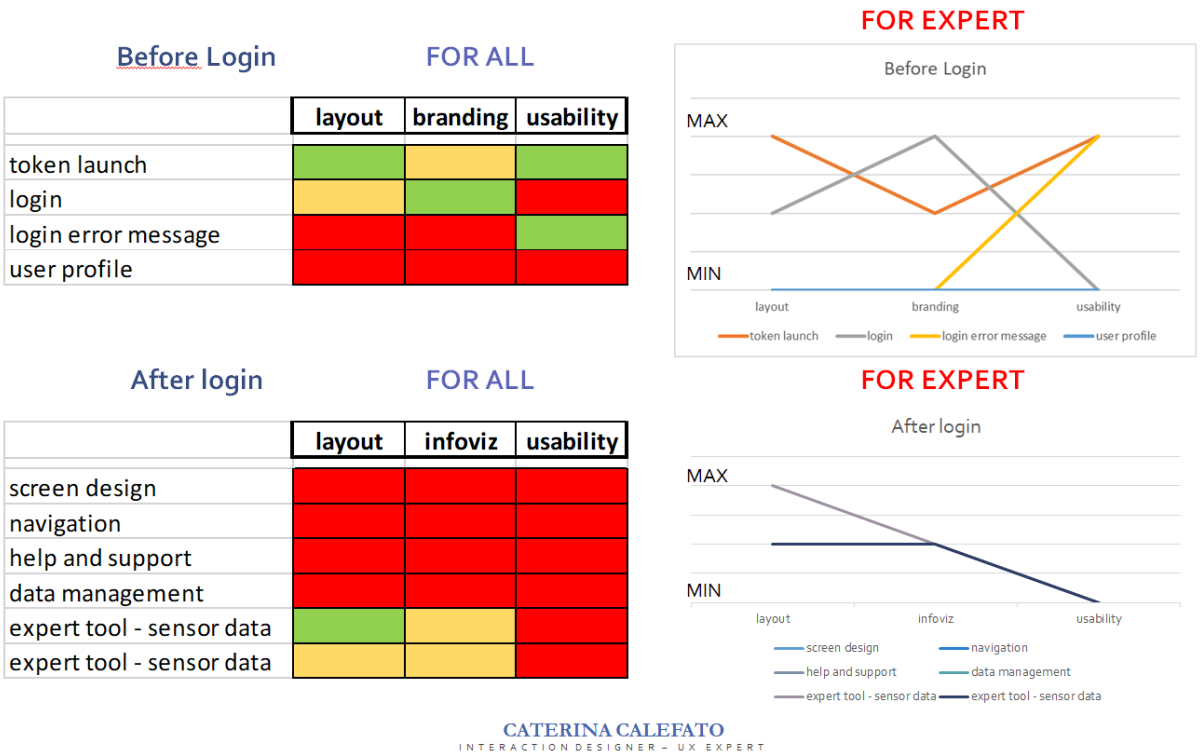



Fig. 22 Summary of the overview for experts

The expert left DEMO with a number of general remarks for future improvements:

- An effective visualization allows to absorb and remember large amounts of information effortlessly
- Even if it Is difficult to identify and measure the decision-making process that use information from diverse sources, it is possible to trigger it
- Usability is about people and how they understand and use things, not about technology (Steve Krugs)
- Don't waste users' time. Much of the use of a tool is motivated by the desire to save time.

## 5.2. Demo cases feedback collected

In line with the protocol for MOBISTYLE solutions testing implemented in **D4.3 Software modules for user interfaces on mobile devices** based on the System Usability Scale (SUS) testing and evaluation questionnaire, the demonstration case holders, as main users of the Expert Tool have provided feedback on their experience with the Expert Tool (at M36). Unlike the SUS questionnaires used for the end-users MOBISTYLE Tools (i.e. Dashboard, Game, App), for the evaluation of the Expert Tool, the demo case holders have briefly covered the following aspects of the tool:

- Effectiveness: the ability of users (i.e. managers/experts) to complete tasks using the tool and the quality of the output of those tasks;
- Efficiency: the level of resources consumed in performing tasks;
- Satisfaction: user's subjective reactions to using the system).

***IRI University of Ljubljana for the Slovenian demonstration case***

In terms of efficiency and effectiveness (data transfer functionality):

- The tool works very slowly; this might be however related to the remote access functionality;
- When choosing a date from the drop-down menu, the month and year are written in black on a dark blue background (i.e. very poor visibility);
- When you select all the criteria and press the **Load** button, it would be great if you could see that the function is executing, because it happens, that you cancel the task too quickly not aware if there is no data or you are too fast and you can continue;
- With respect to the weekly AutoCheck file, this functionality is very valuable as it triggers the manager/owner to start investigating for example when data flow interruptions are occurring;
- Overall, I am positively surprised by the Expert Tool. I managed to figure out how to get the data needed quickly. I like that in addition to the data, a graph is also drawn.

***AAU for the Danish demonstration case***

For the Danish demonstration case the tool has primarily been used to download the data and analyse that outside of the Expert Tool environment. Therefore, only this feature of the tool has been evaluated.

- In general the tool has a clear structure, which is user friendly and easy to navigate. However, for downloading purposes it lacks a function for simultaneous download of data from many parameters. In the existing situation, the user must do it separately for each parameter, not even the sensor, which is every time a consuming activity. The logic behind is fully understandable, namely that by downloading individually the user has a better control of the data amount, etc. However, similar as in SQL database you could call for all data from a particular apartment with a single download action.
- The built-in functions for different aggregation options for the data are very useful and saves editing/coding time after data download.
- Choosing the start and end time of the data needed, could also allow for user to type in the period and not only select it from the calendar;
- Visualization of each parameter for specific purposes are handy.

***POLITO for the Italian demonstration case***

The experience with the Expert Tool as Italian demonstration case holder is mainly related to the following actions:

- Checking on sensor status to identify possible sensors disconnected;
- Downloading of raw data for the assessment of data quality;
- Downloading of raw data for the evaluation of the outcomes of the project;
- Computation and downloading of preliminary KPIs for evaluation purposes;
- Visualization of some parameter trends for different purposes (e.g. visualization of actual active power of printer to identify peak and standby power in order to define rules for the implementation of new suggestions in the Dashboard deployed at demo side).

In leading other activities within the project (i.e. proposal of KPIs for the MOUP; definition of personalized Cost-Benefit Analysis methodology per each demo case) the tool was also deployed to understand available data at each demo case level.

Based on the above mentioned activities the following has been experienced:

- navigation in its different parts and filtering tools are intuitive;
- check on sensor status is useful;
- With respect to the filtering function organized as drop-down list, it is easy to understand which variables are available per each sensor and which sensors are associated to the different rooms (even if understanding of the meaning of the variables requires sometimes direct knowledge of the demo case);
- Functionalities are useful and formatting of downloaded data suitable for the analysis.

Some criticalities that make the tool not always handy in the usage are:

- refresh button does not allow to save some of the filtering options;
- scrolling of the calendar to look for dates of interest uses the refresh all the *times* it has opened, slowing the user down;
- retrieving of data sometimes is not efficient in terms of speed.

Based on the experience with the tool, the following has been identified with respect to possible improvements for exploitation:

- concerning the pre-visualization of data, popping up of a window when the cursor is positioned on the graphs showing x and y values (i.e. numerical value and time) would be particularly useful to understand visualized data, especially when a long data series is displayed;
- concerning the contents, documentation page to explain how the proposed KPIs are computed would be beneficial, especially for an external user.

The “AutoCheck” application was proved to be useful add-on for gaining insight into malfunctioning sensors during the development process. For demonstration cases this allowed easy and quick detection of discrepancies between the data collected and the data that was exposed. During the tool’s application at the demonstration sites, some malfunctions were noticed that needed to be addressed before final version of the tool would be ready for the market application.

### 5.3. External Experts Advisors feedback

On the 9th of June 2020 DMO has presented the Expert Tool to the MOBISTYLE Consumer Advisory Board. In this webinar DMO has explained the background of the need for an Export Tool and the challenge that DMO faced to develop and implement a “one fits all solution” for different demonstration cases. In this presentation a demonstration of this software was included. The audience have asked questions about the applicability for their own cases and asked for more information afterwards. At this moment, DMO is in contact with one of the attendees to investigate the possibility of applying the Expert Tool to their situation.This pitch and the attendances can be found here MCAB pitches as well as a live demonstration of the tool before the update of the user interface.

Five organizations participated to the MCAB webinar: REHVA, Bgrid Solutions, Institute of Anthropology-Romanian Academy, Active House and ESD. Due to confidential nature of the discussions, only pitch recording is available: https://youtu.be/YtVRAudIjjA.

On 23rd of June 2020, a presentation was given at the BUILDUP platform, see recording: https://www.youtube.com/watch?v=H9JW6BdbUME&feature=youtu.be. In this case the updated (with enhancements based on the give feedback) software was presented.

### 5.4. Synthesis and list of optimizations to be applied

The Expert Tool was developed within last year of the project (M30-M42) based on the following functionality objectives:

1. Related to the first purpose of data visualization:

   - Raw data to be visualized in graphs and icons;
   - Visualization of the KPIs;
   - Available summary of the dataset.

2. Related to the second purpose of KPI calculation:

   - Simple KPI algorithms have been implemented in Expert Tool based on the provided list from WP3 (POLITO);
   - Filtering functionality for KPI type;

3. Related to the third purpose of interoperability:

   - Export of KPIs in the most convenient format should be guaranteed. The export format has been previously discussed and agreed with WP3 partners, in order to allow full compatibility of the Expert Tool with other analytical tools used within the project.

The additional improvements based on the diverse testing are shown in the following illustrations in the next paragraph.

### 5.5. Improvements roadmap to exploitation

The feedback of the UX expert as describe above as well as the feedback of the people who used the tool during the MOBISTYLE project for the organization and analysis of the demonstration cases have been studied by DEMO. The recommendations have been analysed and as much as possible is used by DEMO to enhance the user interface. This process is executed in the last period of the MOBISTYLE project. The data collection was not hampered by this and has continued flawlessly. At the end of the project all the collected data however is used in this new version of the software.

The software that is developed, used at the demonstration cases and tested by the external expert is show in the figure below.

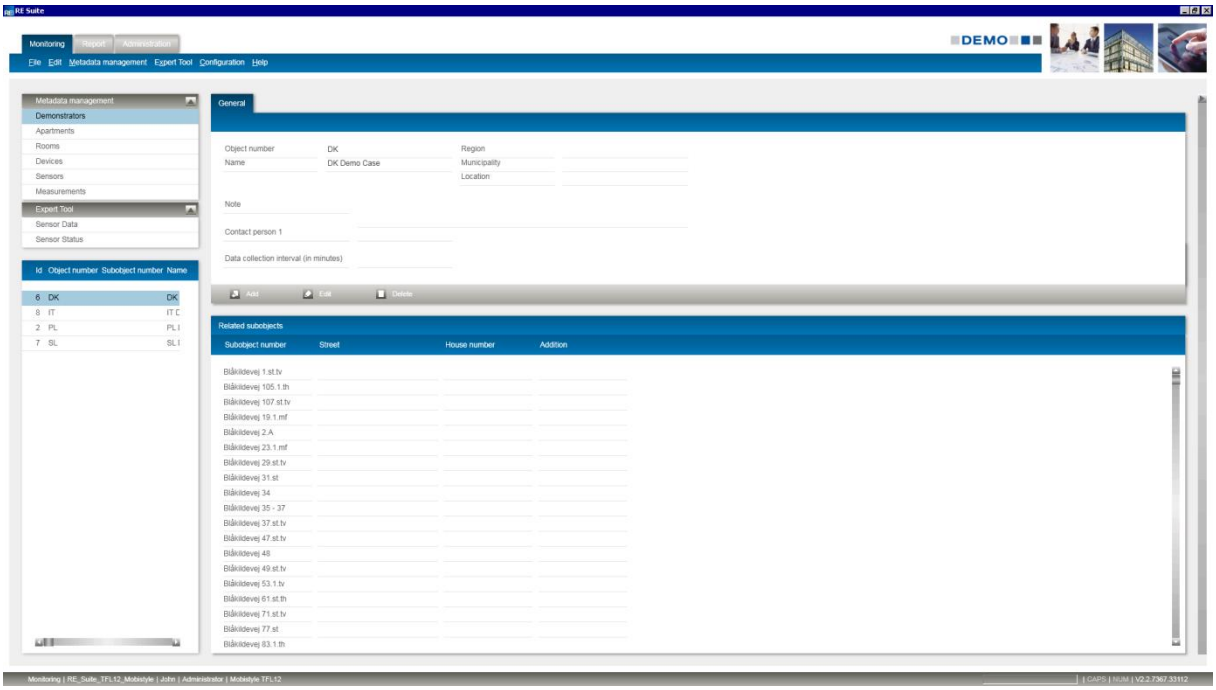



Fig. 23 Expert Tool GUI before user experience tests

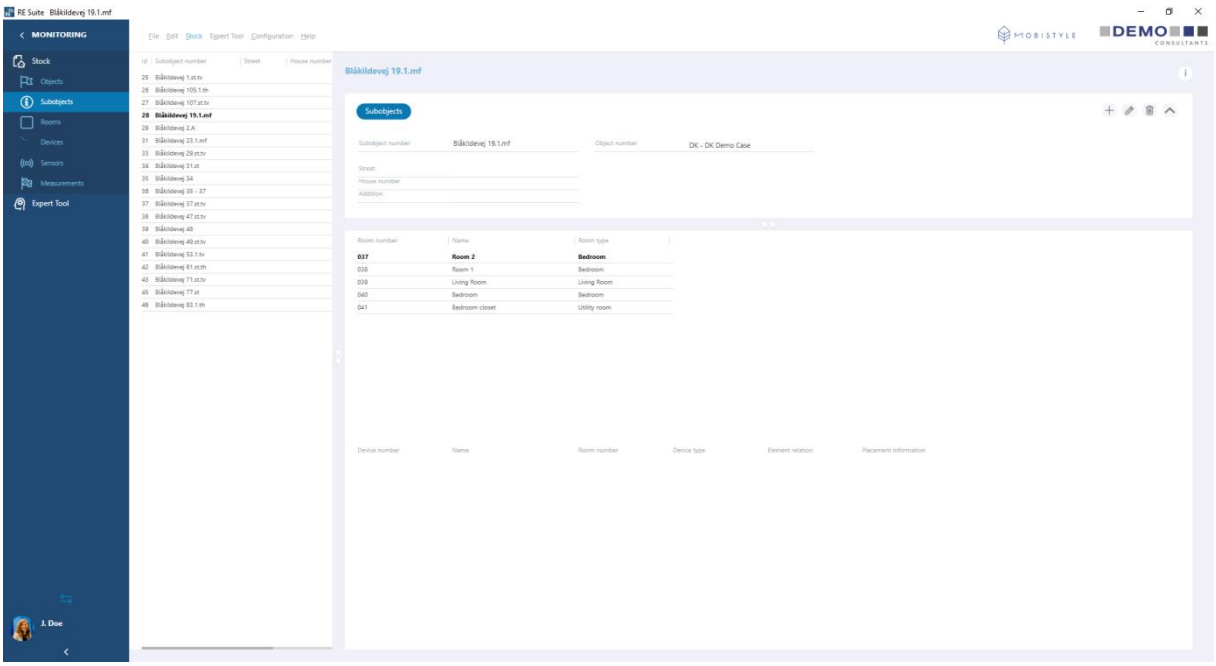



Fig. 24 Expert Tool after user experience tests - subobjects

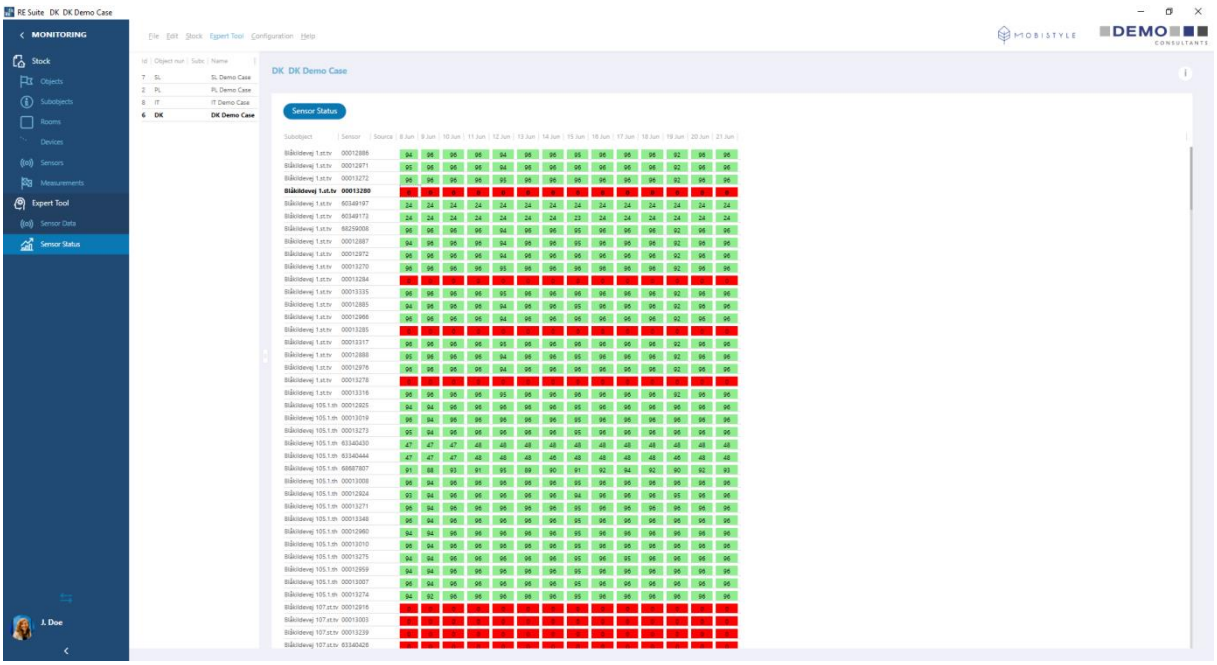



Fig. 25 Expert Tool after user experience tests - sensors status

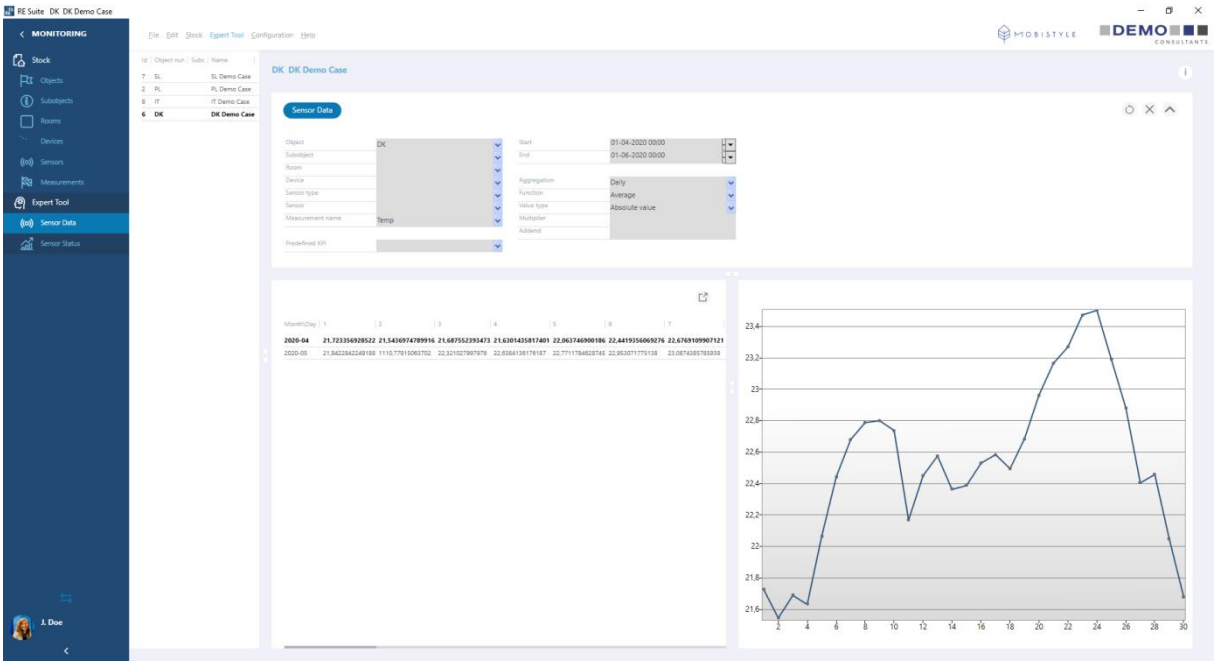



Fig. 26 Expert Tool after user experience tests - sensors data

After the project ends, DMO foresees to work on promotion material, like manuals and video clips. Marketing activities will be executed to raise awareness, while the demonstration cases of MOBISTYLE can be used as testimonials to convince potential customers to deploy the system on their real estate objects. The Expert Tool will be exposed and introduced to existing customers and be offered via Cross selling.

## 6. MOBISTYLE Office App description and validation path

The MOBISTYLE Office App is a dashboard app for behavioural change aiming to increase awareness and therefore acceptance around the dynamic indoor conditions.

The decision to develop the MOBISTYLE Office App was done once it was decided that the Dutch demonstration building type has changed from a health care environment to an office environment (M24). The Dutch demonstration studies in Maastricht University laboratory and Qeske (see D6.2 for description of the Dutch case study) showed that there is thermal comfort acceptance (physiological response of a body) when occupants were exposed to the dynamic temperatures. For the study at Brightlands, the aim was to develop a simple app that can furthermore increase acceptance (psychological response) with these dynamic conditions. The development of the Office App followed the project's people centric approach where the user interface was developed together with the users (development iterations, see D4.3). When first focus groups were held with the occupants of the Brightlands office space, the first interface designs were discussed with users. Two iterations were done to come to a final prototype tested in a real-life environment.

The Office App introduces the dynamic indoor environments in order to increase occupants acceptance as such conditions can lead not only to lower energy bills but also to more productive and healthier employees. Information (based on monitored parameters) and recommendations are given based on the monitored parameters as also some overall recommendations (tips) on how to improve occupant's well-being and productivity.

***TRL obtained***

The MOBISTYLE Office App reached **TRL 6** in the duration of the project. The final system prototype was demonstrated in an open-plan office at Brightlands innovation campus in the Netherlands. This ICT tool was not fully integrated within the MOBISTYLE ICT system (MOBISTYLE database) therefore it has not the full integration to achieve TRL 7. This was due to the case that Dutch case was confirmed once the main MOBISTYLE system was already developed combining the other three tools (see Figure 1 in Chapter 2). The app is also not available via Google Play store as it was used on the tablets. Furthermore, due to the sensitivity of the data coming from the wearables, it was decided to store the data coming from wearables locally and not on a main MOBISTYLE server.

***Validation path***

The validation approach that was adopted for the MOBISTYLE Office App was in line with the project's people centric approach and comprised of two parts:

- The Office App addressed the office environment and office employees at Brightlands campus where close collaboration was established between the MOBISTYLE researchers (Huygen R&D) and the employees located at the office dedicated to the MOBISTYLE experiments. During the development of the solution, two iterations were held to improve the app design. The office occupants' feedback was gathered to improve the tool (see D4.3).
- Due to a development of the tool to TRL 6, an expert validation has not been done as the tool was not too mature for such UX analysis. Due to limited resources, it was decided that such

action was not the most cost-effective. During the exploitation roadmap, Huygen decided to invest more individual resources;

- A final validation was done on the 3rd Feb 2020 with the five representatives of relevant market players that are members of the MCAB board.

### 6.1. Usability Expert validation

As stated in previous paragraph, no UX expert validation was done for the Office App.

### 6.2. Demo cases feedback collected

During the demonstration period, certain issues were reported by the app users. Some issues were related to the technical issues (bugs) which were resolved on a short notice thanks to the fact that the app designer, researchers and MOBISTYLE app users had a good communication. In addition, several ideas were given concerning potential new features to be integrated within the app.

As described in D4.3 and D6.3, the users were overall positive during the validation period. Below it is shown whether the first two objectives presented in Chapter 1 are met.

1. **90% of end users find the GUI usable and attractive.**

This objective was assessed based on the two SUS questions (q3 & q7): '- *"I thought the system was easy to use" & "I would imagine that most people would learn to use this system very quickly".* As it could be seen from the Dutch SUS results (see D6.3, Dutch case – answers on question 3 and 7), more than 87 % (21 out of 24) occupants agreed the system was easy to use where more than 91 % (22 out of 24) agreed most people would learn to use this system very quickly.

2. **90% of end users find the modular information services usable and attractive and are willing to use the services in future.**

This objective was assessed based on the SUS question (q1): ''*I think that I would like to use this system frequently*''. As it could be seen from the Dutch SUS results (see D6.3, Dutch case – answers on question 1), more than 82 % (20 out of 24) occupants agreed that they would use the tool again where the rest remained neutral.

### 6.3. External Experts Advisors feedback

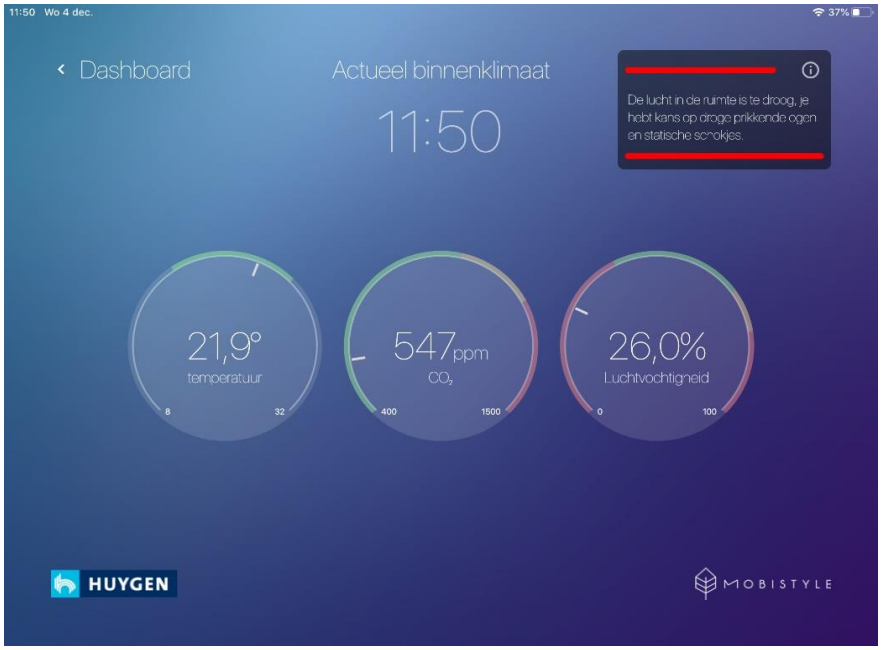
On the 3rd Feb 2020, Loes Visser, Project Leader at Huygen presented the Office App solution to the 6 members of MCAB: REHVA, eu.bac, Skanska, Active House Alliance, Institute of Anthropology F. I. Rainer of the Romanian Academy, S-Labs. Due to data privacy, only the short general presentation is available online: https://www.youtube.com/watch?v=XpID0WNsISs (30 min). Afterwards, 1h was reserved for a discussion on the technical features of the app.

One of the discussion points was related to the possibility to connect the different sensors and interoperability issue. Skanska representative shared their experience with similar data gatherings. Furthermore, representative of eu.bac wanted to understand better the feedback integration possibility. Loes explained that in case where the majority of the building occupants would express a complaint (red smiley) with the surrounding conditions, the feedback can be automatically integrated and change the BMS setpoint. Furthermore, GDPR technical compliance has been further explained.

## 6.4. Synthesis and list of optimizations to be applied

In terms of the MOBISTYLE Office App, the following actions could help address the usability and adoption concerns that were identified:

- The app could be directly connected to the BMS API instead of linked to the DataBuilt platform. This would make the interface faster and most recent data would be shown in the app.
- The 'tips' could be more specified to the different variables that triggered them. The pop-ups could 'pop-up' from the area's where the variables are shown instead of from the information icon on the right top of the screen (see Figure 6.1 and 62)
- After entering the feedback, the user should get information about the actions the system will take to change the environment if necessary (see Figure 6.3 and 6.4)
- Integration of the Daily weather forecast; Integration of the agenda and room occupation (this can be further connected with the BMS system so there is no or minimum heating/cooling/ventilation when room is not anymore booked for a day) (Figure 6.5);
- Integration of self-assessment productivity tests (e.g. if employer wants to see the correlation between employee's productivity and surrounding office environment);
- Addition of more sensors to obtain for example outdoor air quality, occupancy sensors;
- Addition of monthly reports to see how was the satisfaction and indoor quality over a month.



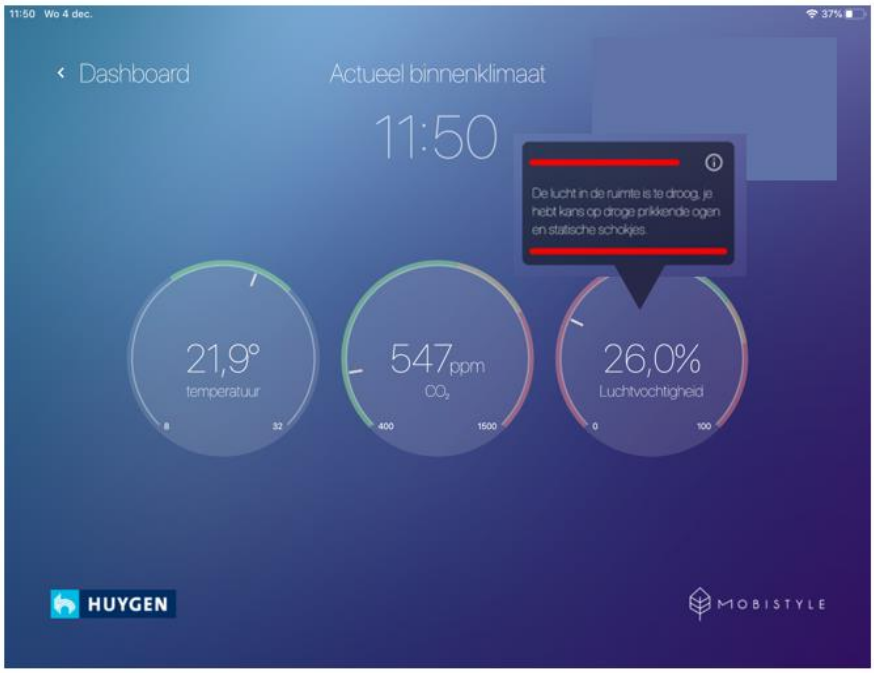




**Fig. 27 and 28: Before (above) and suggested (below) to change the pop-up tips.**

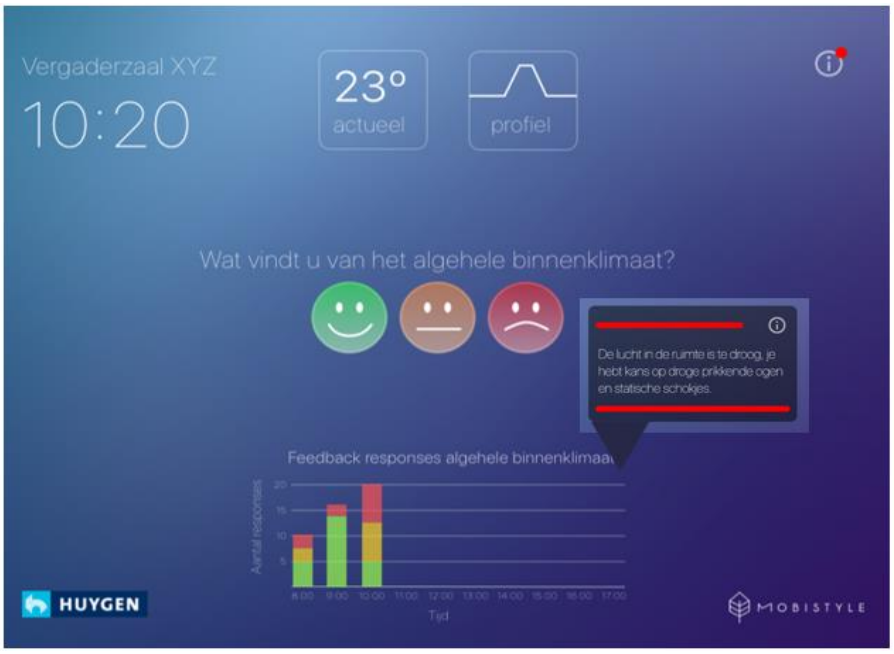




**Fig. 29 and 30: Before (above) and suggested (below) to provide information about the HVAC changes based on provided feedback on the IEQ.**

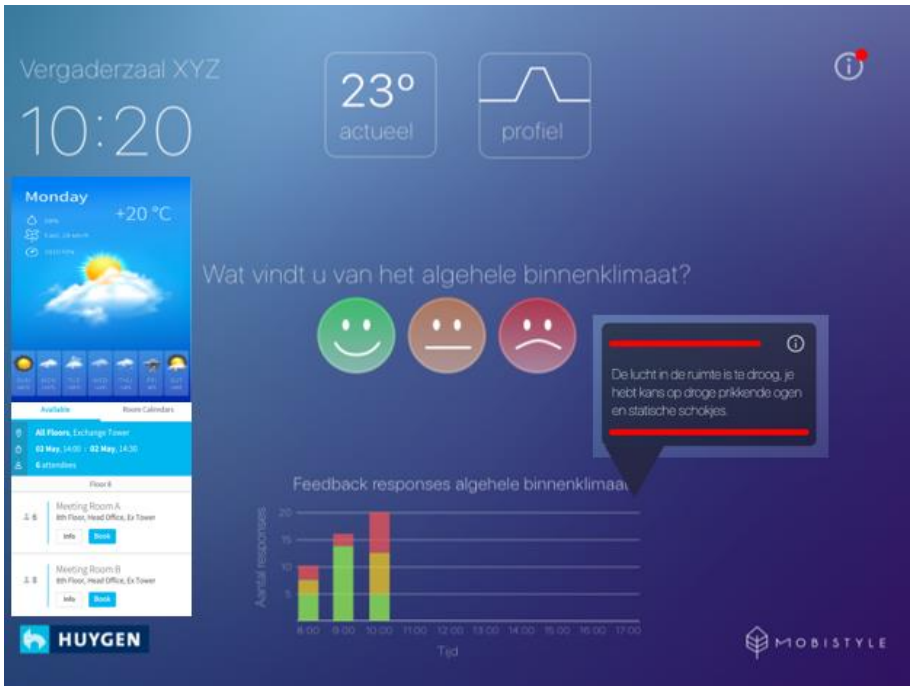



**Fig. 31: Suggested interface to incorporate weather forecast and room availability to enhance the use of the app in day to day activities.**

## 6.5. Improvements roadmap to exploitation

The current exploitation scenario aims at licensing the core gamification mechanisms for integration on organizations with a currently deployed client mobile app. The specific integration roadmap will depend heavily on the consumer organization's data architecture and technical requirements.

Huygen Consultancy is interested in the exploitation scenario for the MOBISTYLE Office App together with the dynamic conditions introduction. As an installations design and consulting company, the office app is to be exploited with the new service of dynamic condition. According to what is explained in T5.4 and T5.5, the aim is still to upgrade the solution to TRL7 and come to an agreement with the several early adopters already identified and interested in the solution. At the moment, there is a discussion with the Brightlands campus to extend the solutions to some more commercial office floors on the campus. The discussion with Maastricht University is still on going in case more expertise and research on the side of human physiology is needed.

Further customization is expected, according to the customer's specific nature and needs. The dynamic indoor conditions consultancy together with the Office App will be available through a dedicated web page and marketing campaign of Huygen: www.huygen.net. It is expected to be life within the 6-12 months after the project ends.

## 7. MOBISTYLE Open Users Platform description and validation path

The MOUP is an IT platform that should make its backend services and the Internet of Things (IoT) Data repository **accessible to new services** that might be developed and used also **outside** the MOBISTYLE consortium. From a technical point of view, the accessibility to the platform and/or to its components can be achieved by providing and publishing standardised APIs.

The MOBISTYLE databases are distributed and consist of local databases, the user management repositories and the sensor-data repository where data collected from the sensors is stored and managed. The MOBISTYLE tools are software applications that, via dedicated APIs and users interfaces (UI), provide services to the end users who can visualise specific data and interact with the UIs of the particular applications (Dashboard, Game, Expert tool, Office app). The MOUP APIs enables access to the sensor data repository to provide third party developers with information that can enable the creation of new applications.

Available information is coming from the sensors that monitor the energy consumption and environmental conditions, e.g. IEQ, that may also impact individual health and wellbeing.

As described in D5.3, third party developers are allowed to access to a specific portal in which they can unlock and access to MOBISTYLE Open APIs. Hereunder a screenshot of this.

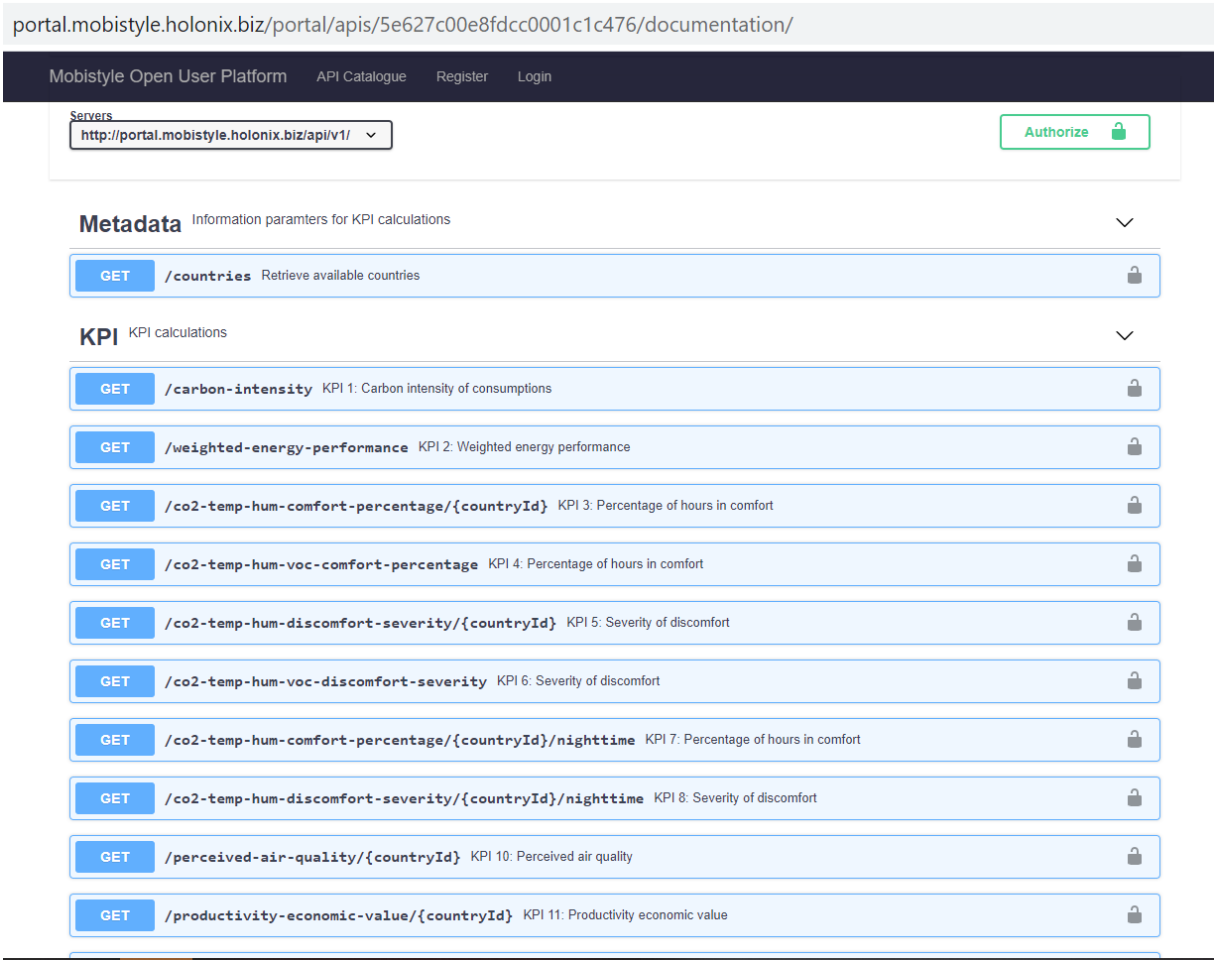



Fig. 32 MOUP swagger overview

As explained in D5.3, available KPIs are aggregated and anonymized.

***TRL obtained***

The TRL obtained for the MOUP tool is 4.

***Validation path***

No Usability validation had been done as the TRL of this MOBISTYLE tool is too low and as the graphic user interface of the third party developers' dashboard is created with an external tool (Tyk) which does not allow many modifications to the form of content.

MOBISTYLE demo cases were not expected to use the MOUP, as it is a tool which is intended to be for external users, with a completely different business model and adoption examples. As such, no one was interviewed in the Focus Groups described into D6.4. Feedbacks have been collected from a commercial potential point of view, in two ways: a pure exploitation analysis through exploitation events mentioned in WP5, task5.4 and task 5.5, and in WP7, and third party validation which is described in this deliverable chapter 7.2.

### 7.1. External Experts Advisors feedback

Five external companies have been involved in the validation of the MOUP tool. They are all IT companies interested in the data which can be collected through the MOBISTYLE platform, thus they have applied for the validation activity proposed. Developers from these companies were requested to access the MOUP and to carry on an acceptance test according to the Methodology which is described in the following lines. Results are considered successful fromthe developers' point of view, and are reported hereunder. The solution is confirmed to be interesting, the approach is commented as having high added value, and the implementation is referred to as simple, working, and easy to adopt.

The companies involved in the validation process are:

- DOMINA SRL, VAT CODE 01912740022, www.domina-biella.it
- I-DEAL SRL, VAT CODE 02528250026, www.sizeyou.it
- ROBINSON SRL, VAT CODE 01700490020, www.robinson.it
- MASSIMO CAMPAGNOLO, VAT CODE 01882130022, freelance
- CYBERBRAIN, VAT CODE 09981310965, www.cyber-brain.it

#### *Methodology – Acceptance test*

According to ISQTB definition Acceptance testing is "Formal testing with respect to user needs, requirements, and business processes conducted to determine whether or not a system satisfies the acceptance criteria and to enable the user, customers or other authorized entity to determine whether or not to accept the system".

Thus, the purpose of these tests is to evaluate the system's compliance with the project requirements defined through the exploitation preparation activities and assess whether it is acceptable for delivery at the expected TRL.

The Acceptance tests are designed to test a specific functionality that can cover only one requirement or several requirements.

The approach adopted for grouping requirements was related to the KPIs identified.

The Pass/Fail Criteria are defined as recorded in the tables reported and compiled by external developers.

Some steps of the validation procedure are common and had been reported in this deliverable grouped. Only one example is shown.

According to the methodology, in order to specify a test case, the following information should be provided:

- A unique identifier for each Validation Test Scenario (VTS);
- The Functional Requirement addressed by the functionality the test aims to validate;
- A brief description of the functionality that the test aims to validate;
- A brief description of the overall scenario for the test (including the components to be involved and the integration scenario);
- The inputs to the test;
- The test pass/fail criteria;
- The output obtained.

To manage the tests, during the COVID-19 lockdown, Holonix set a webinar session during the entire day of the 25th of March 2020, during which the third party developers had been invited to learn about MOBISTYLE project, then they were introduced to the MOUP so they could subsequently try to use it.

The tests had been prepared in advance by Holonix in order to have comparable results, and the developers were asked to use the same client (CocoaRestClient).

### *Analysis results report*

The entire process to access the APIs developed for the MOBISTYLE platform, has been tested by third party developers considering the following steps:

1. subscription to the platform,
2. request of a new API key,
3. analysis of API documentation,
4. invocation of every API function to test the availability.

The report of the results by the developers considers that the subscription phase had been organized by using a web page, which is easy and clear for a developer also with minimal development skills.

Also, the process to request an API key is straightforward and no issues were found.

The choice of using Swagger web interface to document and to test API, the related information of input/output parameters and models, is suitable.

The choice of offering the data organized as RESTful APIs gives a wide set of opportunities to developers. More in details the APIs:

- can be adopted directly by a mobile application (App), e.g. to build a dashboard for showing collected data;
- can be accessed by a web application (WebApp);
- can be adopted by a classical standalone application, directly installed on a PC;
- can be integrated into a more complex system to build new functionalities based on available data, e.g. for monitoring purposes.

Finally, these APIs could be adopted or integrated in several sectors, from consumer to production environments.

Hereunder the tests results are reported, while in Annex 4 are reported the relevant screenshots of the results taken from one of the third party developers. Other screenshots, for the same validation path, made by other developers, are similar and not reported here to avoid redundancy.

1. Subscription

The registration to MOBISTYLE Open Users Platform is granted only after the registration of a developer account, i.e. subscription. The figure in Annex 4 (Fig. 34) depicts the requested information to perform the subscription to the service. In particular, a developer must enter:

- a valid email;
- a password.

| **TEST IDENTIFICATION** | | **TEST EXECUTION** | |
|---|---|---|---|
| **ID** | MOUP_1 | **TEST DESIGNED BY** | HOLONIX |
| **TEST PRIORITY** | High | **TEST EXECUTED BY** | • DOMINA SRL<br>• I-DEAL SRL<br>• ROBINSON SRL<br>• MASSIMO CAMPAGNOLO<br>• CYBERBRAIN |
| **MODULE NAME** | Subscription | **TEST DATE** | 25/04/2020 |
| **TEST TITLE** | Subscription | **TEST STATUS** | Passed for all |
| **DESCRIPTION**<br>In this test we verify that developers are able to subscribe to the MOUP | | | |
| **PRECONDITION** | | Internet connection and access to the URL portal | |
| **EXPECTED RESULTS** | | Get registered, with personal user ID and password | |
| **OUTPUT RESULTS** | | Get registered, with personal user ID and password | |

2. Access to the MOUP (Fig. 35)

The access is granted to registered users, after subscription.

| TEST IDENTIFICATION | | TEST EXECUTION | |
|---|---|---|---|
| **ID** | MOUP_2 | **TEST DESIGNED BY** | HOLONIX |
| **TEST PRIORITY** | High | **TEST EXECUTED BY** | • DOMINA SRL<br>• I-DEAL SRL<br>• ROBINSON SRL<br>• MASSIMO CAMPAGNOLO<br>• CYBERBRAIN |
| **MODULE NAME** | Access | **TEST DATE** | 25/04/2020 |
| **TEST TITLE** | Login | **TEST STATUS** | Passed for all |
| **DESCRIPTION**<br>In this test we verify that developers are able to log in to the MOUP | | | |
| **PRECONDITION** | | Internet connection and access to the URL portal, subscription done | |
| **EXPECTED RESULTS** | | Get logged in with personal user ID and password | |
| **OUTPUT RESULTS** | | Get logged in with personal user ID and password | |

3. Visualization of APIs catalogue (Fig. 36 and Fig. 37)

| TEST IDENTIFICATION | | TEST EXECUTION | |
|---|---|---|---|
| **ID** | MOUP_3 | **TEST DESIGNED BY** | HOLONIX |
| **TEST PRIORITY** | High | **TEST EXECUTED BY** | • DOMINA SRL<br>• I-DEAL SRL<br>• ROBINSON SRL<br>• MASSIMO CAMPAGNOLO<br>• CYBERBRAIN |
| **MODULE NAME** | Access API catalogue | **TEST DATE** | 25/04/2020 |
| **TEST TITLE** | APIcat | **TEST STATUS** | Passed for all |
| **DESCRIPTION**<br>In this test we verify that developers are able to see the APIs catalogue | | | |
| **PRECONDITION** | | Internet connection and access to the URL portal, subscription done, logged in | |
| **EXPECTED RESULTS** | | See the APIs catalogue | |
| **OUTPUT RESULTS** | | See the APIs catalogue | |

4. Request the API-Key and receive it (Fig. 38 and Fig. 39)

In order to protect the usage of APIs, MOBISTYLE MOUP requires the adoption of a unique API key. This is a typical approach to restrict the APIs access only to a subset of registered users. Therefore, before invoking an API, the developer must follow the procedure to request an API key. This key is unique and assigned only to a specific user. Hence, the platform is able to grant access and trace the requests performed by a developer.

| TEST IDENTIFICATION | | TEST EXECUTION | |
|---|---|---|---|
| **ID** | MOUP_4 | **TEST DESIGNED BY** | HOLONIX |

| | | | |
|---|---|---|---|
| **TEST PRIORITY** | High | **TEST EXECUTED BY** | • DOMINA SRL<br>• I-DEAL SRL<br>• ROBINSON SRL<br>• MASSIMO CAMPAGNOLO<br>• CYBERBRAIN |
| **MODULE NAME** | Request APIKey | **TEST DATE** | 25/04/2020 |
| **TEST TITLE** | APIKey | **TEST STATUS** | Passed for all |
| **DESCRIPTION**<br>In this test we verify that developers are able to receive the API Key | | | |
| **PRECONDITION** | | Internet connection and access to the URL portal, subscription done, logged in | |
| **EXPECTED RESULTS** | | Receive the unique API Key | |
| **OUTPUT RESULTS** | | Received the unique API Key | |

5. Overview of APIs documentation (Fig. 40, Fig. 41 and Fig. 42)

Once the API key is released, the developer can invoke the available web services. Therefore, the next phase is analysing the available documentation on APIs, i.e. the available HTTP methods (e.g. GET), the input and output parameters organized as a set of JSON models.

By using Swagger web interface, the available APIs are organized in two groups:

- Metadata that contains information parameters for calculations
- KPI that contains the calculations

The Metadata group contains only one API:

- GET /countries

The KPI group contains the following APIs:

- GET /carbon-intensity
- GET /weighted-energy-performance
- GET /co2-temp-hum-comfort-percentage/{countryId}
- GET /co2-temp-hum-voc-comfort-percentage
- GET /co2-temp-hum-discomfort-severity/{countryId}
- GET /co2-temp-hum-voc-discomfort-severity
- GET /co2-temp-hum-comfort-percentage/{countryId}/nighttime
- GET /co2-temp-hum-discomfort-severity/{countryId}/nighttime
- GET /perceived-air-quality/{countryId}
- GET /productivity-economic-value/{countryId}
- GET /medium-energy/{countryId}

The documentation also contains the Models section that defines the structure of input and output parameter in JSON format.

The Swagger web interface is a useful approach to describe the APIs, related input/output and to explain its usage by an example.

| TEST IDENTIFICATION | | TEST EXECUTION | |
|---|---|---|---|
| **ID** | MOUP_5 | **TEST DESIGNED BY** | HOLONIX |
| **TEST PRIORITY** | High | **TEST EXECUTED BY** | • DOMINA SRL<br>• I-DEAL SRL<br>• ROBINSON SRL<br>• MASSIMO CAMPAGNOLO<br>• CYBERBRAIN |
| **MODULE NAME** | Overview API doc | **TEST DATE** | 25/04/2020 |
| **TEST TITLE** | APIdoc | **TEST STATUS** | Passed for all |
| **DESCRIPTION**<br>In this test we verify that developers are able to have a complete access and overview to all the API documentation, useful to autonomously use the MOUP | | | |
| **PRECONDITION** | | Internet connection and access to the URL portal, subscription done, logged in, APIKey | |
| **EXPECTED RESULTS** | | Access and see the documentation | |
| **OUTPUT RESULTS** | | Accessed and verified documentation availability | |

6. Verification of working APIs (Fig. 43, Fig. 44, Fig. 45, Fig. 46, Fig. 47, Fig. 48, Fig. 49, Fig. 50, Fig. 51, Fig. 52, Fig. 53, Fig. 54)

The validity of the APIs had been tested firstly through the Swagger interface, to ensure they work.

| TEST IDENTIFICATION | | TEST EXECUTION | |
|---|---|---|---|
| **ID** | MOUP_6 | **TEST DESIGNED BY** | HOLONIX |
| **TEST PRIORITY** | High | **TEST EXECUTED BY** | • DOMINA SRL<br>• I-DEAL SRL<br>• ROBINSON SRL<br>• MASSIMO CAMPAGNOLO<br>• CYBERBRAIN |
| **MODULE NAME** | Working APIs | **TEST DATE** | 25/04/2020 |
| **TEST TITLE** | APIwork | **TEST STATUS** | Passed for all |
| **DESCRIPTION**<br>In this test we verify that developers are able to let the APIs work, through the Swagger interface | | | |
| **PRECONDITION** | | Internet connection and access to the URL portal, subscription done, logged in, APIKey | |
| **EXPECTED RESULTS** | | Receive expected information for each of the described KPIs through the interface: | |
| **OUTPUT RESULTS** | | Received expected information through the interface, for each KPI | |

7. Invoking APIs from the REST client chosen (Fig. 55, Fig. 56, Fig. 57, Fig. 58, Fig. 59, Fig. 60, Fig. 61, Fig. 62, Fig. 63, Fig. 64, Fig. 65, Fig. 66, Fig. 67, Fig. 68, Fig. 69, Fig. 70, Fig. 71, Fig. 72, Fig. 73)

Once the developer read the APIs documentation, the next phase is to choose a REST client to perform tests on the set of presented APIs.

Generally, every modern REST client is suitable, the only strict requirement is the support of the Authentication header (to define API key). For this test we chose CocoaRestClient, freely available at https://github.com/mmattozzi/cocoa-rest-client.

After configuring the client, by adding the API key string (`5dcbe2c6f02fb400014a1d6be8aa4a7f53ca4fbd852ad58a1795a4eb`) into the Authentication header, for each API we perform invoke operation (HTTP GET method) by passing the required parameters (whether needed). Every API works as expected and the results of queries are correct.

| **TEST IDENTIFICATION** | | **TEST EXECUTION** | |
|---|---|---|---|
| **ID** | MOUP_7 | **TEST DESIGNED BY** | HOLONIX |
| **TEST PRIORITY** | High | **TEST EXECUTED BY** | • DOMINA SRL<br>• I-DEAL SRL<br>• ROBINSON SRL<br>• MASSIMO CAMPAGNOLO<br>• CYBERBRAIN |
| **MODULE NAME** | Working APIs through the RESTclient | **TEST DATE** | 25/04/2020 |
| **TEST TITLE** | APIworkrest | **TEST STATUS** | Passed for all |
| **DESCRIPTION**<br>In this test we verify that developers are able to let the APIs work, through the CocoaRestClient | | | |
| **PRECONDITION** | | Internet connection and access to the URL portal, subscription done, logged in, APIKey | |
| **EXPECTED RESULTS** | | Receive expected information for each of the described KPIs through the RESTclient | |
| **OUTPUT RESULTS** | | Received expected information through the RESTclient, for each KPI | |

8. Quick Usability test by Cyberbrain

CyberBrain then tested the usability of the Open APIs through the immediate creation of a dashboard through an online free tool which is called Freeboard. The third party developer chose to present some data at regional level, as:

- Average carbon consumption and energy performance in residential Danish contexts;
- Productivity economic value and perceived air quality in Italian hotels contexts.

The result, obtained in the same session, is the following.

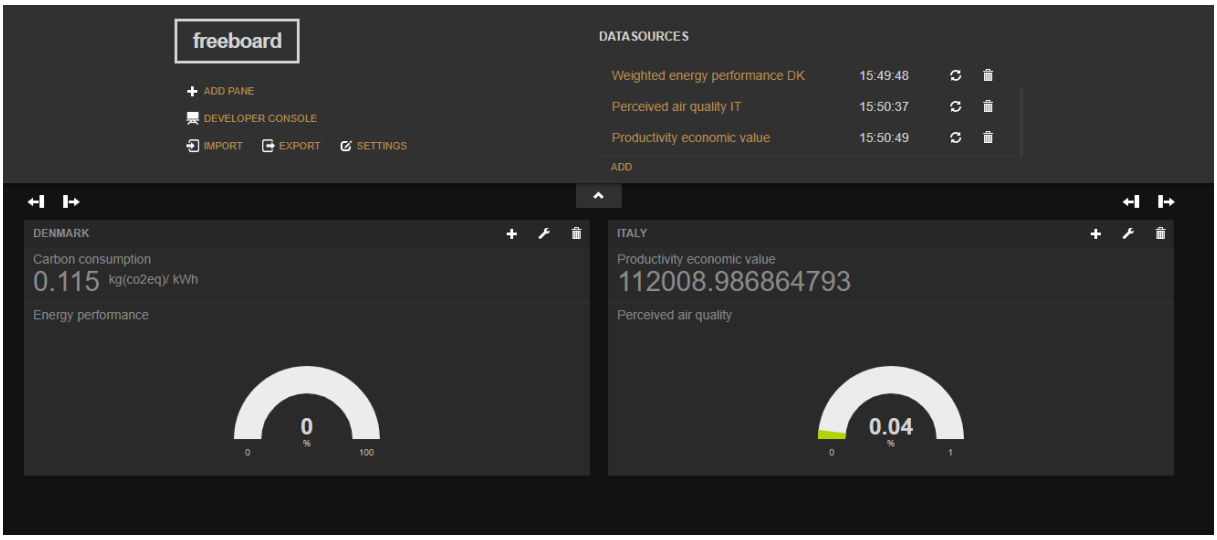



Fig. 33 MOUP usability test through adoption in Freeboard of results

## 7.2. Synthesis and list of optimizations to be applied

The MOUP solution needs two steps of analysis which are cross-competence and not strictly IT, before being ready for a next step of development. In particular, it is needed to improve the calculation for some specific KPIs.

During the final implementation of the MOUP, some KPIs reported as part of D5.3 were not fully calculated through the aggregation service. These KPIs and reasons for their underdevelopment are described in the following table.

| KPI | Motivation |
|---|---|
| Carbon intensity of consumptions | Lack of sufficient input data for the computation. |
| Energy performance weighed on thermal discomfort with respect to a performance target (daytime) | Lack of sufficient input data for the computation. |
| Medium energy consumptions for standby for TVs | Inconsistency (in terms of units of measure) between measured values and input data required for the computation. |

The parameterization of some KPIs proposed in D5.3 represents a possible future development of the MOUP. In detail, the KPIs that could be parameterized are:

- Energy performance weighed on thermal discomfort with respect to a performance target (daytime). Parameter: District heating consumption/$m^2$, target
- Percentage of hours in comfort in terms of temperature, relative humidity, $CO_2$ and VOC concentration (daytime/night-time). Parameter: weighting factors α
- Severity of discomfort in terms of temperature, relative humidity, $CO_2$ and VOC concentration (daytime/night-time). Parameter: weighting factors α

Moreover, the increase in metadata offered by the MOUP would also represent a valuable improvement of the platform itself, in order to increase KPIs significance and level of understanding by users.

### 7.3. Improvements roadmap to exploitation

An agreement is signed with partners involved in the development of the MOUP, which means Holonix, DEMO, and POLITO, in order to continue on the analysis and calculation of relevant and effective information.

Additionally, it has to be noticed that the MOUP will be useful and effective only in the case MOBISTYLE platform will have a critical number of buildings connected. The critical number to ensure the KPIs will be interesting and representative needs further investigation.

## 8. Conclusions

At the moment of the finalization of MOBISTYLE project, many points of awareness have been raised up, and some relevant outcomes had been produced, including those in the ICT domain.

First of all, all the ICT solutions had been able to aggregate competences from experts, including Anthropologists, Energy Efficiency Experts, Health related aspects experts, Indoor Environmental Quality experts. Additionally, a complex and stable ICT solution had been produced, with a completely modular approach which allows scalability and enables the involvement of further tools.

Users involvement and experts engagement have created a common knowledge base about many aspects which will need to be considered in the future of all ICT companies, also beyond MOBISTYLE: importance of user awareness, collaboration with different expertise and competencies, relevance of the interaction among users and ICT-tools, relevance of the concept of "calm technology approach", effectiveness of coupling ICT and non ICT solutions for the same goal, GDPR compliancy, etc.

Another awareness reached by the consortium during the project, and tested through the development methodology adopted, is that the exploitation of MOBISTYLE solution needs a strong and committed participation by all partners. This means that to reach an exploitable joint result, all the partners need to be aligned from the first day of the project. Competencies are a network, the platform is a network, and a network needs to be the group of partners involved in the exploitation of joint results.

Modularity of the Information Service allows a simplification of the organizations involved in each single instance of the exploited platform, but as all solutions are cross-competencies, many partners need to be involved.

From the users' perspective, the interest in MOBISTYLE tools is confirmed, even though many aspects had been pro-actively criticized and alternatives have been proposed.

Concerning tools deployed at pilots' side, the level of activity was diversified in different environments. In particular, in the hotel context (Italian demo case), validation was developed targeting mainly staff members, because only one single guest accessed the tools during his stay. Thus, interest from real guests was not fully achieved, but feedback to understand limitations and look for tools future development were gathered (also reported in D6.3). From staff members' perspective, main limitations towards a more active use are in lack on integration with other services and in time-constraints. However, the tools were positively judged in terms of technical aspects and usability (as described in this report), and contents were considered of interest. Part of the numerical results have been achieved and the awareness on the topic had been reached with engaged users.

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## Annex 1: MOBISTYLE Dashboard UX validation

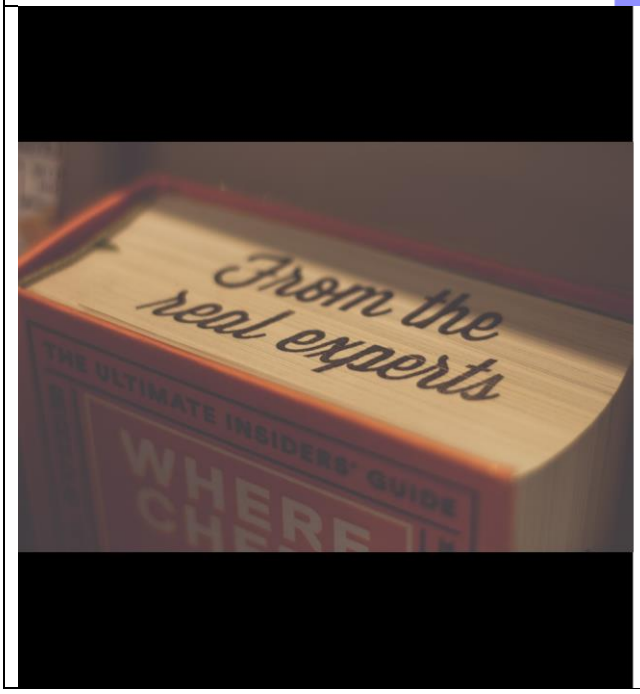
HOLONIX®
BRING THINGS TO LIFE

MOBISTYLE

# Analisi euristica di usabilità

Versione desktop
Maggio 2019

Caterina Calefato – UI-UX expert




Analisi delle criticità del software attuale

## Metodologia

L'analisi euristica è un metodo ispettivo che non prevede il coinvolgimento dell'utente finale.

Uno o più esperti di ergonomia cognitiva valutano l'aderenza o meno dell'interfaccia a una serie di principi di usabilità (le euristiche)

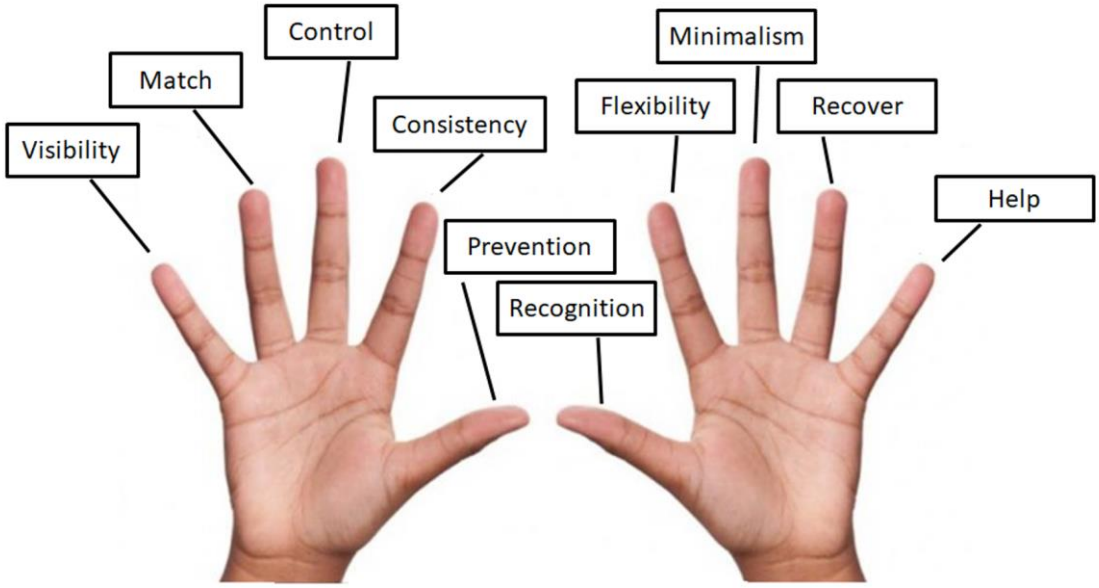
User Interface Design

# Le 10 euristiche di Nielsen

Tramite le euristiche si segnalano eventuali problemi e possibili soluzioni

(rif. Nielsen/Norman Group)

## One heuristic for each digit



Si tratta solo di questo

## Usabilità

Una persona con una capacità e un'esperienza nella media (o anche sotto la media) può capire come si usa una determinata cosa per raggiungere un scopo senza dover risolvere più problemi di quanto valga la pena

Steve Krug, *Don't make me think.*

## Valutazioni generali

## Architettura

L'interfaccia è molto complessa. Anche se le funzioni e la parte ingegneristica sono complesse, la complessità non deve salire in superficie.

Manca l'information architecture.

Manca la progettazione dello user journey

Manca la navigazione, il mapping e un buon modello concettuale

Manca una home page evidente, e una suddivisione coerente in sezioni e sottosezioni

Manca gli help: tuorial, FAQ, informazioni contestuali, contatti

***Dopo la navigazione del sito, resta la spiacevole sensazione di non aver esplorato tutto***

## Valutazioni generali

## Grafica & layout

Manca un progetto grafico. La grafica migliora l'estetica e l'usabilità:

Mancano affordance, icone, tasti, label e nomi delle pagine chiari.

I font sono molto piccoli.

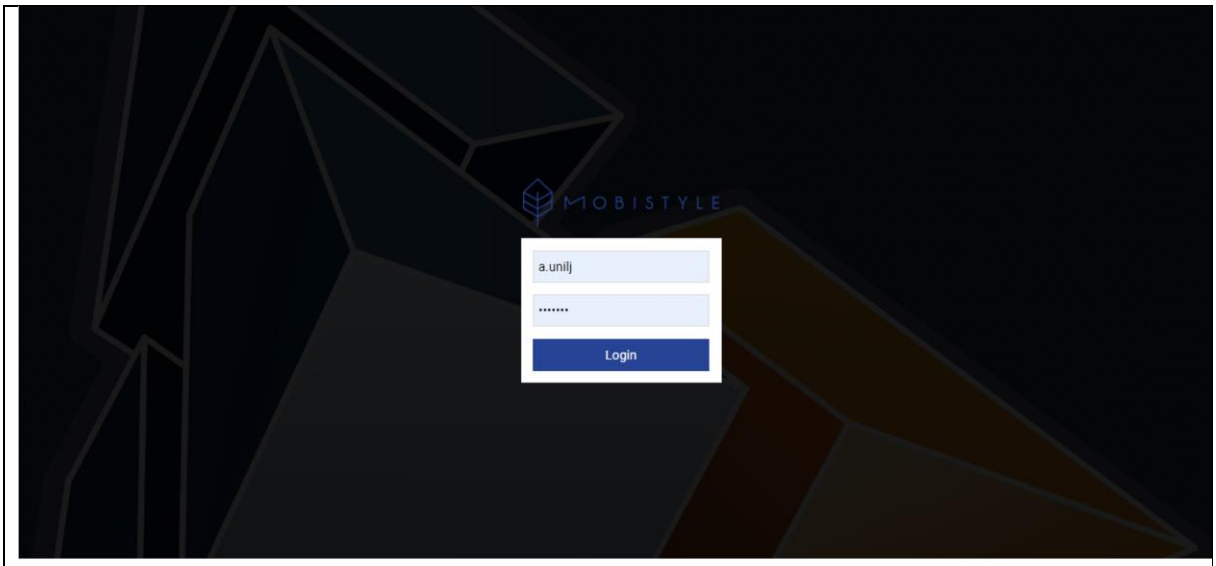
Navigazione e contenuti non seguono una gerarchia visiva che aiuti l'orientamento.

Le schermate sono affollate e disorganizzate e quindi il livello di rumore è molto alto.

L'uso delle card non aiuta a far emergere gli elementi dallo sfondo, perché manca profondità e contrasto.

***Durante la navigazione del sito, si prova la spiacevole sensazione di essere in una stanza che è stata saccheggiata, con le cose sparse ovunque***

## Analisi delle schermate



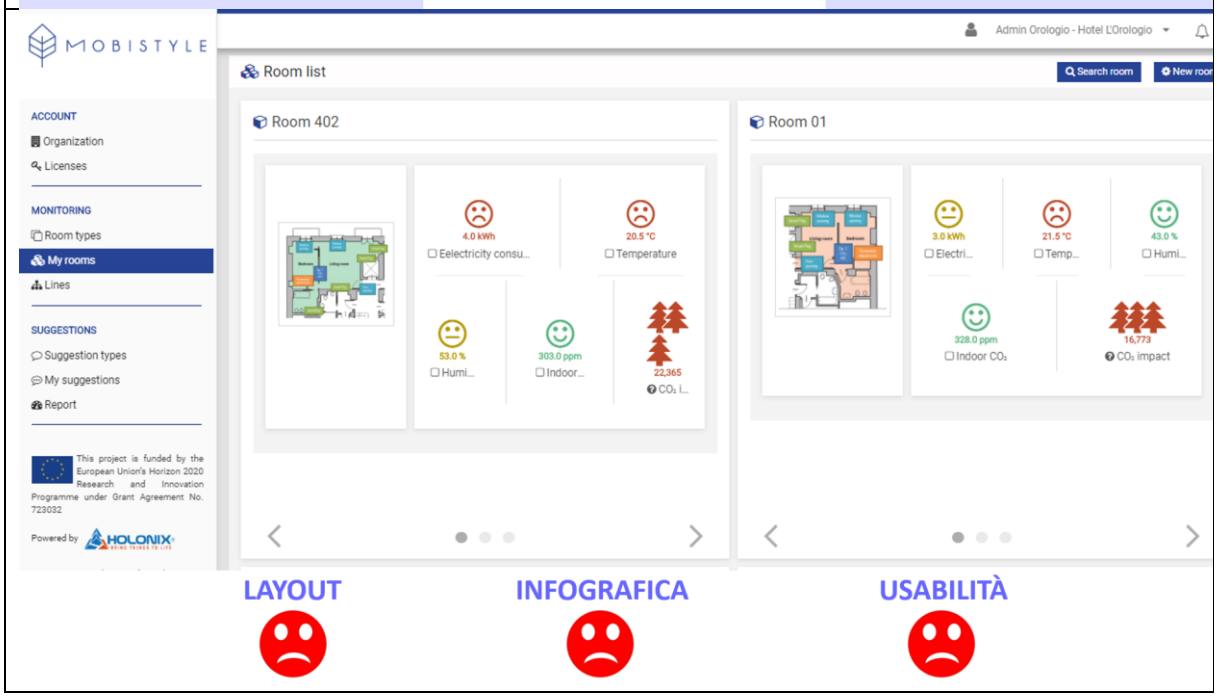

BRANDING LAYOUT GRAFICO USABILITÀ

## LOGIN - CRITICITÀ

| BRANDING | LAYOUT GRAFICO | USABILITÀ |
|---|---|---|
| Il logo Mobistyle non contrasta con lo sfondo e si vede poco<br><br>Il logo di Holonix è è riconoscibile solo per chi già lo conosce<br><br>Manca il nome di Holonix nella pagina | La finestra di login ha uno stile grafico diverso dallo sfondo.<br><br>In più risulta «appiccicata sopra» | Mancano le funzioni di retrieve password/username<br><br>Non c'è un welcome<br><br>Non ho nessuna informazione preliminare al servizio prima del login.<br><br>Sarebbe sufficiente anche solo una tagline |

## LOGIN – SUGGERIMENTI DI REDESIGN

| BRANDING | LAYOUT GRAFICO | USABILITÀ |
|---|---|---|
| Presentazione del servizio | Creare una landing page | Creare la base della navigazione |
| Video tutorial/slideshow | Gestire le proporzioni | Inserire il cambio lingua |
| Contatti | Creare orientamento | Inserire le utility per la login (retriev password, username, ecc.) |
| Policy di subscription | | |



## MY ROOMS CARD 1 – CRITICITÀ 1/2

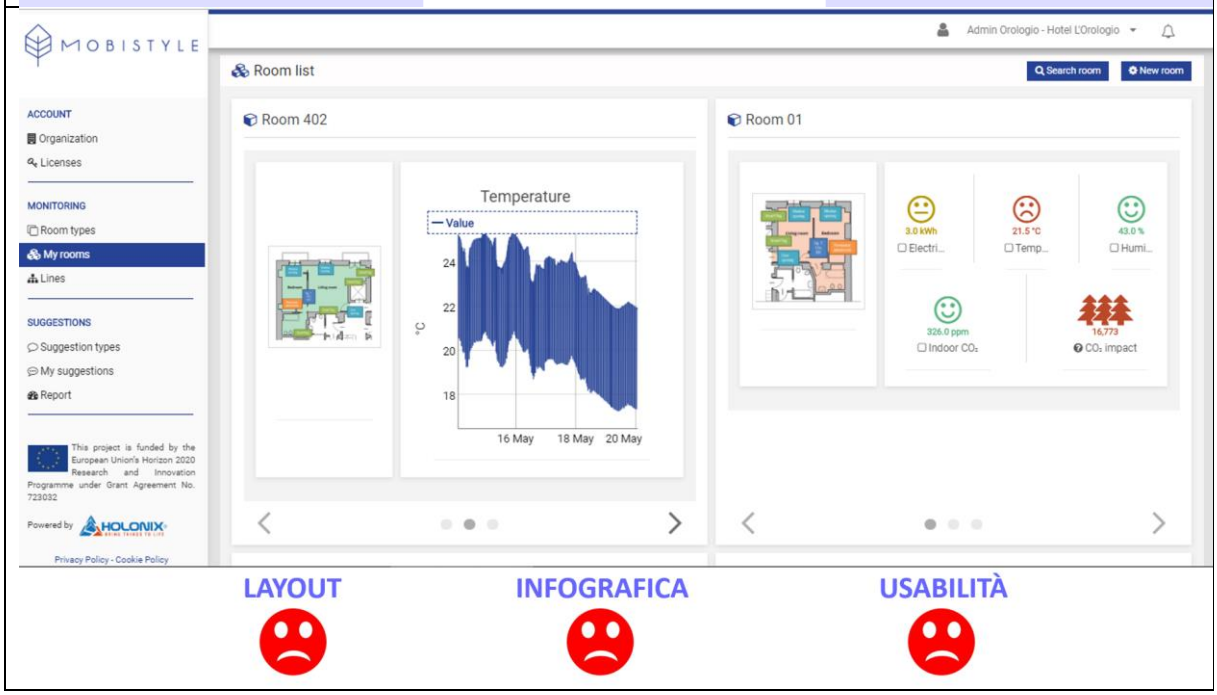
| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| I widget delle stanze sono tutti di dimensioni diverse anche se contengono le stesse informazioni. La pagina così risulta «storta».<br><br>La label non aiutano la navigazione<br>• Sono tutte piccolissime nonostante lo spazio bianco<br>• Le label sono troncate anche se c'è molto spazio.<br>• Il mouseover non funziona e non ho modo di sapere cosa sono, sono obbligata a cliccare<br><br>La piantina della stanza è e senza zoom, quindi non si vede | Non è evidente il criterio di presentazione delle sequenza di stanze.<br>• Per numero progressivo?<br>• Per piano?<br>Scale e unità di misura<br>• L'indicatore smile sorride solo se tutti gli apparecchi sono spenti, è frustrante, perché non è di per sé un comportamento virtuoso<br>• Manca l'un. di misura della CO2. Cosa rappresenta la cifra? Milligrammi? I 3 decimali dopo la virgola appesantiscono la lettura<br>• Non si capisce la scala riferita agli alberi (min? max? cambia colore?) | «My rooms» sembrerebbe la home, ma non c'è evidenza:<br>• Il logo non è un link alla HP (convenzione)<br>• My rooms è il quarto elemento del menu di navigazione a sx<br><br>I checkbox, per convenzione, indicano un'opzione selezionabile. I checkbox vicino alle label fanno pensare alla possibilità di spuntare qualcosa (è una dashboard) e invece no |

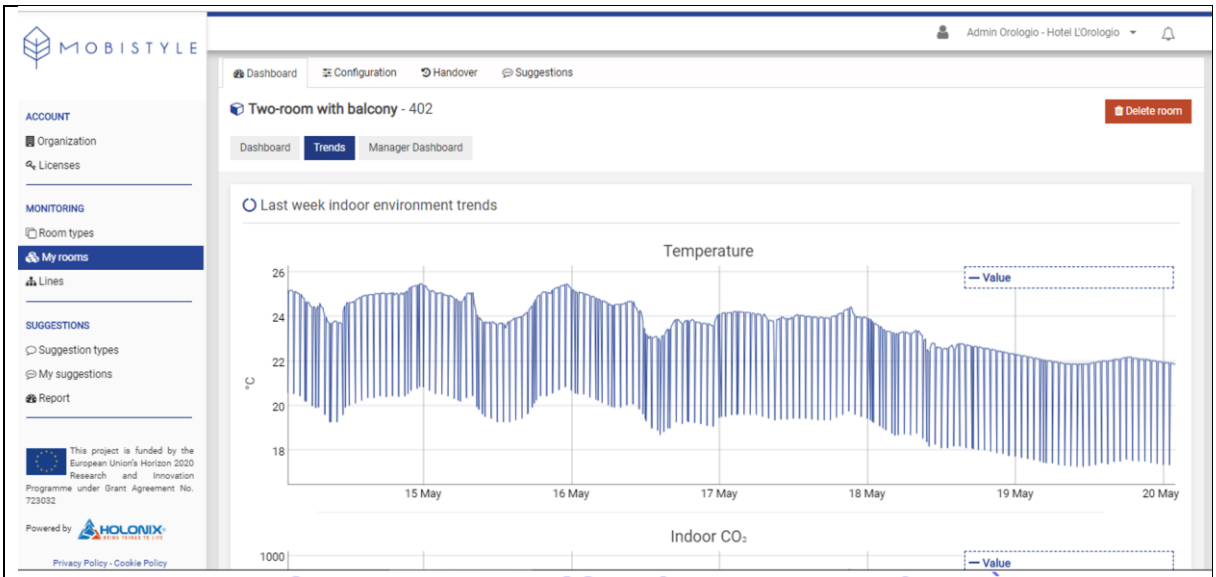
## MY ROOMS CARD 1 – CRITICITÀ 2/2

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Non c'è evidenza grafica che il widget è tutto un unico tasto (per es. evidenziazione).<br><br>I riferimenti al progetto, powered by, l'anno e alcune ridondanze delle utilities (per es. i contatti) si mettono di solito nel footer. Lì creano solo rumore | Indicatore CO2: Dall'immagine e dalla spiegazione in mouseover capisco che ci vogliono 3 alberi in un anno per assorbire la Co2 prodotta da me ospite.<br>• Quando? Oggi? Durante tutto il mio soggiorno?<br>• I dati sono istantanei o una media?<br>• Se sì qual è la granularità temporale? | Se passo con il mouse sul nome (per es. «room 402») viene visualizzata la mano ma non clicca.<br><br>L'impressione è di poter cliccare su ogni singolo indicatore ed arrivare a un dettaglio di esso<br><br>La mancanza di uno studio grafico, assieme alla dispersione della navigazione crea molto rumore<br>• Ci sono almeno 6 layer di card<br>• Le convenzioni di navigazione non sono rispettate |

## MY ROOMS CARD 1 – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Adottare le convenzioni per l'aspetto e l'aspetto degli elementi di navigazione.<br>• Standardizzare il loro aspetto permette di distinguerli molto facilmente da tutto il resto<br><br>Mettere i contenuti in un posto standard ci permette di individuarli rapidamente. | Utilizzare scale chiare e significative, che di fatto premino un comportamento virtuoso e che non siano legate al power off.<br><br>I decimali in questo contesto non sono significativi (per di più 3) meglio usare un intero o al massimo un decimale | Creare una home page<br><br>Creare una navigazione persistente (primaria/secondaria)<br><br>Inserire una sezione di utility<br><br>Ridurre il rumore delle pagine e creare un design system coerente, usabile e piacevole. |





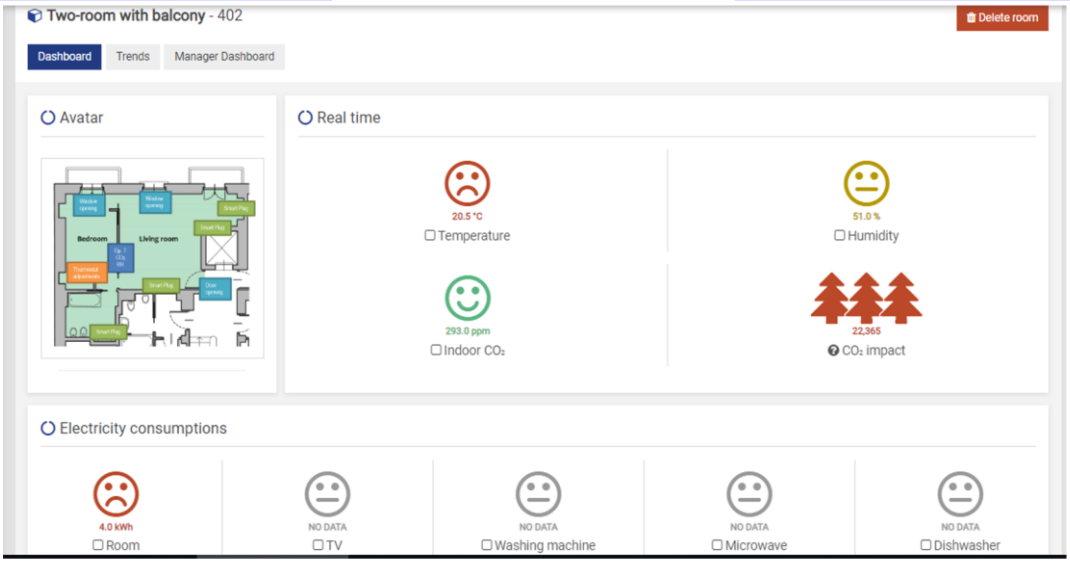

LAYOUT INFOGRAFICA USABILITÀ

## MY ROOMS CARD 2 – CRITICITÀ 1/2

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Non è chiaro cosa si evince da questo grafico.<br>• È troppo denso e nonostante il mouse è difficilissimo selezionare un singolo valore. | Forse le info veramente utili non sono mostrate (valore, medio, min. max giornata, valore corrente). | Se clicco sul 16 maggio mi porta a un'altra videata (non richiesta)<br>• Cambia completamente la navigazione: passo dal primo livello (My rooms) al terzo (dashboard/trends).<br>• Se faccio back, non fa né back storic né level up (secondo livello e quindi dashboard) |

# MY ROOMS CARD 2 – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| • Sarebbe meglio avere un trend ottenuto dall'interpolazione<br>• Passando dal livello 2 al 3 la dimensione degli elementi della card cambia, creando uno spiacevole sfarfallamento | Occorre dare all'utente le informazioni di cui ha realmente bisogno in forma semplice, e a richiesta si può mostrare l'istogramma di dettaglio | Non tutto è importante allo stesso livello<br>Occorre dare informazioni ben visibi e nel posto giusto<br>Occorre progettare la profondità delle sezioni e organizzarle, senza saltare a casaccio da un livello a un altro |




LAYOUT

INFOGRAFICA

USABILITÀ

## DASHBOARD – CRITICITÀ 1/2

### LAYOUT

Dal punto di vista grafico, le card sono tutte uguali, ma queste per esempio non si cliccano (al livello superiorie sì)

Perché c'è scritto avatar se c'è una mappa? Perché vicino alle label c'è l'icona di un loader? (o molto simile)

Le label sono molto piccole e non si leggono bene

### INFOGRAFICA

L'unità di misura della Co2 indoor è diversa sotto l'indicatore con gli alberi.

- È la stessa informazione presentata con 2 metriche diverse che confondono l'utente.
- Vedo la faccina verde, ma vedo anche tre alberi rossi. Quindi discordano? Concordano?

### USABILITÀ

I checkbox, per convenzione, indicano un'opzione selezionabile. Qui però non si seleziona nulla

La mappa non ha zoom e si vede male

Le faccine grigie sembrano perplesse (il codice antropomorfo è più forte del codice colore).

- Quindi c'è qualcosa che non va?
- Cosa vuol dire «no-data»? Spento? Rotto? Assente? In standby?

## DASHBOARD – SUGGERIMENTI DI REDESIGN

### LAYOUT

Differenziare bene gli elementi cliccabili da quelli statici

Aumentare i font, per facilitare la lettura

Utilizzare i codici colore (che sono delle convenzioni) con coerenza e chiarezza

### INFOGRAFICA

Prevedere sempre l'unità di misura nelle metriche e usare la stessa unità di misura sulle stesse metriche, anche se cambia il widget.

Aiutare l'utente a comprendere il significato dei valori, magari con delle piccole info contestuali

### USABILITÀ

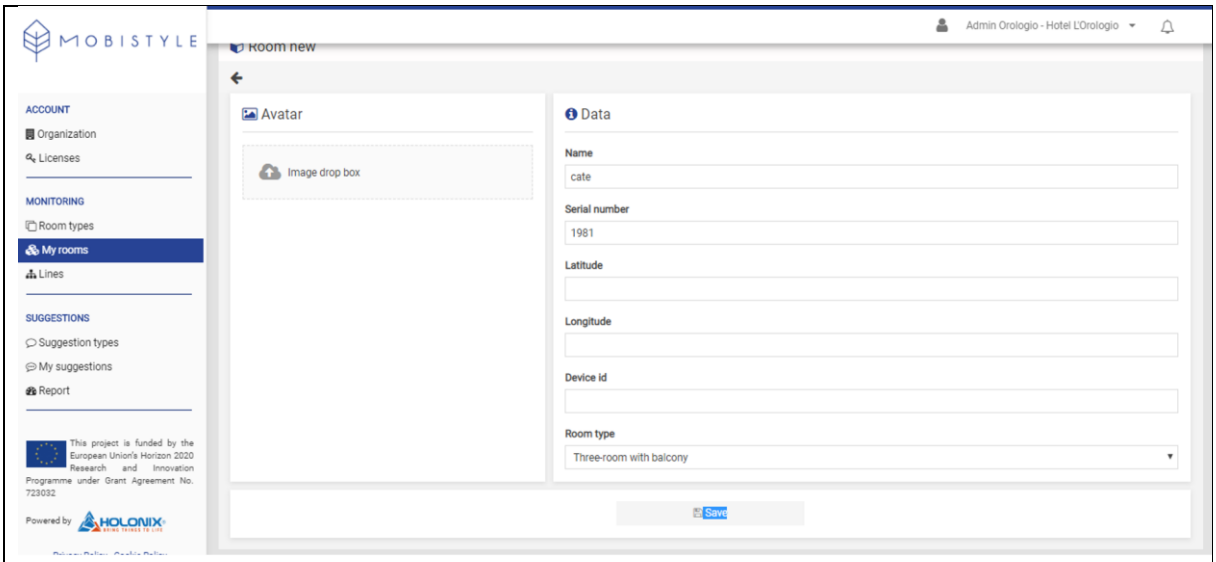
Dare un nome chiaro e ben visibile alle pagine, le card e le sezioni

Rispettare le convenzioni nella navigazione

- Usare il check box per liste a scelta multipla

Se ci sono delle interruzioni di servizio o malfunzionamenti (no data) oscurare il dato o dare una spiegazione.

- L'errore, decontestualizzato, confonde l'utente



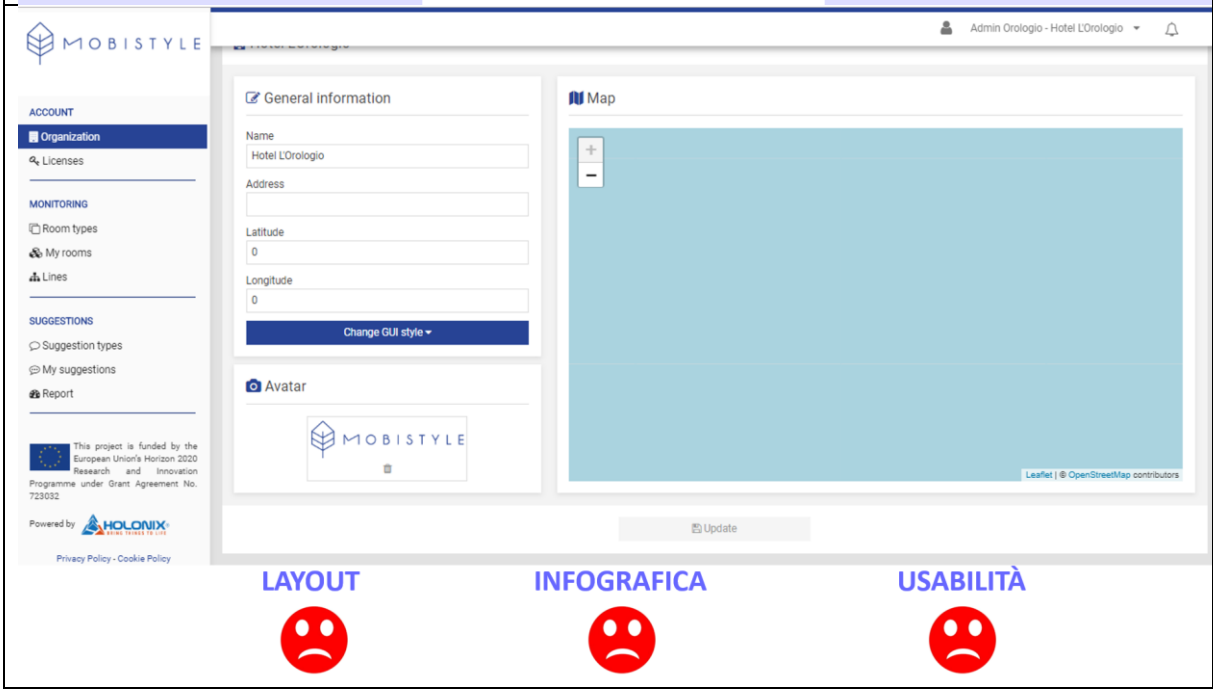

LAYOUT 😐 INFOGRAFICA 😐 USABILITÀ ☹

## MY ROOMS/NEW ROOM – CRITICITÀ

| LAYOUT 😐 | INFOGRAFICA 😐 | USABILITÀ ☹ |
|---|---|---|
| Perché c'è scritto avatar se viene chiesto di caricare un'immagine?<br><br>Gli spazi sono distribuiti in maniera poco efficace.<br>• L'istinto è quello di fare scroll per vedere se ci sia ancora qualcosa.<br>• In realtà la pagina è tutta presente in un singolo screen, ma non si ha questa sensazione | NA | L'uso delle icone non è appropriato né standard e non aumenta l'efficac delle label<br>• Cubo per il titolo New Room<br>• <i> di info per i form da compilare |

## DASHBOARD/NEW ROOM – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Il nome degli oggetti (delle pagine, dei form, dei widget) deve corrispondere a quello su cui ho fatto/ devo fare clic<br><br>Utilizzare la distribuzione dello spazio per comunicare contenuto e funzioni all'utente | NA | Rispettare le convenzioni, utilizzand icone, label e nomi standard ove possibile.<br><br>Le convenzioni riguardano:<br>• Dove devono trovarsi le cose in una pagina<br>• Come funzionano le cose<br>• Come si presentano le cose<br><br>Se si decide di non utilizzare le convenzioni del Web già esistente, è assolutamente necessario che quell con cui le sostituite sia:<br>• Tanto chiaro e autoesplicativo da no richiedere alcuna curva dell'apprendimento<br>• Talmente di valore da meritare una piccola curva dell'apprendimento |




LAYOUT 

INFOGRAFICA 

USABILITÀ 

## ORGANIZATION – COGNITIVE WALKTHROUG

Inizialmente immagino che questo screen (nome: <organization>) serva per creare/localizzare un nuovo edificio e creare i relativi permessi/accessi. In realtà non serve a creare una nuova organizzazione.

A questo punto penso che modifichi le info dell'account.
Ma se modifico dei campi il tasto update non si attiva e quindi non posso salvare le mie modifiche.

In Organization/General info ho scritto «casa mia» su name e non riesco più a rimuoverlo. Non so nemmeno come abbia fatto a salvarlo. Se provo a cambiare tab dopo la modifica, compare il popup che mi dice che ci sono modifiche non salvate, ma le uniche azioni sono cancel/ok che non mi aiutano. Sarebbe meglio cancel/save.

Dopo moltissimi tentativi (20 minuti circa) trovo il modo di salvare: bisogna andare nel tab users e fare update da lì. Infatti ora il nome dell'organizzazione da «casa mia» ora è diventato «uni».

## ORGANIZATION – CRITICITÀ

### LAYOUT

Menu a sx: guida poco la navigazione
- ha dei speratori di sezione, ma è scollegato dalla dashboard
- dovrebbe avere delle icone più rappresentative

Change Gui style: come livello di personalizzazione skin è povero. Di fatto non migliora la UX e aggiunge rumore.
- Meglio avere un'unica grafica ben fatta e stop.

### INFOGRAFICA

La mappa non funziona

La presenza dell'avatar ha come default Mobistyle, ma di fatto rappresenta un doppione (di funzionalità nell'avatar già presente nel profilo personale)

Richiesta informazioni complesse:
- Latitudine e longitudine non sono info facilmente reperibili per l'utente
- L'indirizzo non è strutturato in campi.

### USABILITÀ

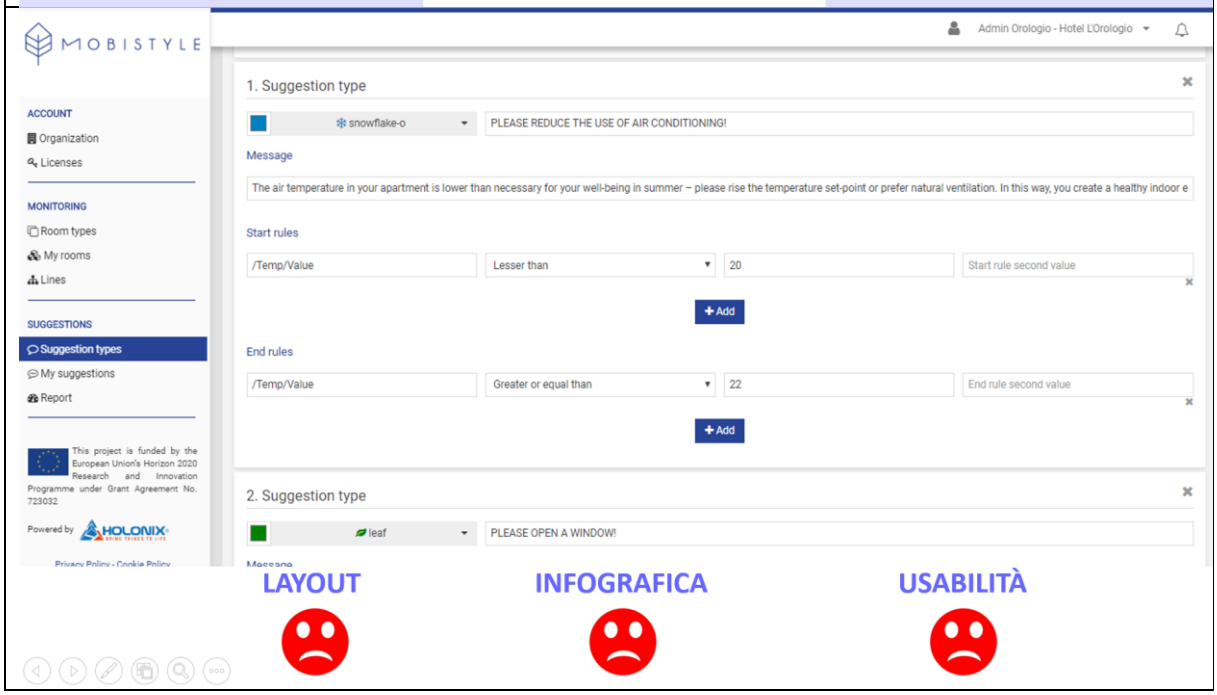
Le utilities (per es. le funzioni riguardanti l'account) sono disorganizzate e sparpagliate

Le icone scelte sono icone di sistema (tipo DB) e non rappresentano il concetto (che è determinante, per e quando il menu viene ridotto)

Non è chiara la differenza tra suggestions e my suggestions
- è un sottoinsieme?
- Se è un subfunction occorre annidarlo.
- Mancano completamente delle spiegazioni

## ORGANIZATION – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Menu a sx: guida poco la navigazione<br>• ha dei speratori di sezione, ma potrebbe ospitare la navigazione di I e II livello (extent & collapse)<br>• La grafica selezione dell'item deve essere ricollegata alla dashboard centrale, per migliorare l'orientamento<br>• Il menu potrebbe essere riducibile (lasciando fuori solo le icone per es.) per lasciare più spazio alla dashboard. | Le funzioni non implementate o non attive creano disorientamento e frustrazione<br><br>L'indirizzo dovrebbe essere strutturato in campi (standard) e ricercare da solo le coordinate GPS (ref. Google maps) e chiedere eventualmente conferma di queste ultime | Le utilities (tra cui l'account) devono stare tutti insieme e per convenzion sono in alto a dx<br><br>Prevedere un aiuto all'utente per comprendere il significato delle funzioni, soprattutto se le scelte o i compiti da svolgere sono difficili |




LAYOUT ☹ INFOGRAFICA ☹ USABILITÀ ☹

## SUGGESTION TYPES – CRITICITÀ

### LAYOUT

Manca un modello gerarchico delle regole (suggestion type)

### INFOGRAFICA

La logica di creazione delle regole e relative label sono tipicamente da coding

- Start rule/end rule
- /Temp/Value: perché ci sono gli slash? È di nuovo sintassi da coding

- Se aggiungo una condizione come si comporta la regola poi? Non è chiaro.

### USABILITÀ

Manca un mapping efficace sulle funzioni.

- Per capire se a una stanza sono applicate dei suggerimenti devo fare continuamente back and forth

Le regole sembrano completamente fluttuanti

Non c'è aiuto per capire come creare le regole

- I valori delle regole come li determino? Li invento?
- Sono un set fisso? Se si dovrebbero essere riportati nel combo.

## SUGGESTION TYPES – SUGGERIMENTI DI REDESIGN

### LAYOUT

Creare una gerarchia visiva (e quindi concettuale) per l'elenco di regole

- Regole esistenti/esempi/feature modificabile/crea nuovo, ecc.

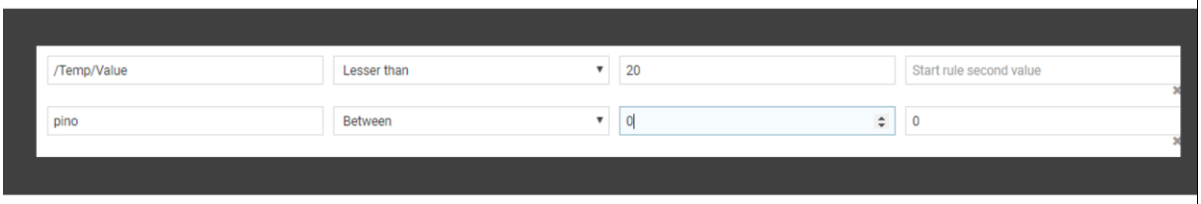
### INFOGRAFICA

Occorre creare una struttura sintattica e semantica più immediata e semplice

- L'approccio e il modo di ragionare da coding non è applicabile alla maggior parte degli utenti, con capiscono né la sintassi né la semantica

### USABILITÀ

Le regole per essere comprese non devono essere delle entità fluttuanti ma ricondotte al caso concreto, aiutando l'utente con grafica, spiegazioni e esempi



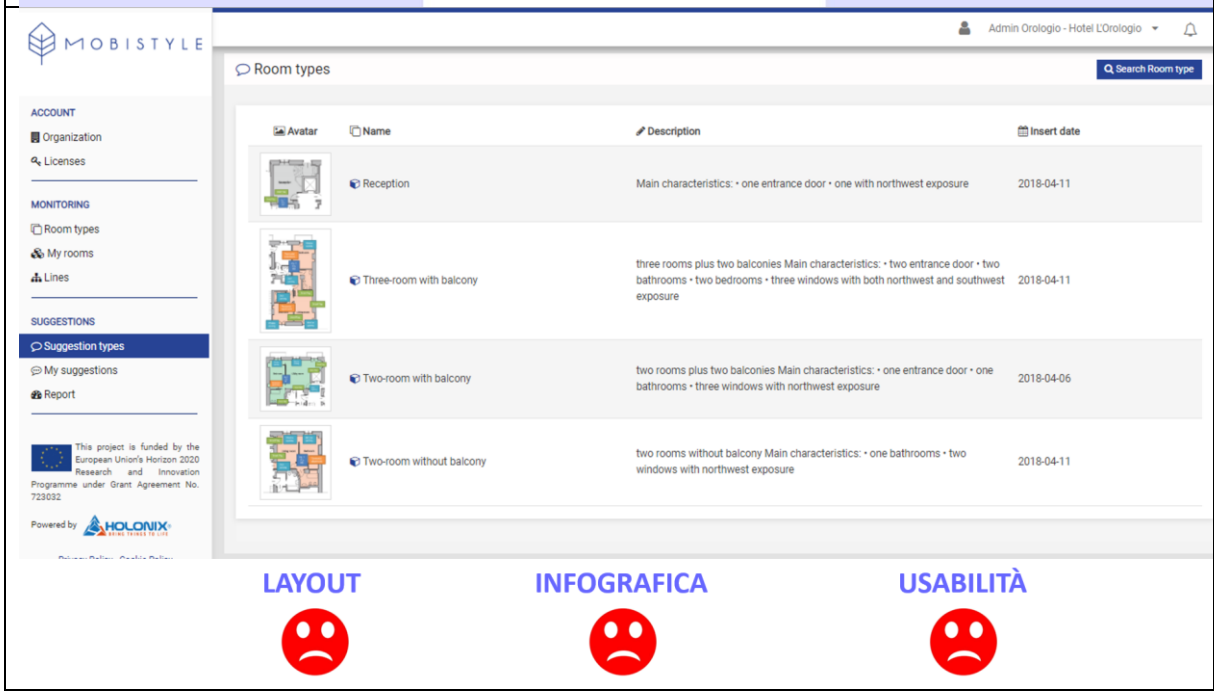

LAYOUT INFOGRAFICA USABILITÀ

## CREAZIONE REGOLE – CRITICITÀ

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Scarsa efficacia dell'affordance up/down:<br>• è piccola e difficile da selezionare con il mouse<br>• è una ridondanza inutile, perchè il valore è editabile<br><br>Funzione di Delete non standard<br>• La X per eliminare la regola è piccola non si vede<br>• Non è in una posizione standard (sotto anziché in linea a dx o in alto a dx)<br>• Per convenzione la x chiude e non elimina. | Non viene chiesta conferma per il delete | Non c'è nessun controllo sulla validit dell'input<br>• Posso scrivere delle cose senza senso<br><br>Il modello concettuale che sottende alle regole non si evince<br>• Come sono collegate tra loro due regole di inizio o fine? In and in or?<br>• Anche se ci fosse un booleano per la gli utenti comuni non è logica semplice da intuire |

# DASHBOARD – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Strutturare le funzioni in modo tale che sia evidente e compensibile cosa posso fare, su cosa posso cliccare e quali sono gli effetti delle mie azioni | Prevedere sempre una conferma per le azioni irreversibili<br><br>Attendersi il più possibile alle convenzioni web. Di seguito le associazioni erronee:<br>• Icona chat= room type<br>• Icona immagine = avatar<br>• Icona documento multiplo = nome<br>• Icona edit = description<br>• Icona sugar cubes = stanza | Curare il modello concettuale, in modo che l'immagine finale del sistema e del suo funzionamento sia il più possibile vicina al modello atteso dall'utente |




LAYOUT ☹ INFOGRAFICA ☹ USABILITÀ ☹

## SUGGESTION TYPES – CRITICITÀ

### LAYOUT

C'è l'impressione che ci siano le breadcrumbs

- Quando clicclo su «description» e mi accorgo che non funziona, mi rendo conto che è un'intestazione e un un'utility
- L'icona di edit disorienta, perché mi fa pensare che sia un tasto

### INFOGRAFICA

L'uso delle icone è inappropriato e crea ambiguità e confusione

L'uso delle icone non è consistente: per le stesse funzioni o label le icone cambiano nelle diverse pagine:

- «room types» ha l'icona file multiplo nel menu, e in questo screen l'icona usata per le chat
- L'icona del report è una macchietta scura e non si capisce cos'è (un gauge?)

### USABILITÀ

Se seleziono nel menu a sx «suggestion types» nel nome della pagina vedo «room types», e questo crea confusione e disorientamento

È la prima volta che compare la label «insert date». Le domande spontanee sono:

- dove inserisco la data?
- per fare cosa?
- a cosa mi serve saperlo?

## SUGGESTION TYPES – SUGGERIMENTI DI REDESIGN

### LAYOUT

Se la label è chiara non serve per forza rinforzare il concetto con un'icona, anche perché si rischia di creare ambiguità se la scelta delle icone non è ottimale

Le icone dovrebbero sostituire le label o aiutare a comprendere il tipo di funzione per cui la label da sola non è sufficiente.

### INFOGRAFICA

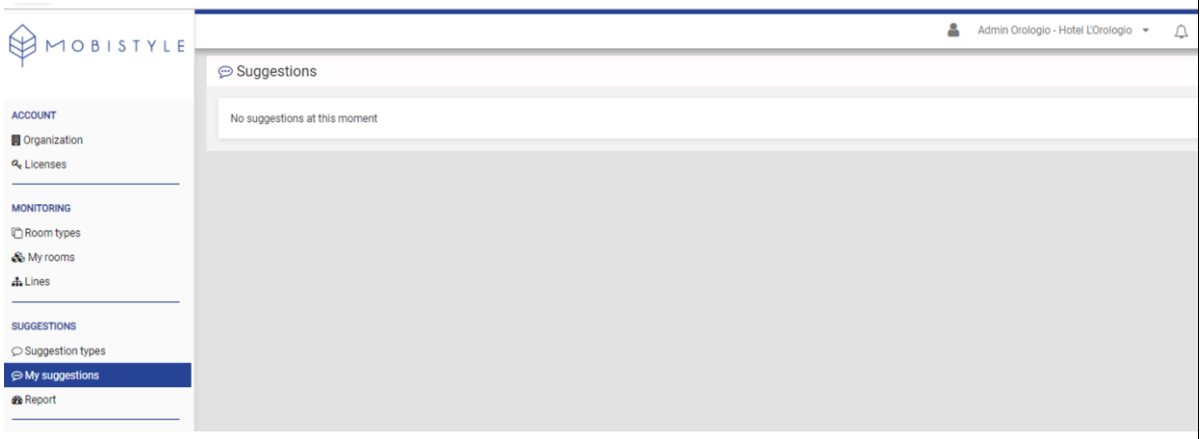
Rispettare le convenzioni per l'uso delle icone:

- La matita indica una funzione di edit, quindi di solito viene usata nei tasti
- Il fumetto (con o senza puntini) indica lo strumento chat
- Il bidone indica il Delete
- Il file indica il report
- Non c'è nessun motivo per cui le stanze debbano essere dei cubi, che è più tipica per un datawarehouse, piuttosto cercare di richiamare l'idea dell'edificio

### USABILITÀ

Creare una navigazione coerente e persistente

Creare dei percorsi (user journey) in modo che le informazioni che trovo non mi sorprendano e confondano (ref. to insert date)



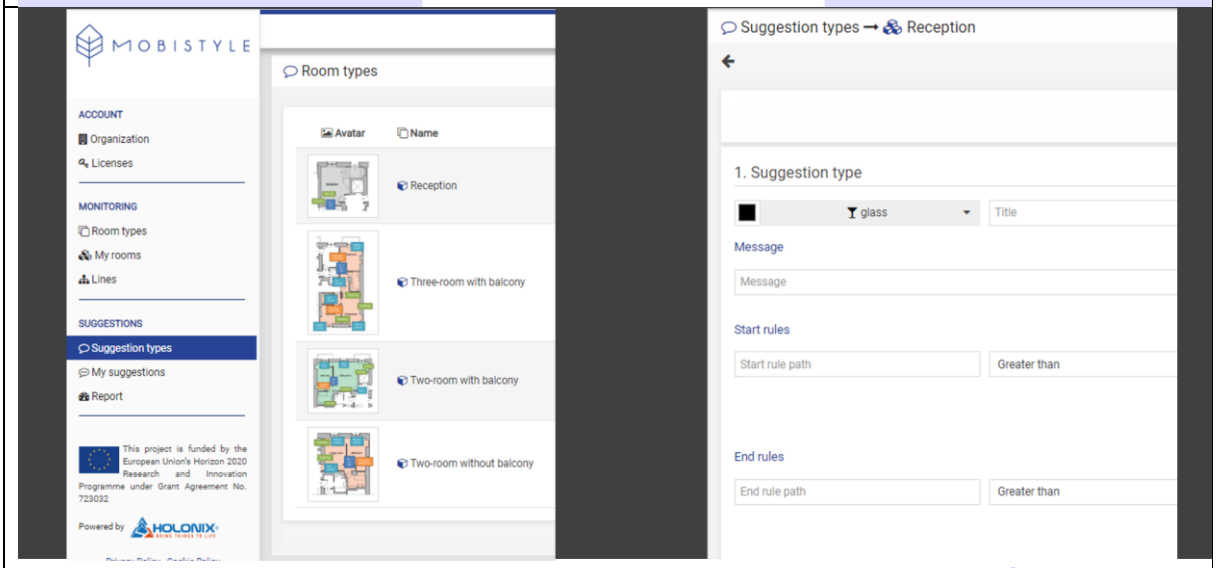

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|

## MY SUGGESTIONS – CRITICITÀ

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| La pagina è completamente vuota ed è frustrante | NA – non avendo trovato un esempio di My Suggestion non è possibile fare l'analisi | L'utente percepisce un senso di inutilità della sezione e soprattutto non ci sono spiegazioni che lo aiutin a capire a cosa serve la pagina e perché è vuota (forse va tutto bene? Ma cosa esattamente?) |

## MY SUGGESTIONS – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| La pagina, se mantenuta, va riorganizzata per evitare questa sensazione di vuoto e diespersione | NA | In alternativa a questa pagina, si può scegliere di disabilitare il tasto.<br><br>Quando ci sono nuovi suggerimenti (sono eventi?) si mette il badge vicino al tasto e si crea una notifica |



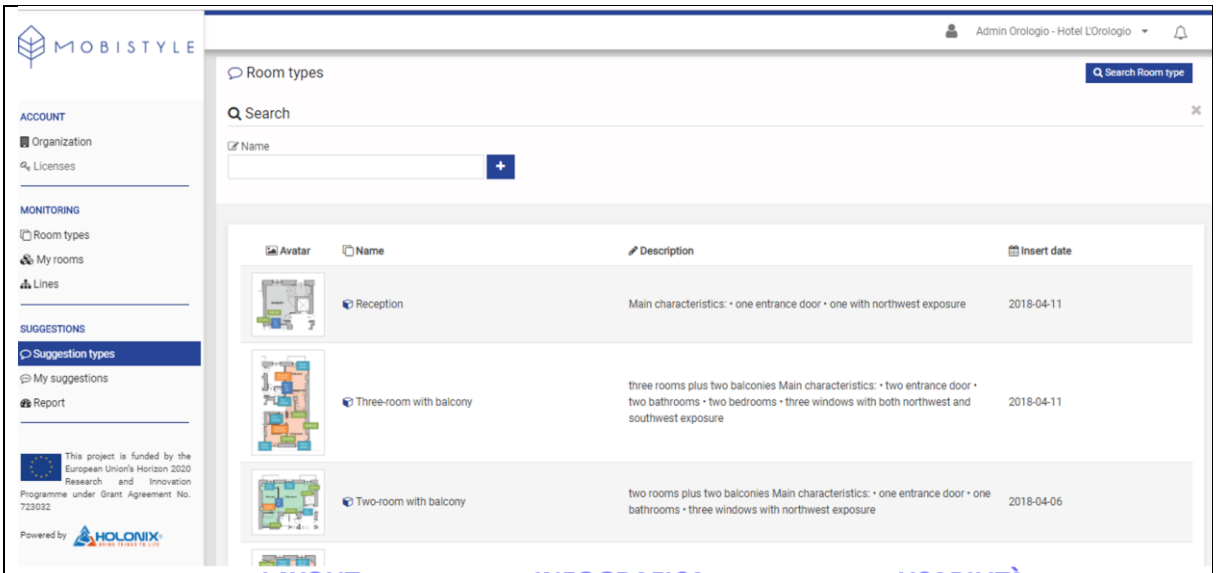

LAYOUT ☹ INFOGRAFICA ☹ USABILITÀ ☹

## DASHBOARD – CRITICITÀ

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
|  <br>Il pattern di navigazione è incongruente:<br>• Il percorso realmente fatto è: suggestion types/room types<br>• Invece l'header è suggestion types/reception<br>• «Reception» non è nemmeno il nome del menu ma il nome della singola istanza)<br><br>Il tasto «add suggestion» è poco visibile e in più non è evidente che è un tasto |  <br>Incogruenza uso delle icone (o è un indicatore di quantità?):<br>• My rooms: icona sugar cubes (multipla)<br>• Reception: icona sugar cube (singolo) |  <br>L'header ha di nuovo l'aspetto delle breadcrumbs, questa volta rafforzat dalla presenza della freccia<br><br>È possibile eseguire delle azioni incongruenti:<br>• Se ho una start/end rule vuota posso eliminarla.<br>• Se questo serve per impostare una regola fissa (senza una condizione di inizio o di fine) non è evidente.<br>• Se non serve a niente non è utile |

## DASHBOARD – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Rendere tutti gli elementi di navigazione (tasti, header, ecc,) evidenti e autoesplicativi | Utilizzare icone che rispettino le convenzioni del web.<br><br>Nel caso questo non sia possibile, usare icone che siano rappresentative della funzione in cui sono state collocate | Implementare le breadcrumbs aiuta a contrastare la sensazione di esserc persi, mostrando dove ci troviamo ir uno schema di cose.<br>• Per creare lo «schema di cose» occorre creare una information architecture<br>• Le breadcrumbs devono avere risalto, se non ce l'hanno perdon la loro funzione di indizi visivi e finiscono per aggiungere ulteriore rumore alla pagina. |



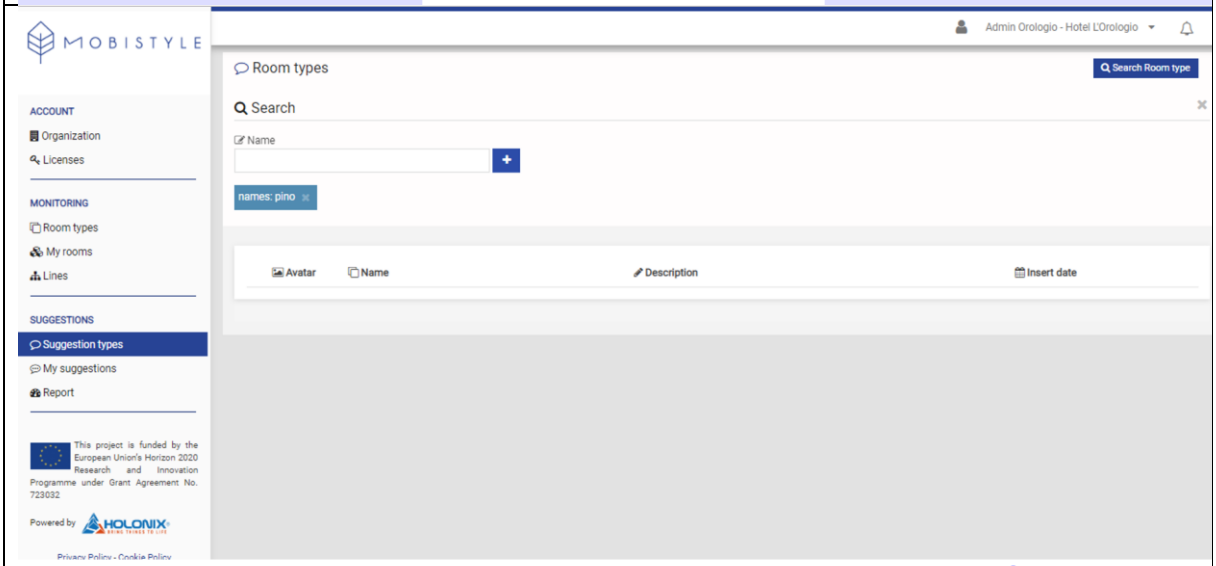

LAYOUT ☹ INFOGRAFICA ☹ USABILITÀ ☹

## SEARCH – CRITICITÀ

| LAYOUT ☹ | INFOGRAFICA ☹ | USABILITÀ ☹ |
|---|---|---|
| È un tasto che apre un cassetto che genera molto rumore:<br>• titolo «Search»<br>• sottotitolo «name» | Il tasto che avvia la ricerca ha un'icona non standard «+», anziché «cerca/vai» o la lente. | Perché dovrebbe servirmi una ricerc «Search room type» anziché una ricerca generale, che è standard?<br><br>La lista delle stanze ha una sezione d navigazione dedicata, non capisco come dovrei utilizzare questa ricerca e per fare cosa |

## SEARCH – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Molto spesso, la prima azione che compiono gli utenti quando raggiungono un sito è quello di scorrere la pagina alla ricerca delle casella di ricerca. | Utilizzare l'icona standard o le label standard per il tasto di avvio della ricerca | Considerata la potenza della ricerca la quantità di persone che preferiscono cercare piuttosto che navigare, a mano che un sito non sia molto piccolo e molto ben organizzato, in ogni pagina dovrebbe esserci una casella di ricerca |




LAYOUT ☹ INFOGRAFICA ☹ USABILITÀ ☹

## SEARCH/CASSETTO – CRITICITÀ

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
|  <br>Il tasto con la X che contiene la chiave di ricerca è convenzionalmente utilizzato per disattivare dei filtri.<br>• L'aspettativa che si genera quindi, è che inserendo più parole vengano visualizzati più tasti e invece no.<br><br>La pagina vuota è disorientante, sembra che non stia caricando. |  <br>NA |  <br>Non emerge l'utilità di inserire una chiave di ricerca per una cosa che posso trovare in un elenco:<br>• Lo sforzo cognitivo richiesto non è proporzionale alla qualità del risultato. Piuttosto impostiamo dei filtri<br><br>La ricerca fa il match solo sul nome delle stanze, abbattendo di fatto la sua efficacia e utilità .<br>• Se scrivo «one entrance» che fa part della descrizione di reception non lo trova. Piuttosto prevedere un campo di autocomplete. |

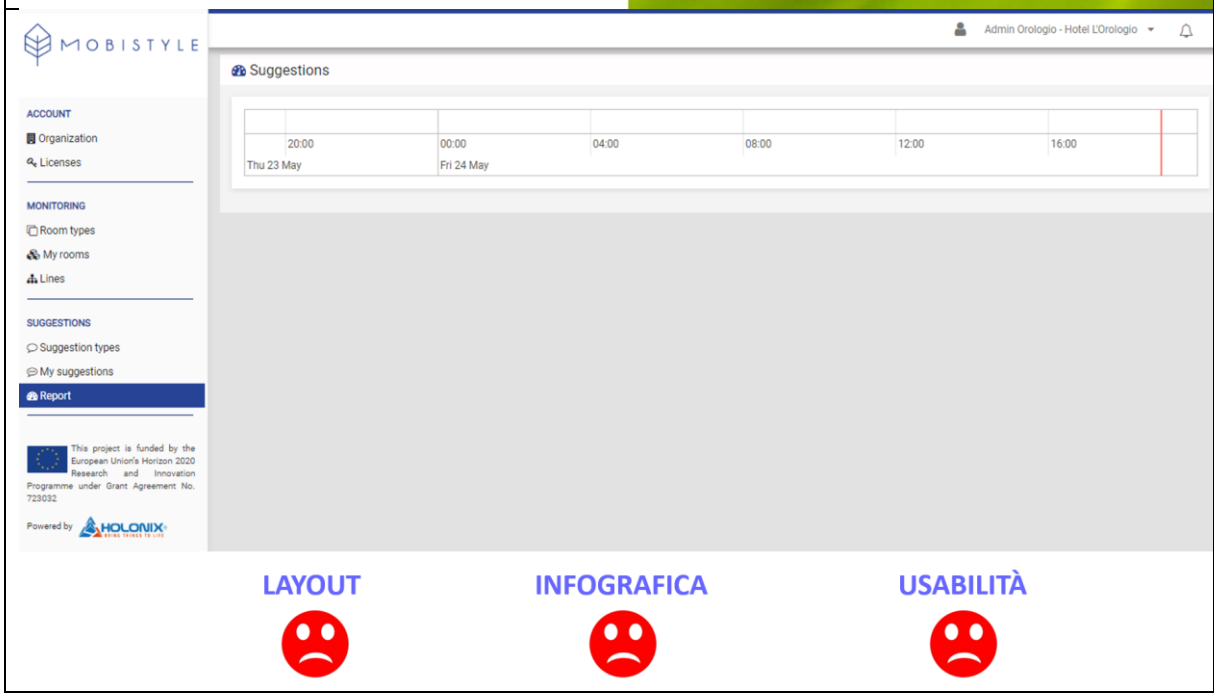
## SEARCH/CASSETTO – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Anziché lasciare la pagina completamente vuota quando la ricerca non va a buon fine, utilizzare un messaggio di feedback | NA | Usare una casella di ricerca standard e generale, che faccia il match su tutto il sito |

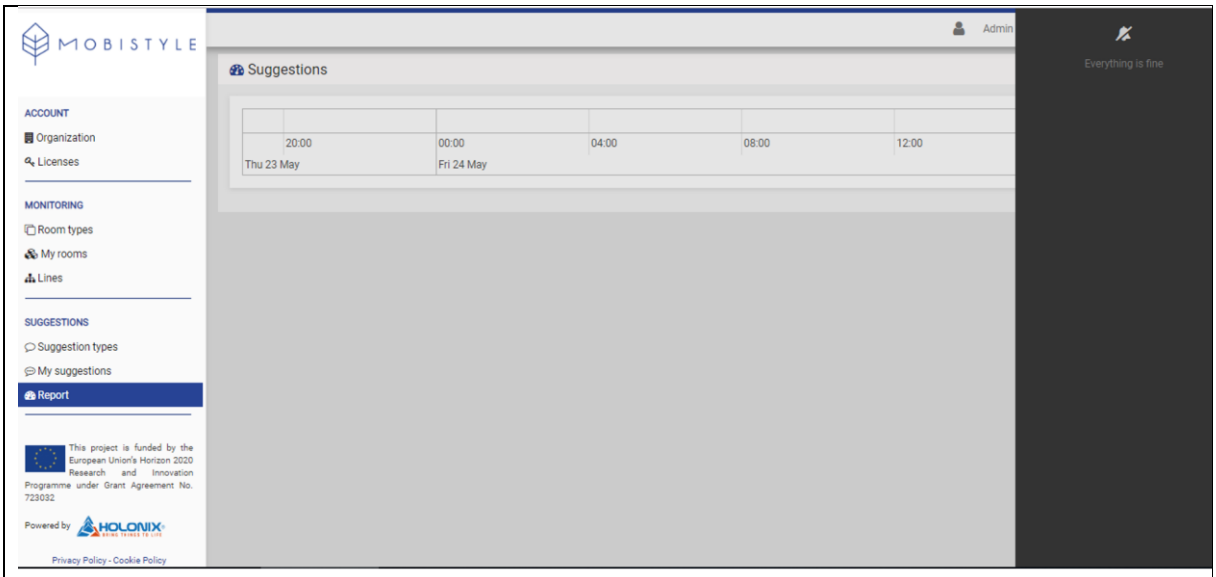
## SEARCH/CASSETTO – BUG

Se sono in questa pagina e chiudo il cassetto search, non mi fa più vedere il livello precedente (la lista stanze).

Se premo «suggestion type» non mi porta più al relativo menu, nemmeno se cambio videata (premo per es. my suggestion e poi suggestion type o my rooms. Bisogna fare un refresh della pagina




**LAYOUT** ☹ **INFOGRAFICA** ☹ **USABILITÀ** ☹




## REPORT – CRITICITÀ

### LAYOUT

Perché c'è un toggle con la campana in alto a dx?

- Se lo premo, perché compare uno screen in slide left? Dove non c'è scritto niente?
- Nello screen che compare c'è l'icona «disattivata» (o silenziata?)
- Cosa dovrei visualizzare? Failure o allarmi?

### INFOGRAFICA

La tabella è formattata in modo poco efficiente

### USABILITÀ

Non si riesce a capire cosa dovrebbe contenere il report. My suggestions?

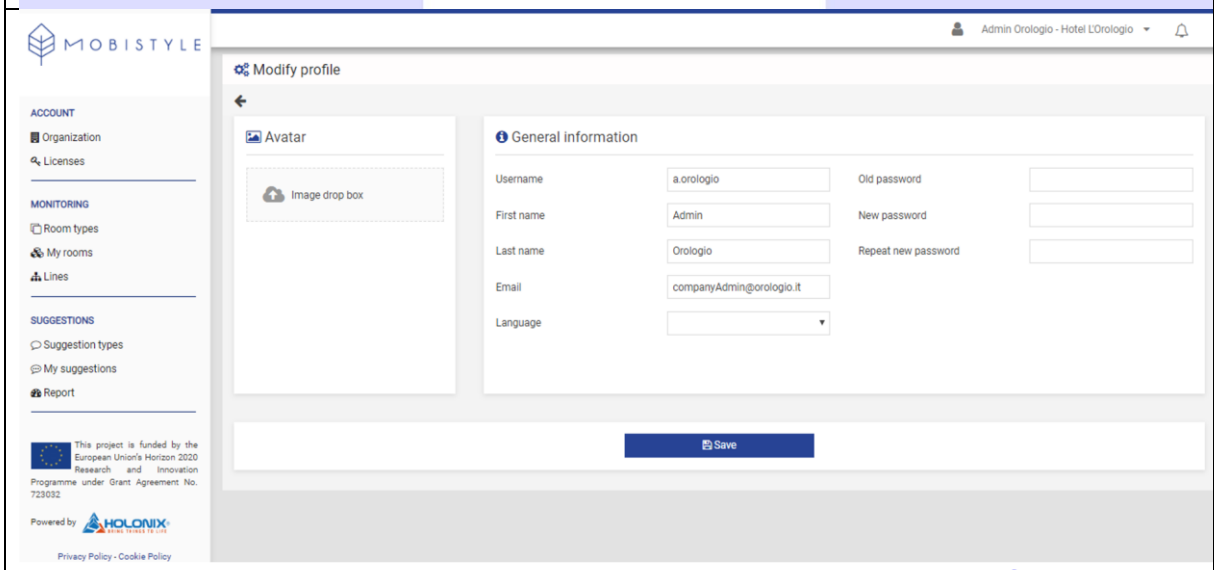
La tabella è vuota e mi costringe a chiedermi perché sia vuoto e se non sia dovuto al fatto che mi sono perso qualcosa

Non si capisce come chiudere la pagina di failure

- se clicco sulla campana non succede niente, nell'area scura neppure. Qui serviva la x (o almeno un back)
- Devo cliccare fuori per chiuderla, dopo alcuni tentativi andati a vacant

## DASHBOARD – SUGGERIMENTI DI REDESIGN

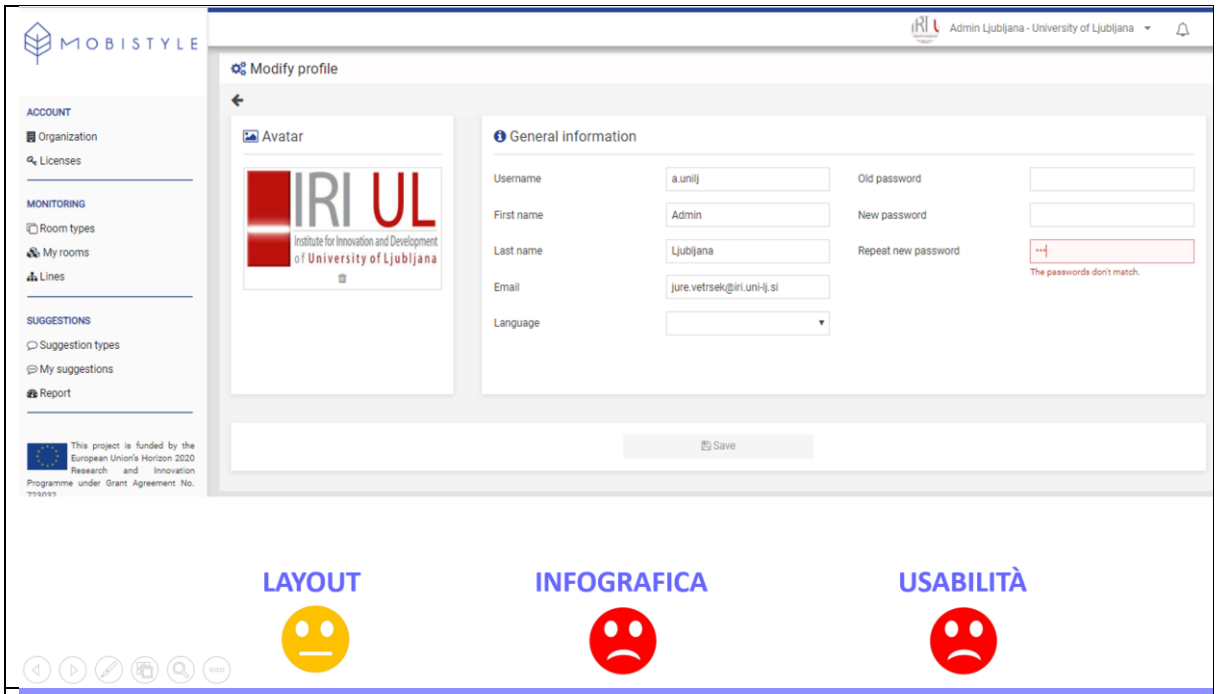
| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| NA | NA | Non potendo capire quale sia lo scopo della funzione «failure» e il contenuto del report non è possibile fornire dei suggerimenti di redesign |




LAYOUT 

INFOGRAFICA 

USABILITÀ 




LAYOUT

INFOGRAFICA

USABILITÀ

## MODIFY PROFILE – CRITICITÀ

### LAYOUT

Label inefficaci:
- Drop box
- Avatar

Il tasto per rimuovere l'avatar (cestino) è piccolissimo.

Se cambio dei dati e non salvo ma faccio back non mi avvisa che ci sono dei dati non salvati

### INFOGRAFICA

Uso non standard delle icone:
- «modify profile»: c'è l'icona che si usa normalmente per l'opzione di setting
- Dove ci sono i dati personali c'è l'icona di info, che si usa per le informative, non per i dati personali

### USABILITÀ

La traduzione in italiano ha dei bug
- il menu suggestion non viene tradotto.

Il cambio della lingua non deve essere una funzione del personal profile, ma delle utilities sempre disponibili, utilizzando le convenzion standard (e.g. bandierine)

Ci sono problemi di consistenza: c'è un back sotto l'header. Si trova lì e i poche altre pagine.

## MODIFY PROFILE – SUGGERIMENTI DI REDESIGN

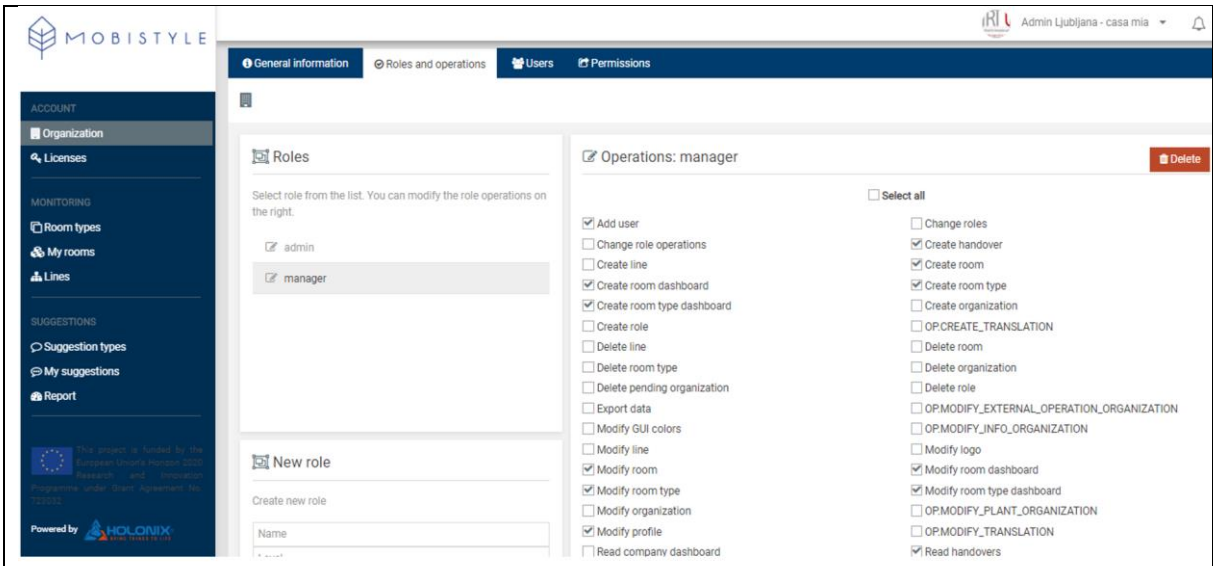
| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Utilizzare label e nomi pagine più efficaci | Per le funzioni di modifica del profilo sarebbe meglio utilizzare l'icona tipic di profilo/account o eventualmente quella edit | Implementare il cambio lingua come utility sempre disponibile, per es. vicino alla casella di ricerca |

## MODIFY PROFILE – BUG

Save: quando arrivo in questa pagina è attivo e blu (o se faccio refresh), ma se posiziono il cursore sul form di old psw e digito qualcosa si disabilita. Dovrebbe essere disabilitato al landing e abilitarsi se inserisco dei campi validi

Se cambio lingua e faccio back senza salvare mi cambia la lingua.

Se imposto la lingua italiana con lo user «Orologio», quando faccio logout e poi login come «Lubiana» mantiene la lingua in italiano. Ogni user dovrebbe mantenere la sua lingua: **occorre progettare la persistenza dei dati.**




## ROLES AND OPERATIONS – CRITICITÀ

### LAYOUT

La lista è una lista tecnica, molte feature sembrano nomi di tabelle di DB o nomi di query.

### INFOGRAFICA

Icone fuori contesto per le funzioni «roles», «new roles»

C'è un'icona inintelligibile nella zona titolo, ma senza label

### USABILITÀ

Non è comprensibile il significato della funzione livello in «Crea nuovo ruolo».

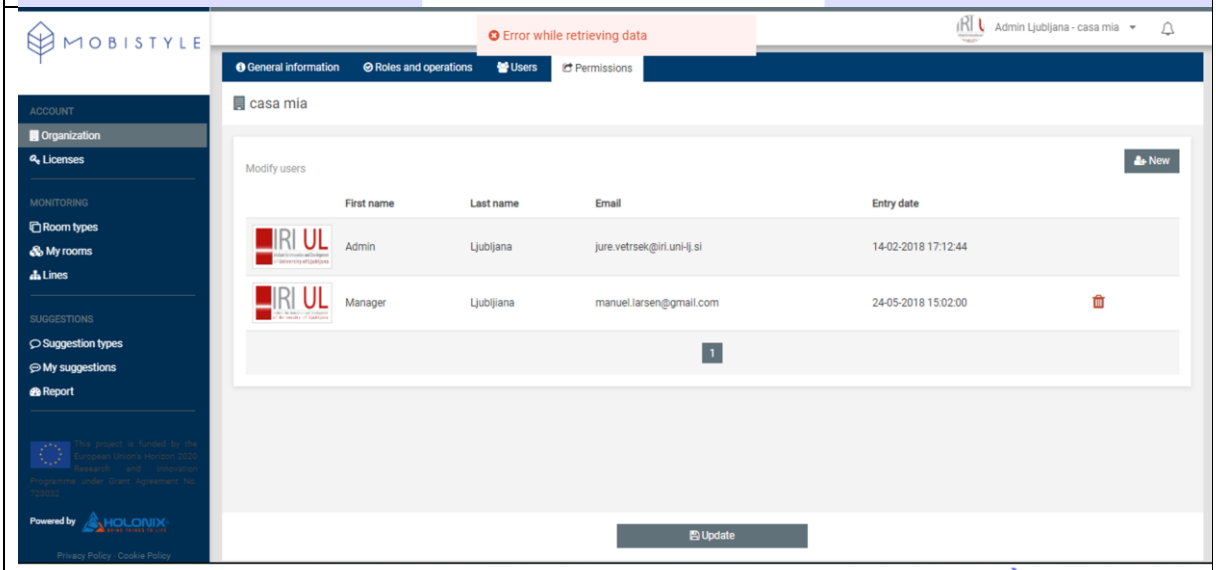
- Immagino sia il livello gerarchico dei ruoli, ma non ha senso poter impostare qualunque numero positivo o negativo

Gli utenti a cui sono collegati i ruoli sembrano essere persone fisiche.

Non è possibile assegnare più un admin.

## ROLES AND OPERATIONS – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Eliminare tutto quello che sembra coding e sostituirlo con qualcosa di più semplice per gli utenti. | Utilizzare icone che rispettino le convenzioni del web.<br><br>Nel caso questo non sia possibile, usare icone che siano rappresentative della funzione in cui sono state collocate | Fornire dei suggerimenti per la creazione di nuovi ruoli<br><br>Dove serve impostare un valore numerico, sarebbe meglio avere un controllo sulla validità dell'input e limitare le possibilità di inserimento di un valore incongruo/inapplicabile |



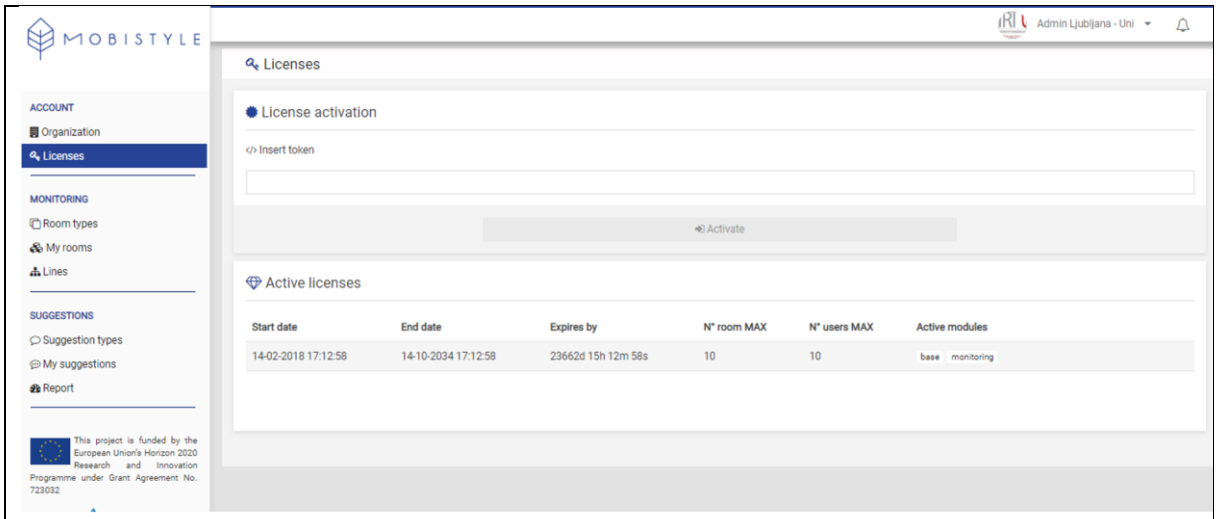

LAYOUT ☹ INFOGRAFICA ☹ USABILITÀ ☹

## USERS AND PERMISSIONS – CRITICITÀ

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| Il tab cambia ma lo screen resta quello di users e non capisco:<br>• Quale dovrebbe essere il contenuto<br>• Perché ci sia un errore<br>• Cosa dovrei fare per risolvere l'errore | NA | I tab sono usati in modo non persistente<br><br>La funzione «permissions» dà errore |

## USERS AND PERMISSIONS – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| NA | | Spiegare di che natura è l'errore e fornire delle indicazioni per risolverl |




LAYOUT

INFOGRAFICA

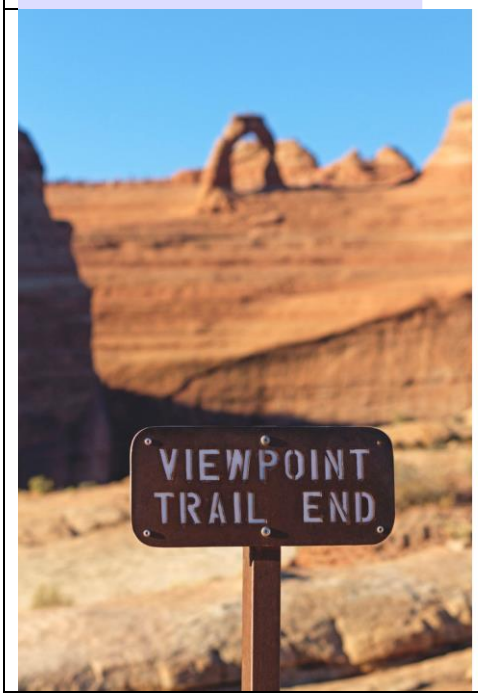
USABILITÀ

## LICENSES – CRITICITÀ

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
|  |  |  |
| I font usati sono molto piccoli | Sembra che la licenza sia legata al numero di stanze | L'info dei giorni, mesi ore ecc. è una ridondanza poco utile e difficile da leggere e comprendere |

## LICENSES – SUGGERIMENTI DI REDESIGN

| LAYOUT | INFOGRAFICA | USABILITÀ |
|---|---|---|
| La schermata è molto vuota e dispersiva, sarebbe meglio ridisegnarla in modo più compatto e focalizzato<br><br>Ingrandire tutti i font | NA | Eliminare la ridondanza dei giorni |




Consigli per tutta la piattaforma

### Sintesi

Creare una navigazione persistente: «la navigazione è ovunque. Alcune parti cambieranno leggermente a seconda di dove siete, ma sarà sempre qui e funzionerà sempre nello stesso modo».

Steve Krug, *Don't make me think.*

Quello che conta veramente non è il numero di clic che devo fare per arrivare a quello che voglio (entro certi limiti), ma quanto sia difficile ogni clic.
A fare la differenza sono la quantità di ragionamento necessario e la quantità di incertezza necessarie quando mi chiedo se sto facendo la scelta giusta.

Consigli per verificare una buona progettazione

## In pratica

Se la pagina o lo screen è ben progettato, dovreste essere in grado di rispondere a queste domande senza esitazione:

- Di che sito/servizio si tratta? (per es. tipo di edificio/servizio)
- In che pagina mi trovo?
- Quali sono le sezioni principali di questo sito?
- Quali opzioni ho in questo livello?
- Dove sono nella gerarchia del sito? (information architecture)
- Come faccio a eseguire una ricerca?

## Annex 2: MOBISTYLE Game App Expert Usability Evaluation

# Mobistyle Game

Expert Review of the mobile app

## How to read the report

This report describe some issues detected in the analysis of the Mobistyle Game mobile app.

Issues have difference impact on the use of the app depending on how difficult is for the user to avoid them and continue using the app or how much they obstruct the understanding of the information.

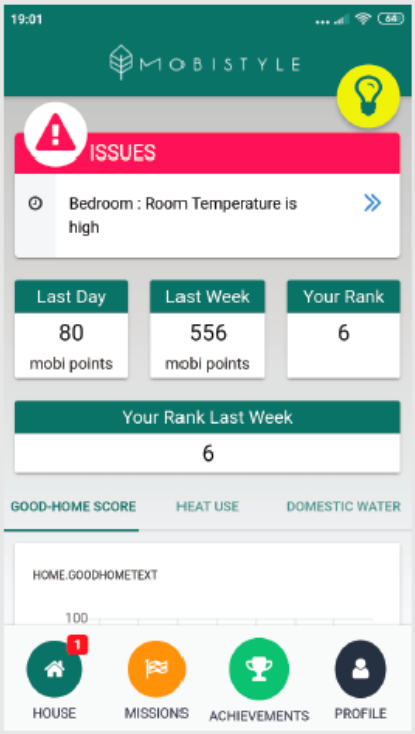
This impact is reflected with the following code.

- Critical issue: user may not be able to continue navigating, access to the information or understand the information showed.
- Major issue: user may not be blocked in the app but finding the way to use it may be too difficult.
- Minor issue: user may be able to continue using the app normaly, but it is not a right use of the interaction patterns and/or may interfire with a professional look&feel.
- Good design decissions and elements that works well.

The report also include ideas on how to improve of fix these issues, they are mark with the icon.

# INFORMATION ARCHITECTURE

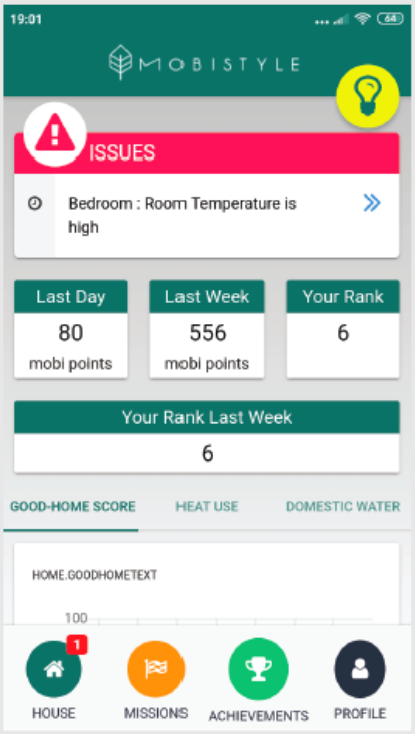
- The general mapping of the information in different screens is offers a clear classification of contents: 3 main areas (house, missions, achievements) and a landing overview screen.
- The general display of information shows content starting on general to specific: general information are on landing and first level screens, and user have to navigate on deeper levels in the information architecture to find the detailed data.



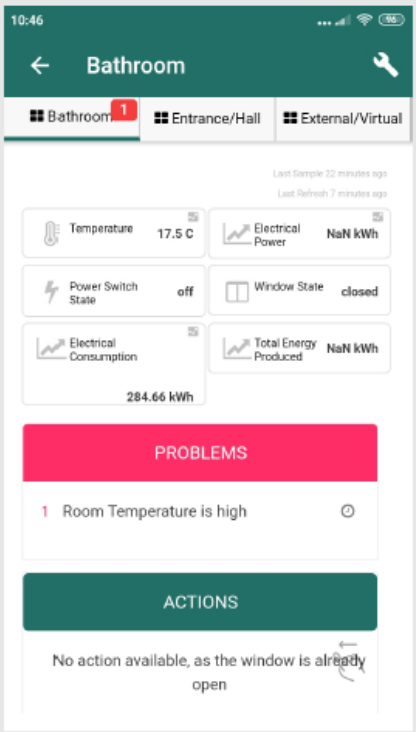
# NAVIGATION

## MAIN NAVIGATION

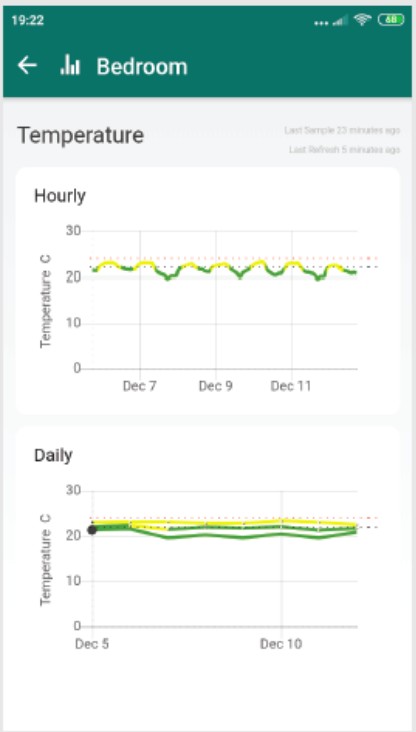
- Bottom menu navigation is a good choice. This interaction pattern allows to have visible all menu options in all screens. Current section is highlighted.
- Mobistyle Game app uses a bottom menu but hide it when entering a section. This is a bad use of this pattern as user lose the main advantage of it: having context and navigation options visible all time.
  - A correct and more intuitive use of this pattern would be to have bottom menu visible in all first level screen (House, Missions, etc.). And use the back arrows in second level screens (i.e. humidity chart for a room).



FIRST LEVEL SCREEN

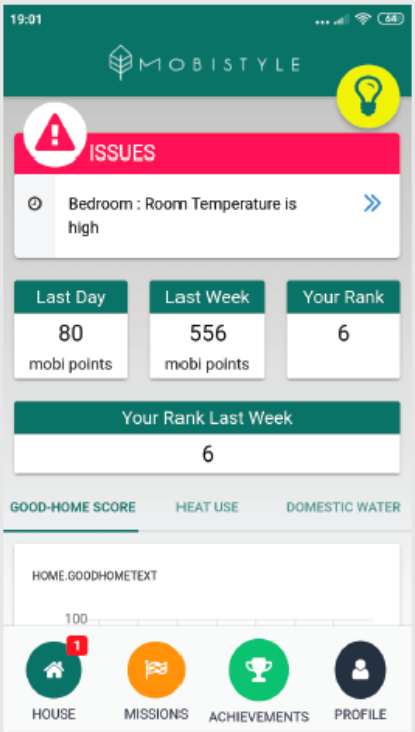



SECOND LEVEL SCREEN



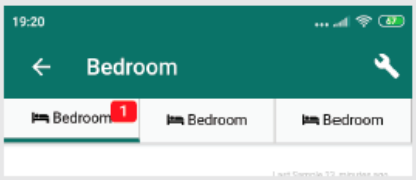

## MAIN NAVIGATION

- House icon is confusing as this icon usually refers to the home/first screen of an app. User probably expect this icon will lead to the landing screen. Also there is no menu item to navigate to this landing page.
  - Include a new menu item, having 5 items in total: Landing | House | Missions | Achievements | Profile
  - Use the house icon for the landing screen menu item, as this is a convention in digital products. Use a different icon for **House**, and maybe even change the **House** section name to, for example, Rooms.



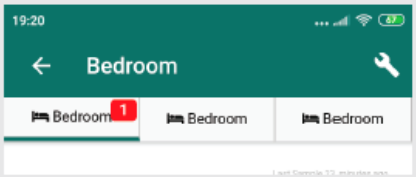
## SECONDARY NAVIGATION

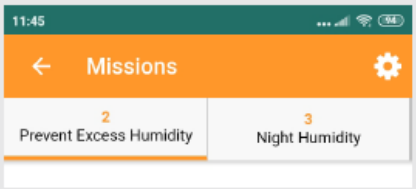
- Horizontal menu to navigate the different rooms is a good choice. It is easy to navigate and more visible than other options. As long as there are not too many menu items.
- There is a critical issue regarding to the horizontal menus in Mobistyle Game: the user have no way to identify that there are other menu items right and/or left the visible items.
  - Show part of the menu items that are right and/or left the visible items. I.e. show half of the next menu item on the right, so user knows there is more content hidden out of the screen.

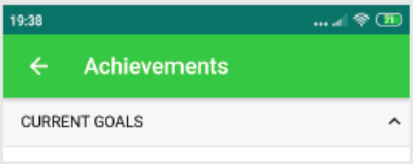



## SCREEN TITLES

- Screen titles should be handled consistently so the user has always a clear context. Right now titles work different in **House**, **Missions** and **Achievements**. In the **House** section the title is the name of the room user is viewing.
  - Screen titles wouldn't be needed with a correct use of the bottom menu.
  - Room names could stille be shown with a different layout.



## *MISSIONS* SECTION

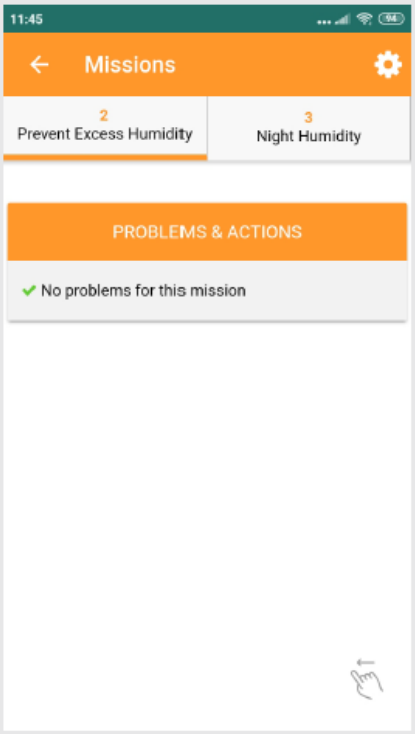
Access to information should be as direct as possible and with the minimum interaction by the user.

When we split information to more than one screen can be for 2 reasons:
- There is too much information to be seen in one screen.
- Some information is less important and we "hide" it in a deeper level of navigation.

If we have information of the same level of importance, and we have enough screen space, we should show it all in one screen.

- In **Missions** sections the relevant information are the missions themselves and problems notifications if any. Navigation through different missions is long and often there is no relevant information under each menu item. User has to scroll right to see that often last screens are empty.

  This section may be presented as a list of missions and icons+text to show the estatus (i.e. "there is problem" or "everything is ok").




## INTERACTIVE ELEMENTS

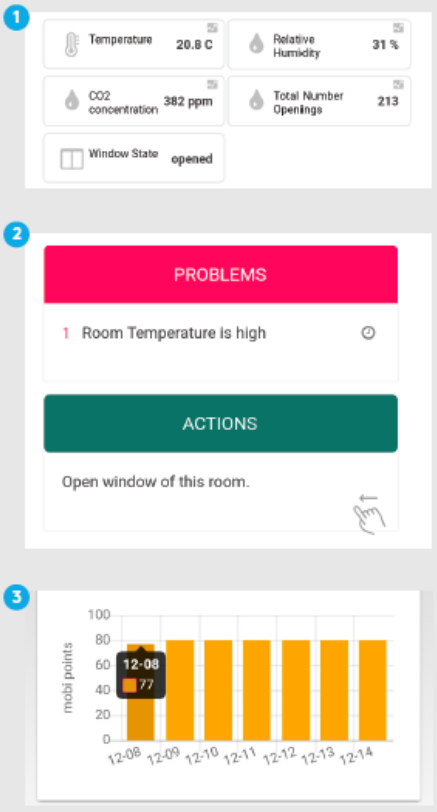
User should have very clear which elements are interactive and which not in the interface. Visual design patterns and some icons can help the user understand what is each element for.

- Some blocks about the status of the rooms are interactive, other aren't. It is difficult to distinguish which are interactive and which not. In general they don't look like interactive elements (1).

  Include a more visible/descriptive icon to indicate when the user can interact with the content.

- **Problems** and **Actions** labels looks like buttons but they are not interactive (2).

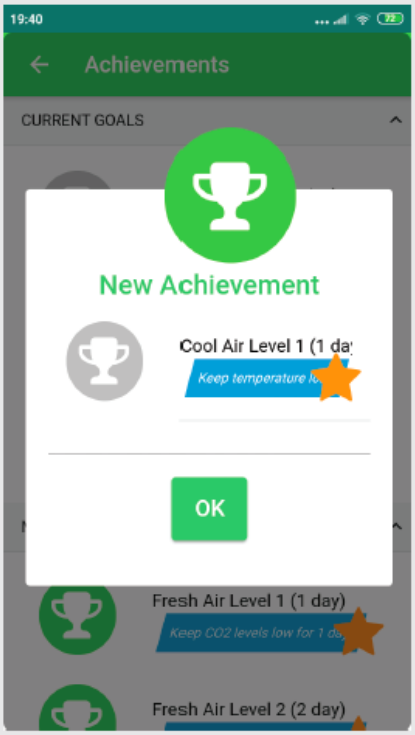
- There is not indication for the user to know that tapping on bars more information is displayed (3).



## SECOND LEVEL INFORMATION

If we are offering the user a second level information, i.e. a new screen or a popup with extended view, we have to ensure we are offering them quality information that is a good reason for the interaction of the user.

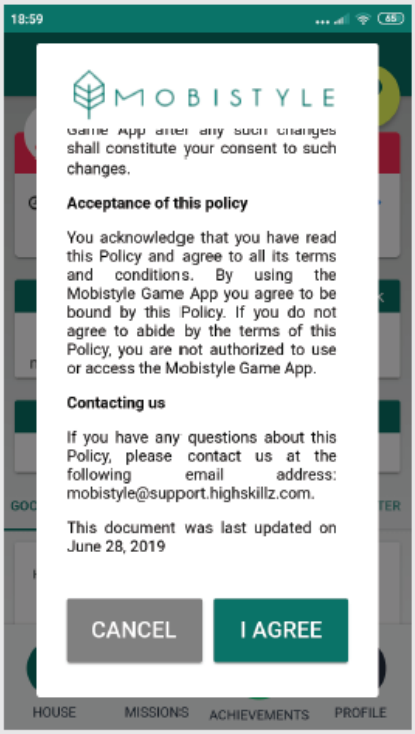
- **Achievements** second screen doesn't offer extra information, it shows same information that in previous screen.




## BLOCKING THE USER

One situation to avoid in interfaces is to block users from doing one action. Also, they should always have one option to go back and/or cancel actions.

- Cancel button on first screen doesn't have an action linked to it. If user tap on Cancel button nothing happens.
  - Cancel button should cancel the current action and lead to the previous screen.



## LOGOUT

- User should have the option to log out the app. This is a requirement related to the privacy of the user. In some scenarios user may want to close the session of the app in their device without uninstalling it.

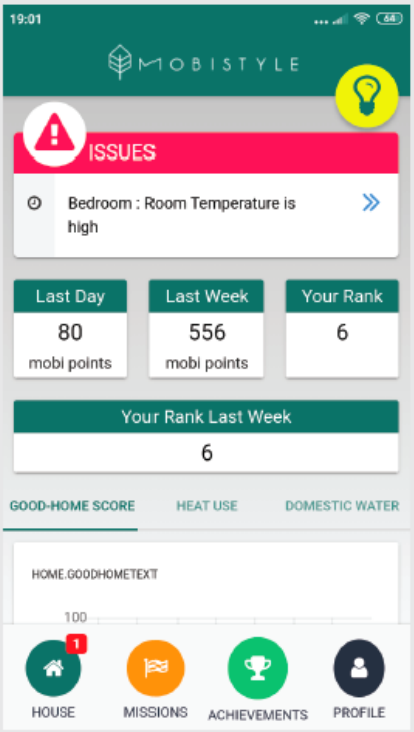
# VISUAL DESIGN

## VISUAL DESIGN

- The visual appearance of the app need some fine tuning to look professional and appealing. It would need some attention to details: color harmony, use of iconography, use of spaces and sizes...

  Also the look&feel of the brand (logo) is not very well represented in the final visual design. The brand design is more delicate and subtle.

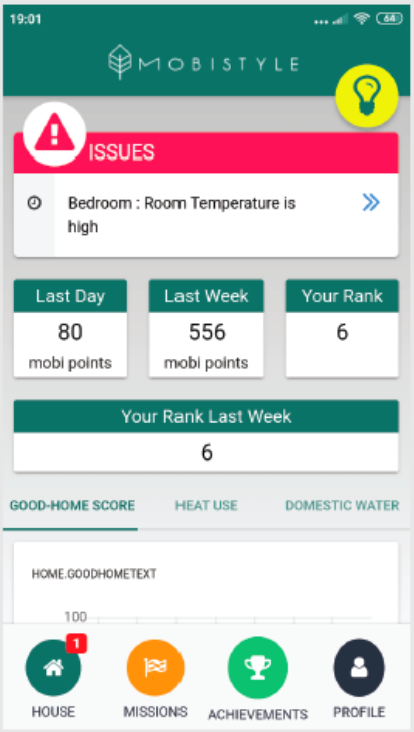
  Visual design should define a coherent visual identity and a guideline of colors, fonts and size of elements (texts, icons...) that reinforces the readability of the interface and produce a pleasant effect when looking at it.




## IDENTIFY UI ELEMENTS

Visual design is an aid to identify and understand elements. There are some visual patterns, conventions in digital interfaces that user identify easily and we use them to avoid user extra thinking or putting too much effort to understand interfaces. Extra thinking and effort may lead to users abandon tasks.

- The **issues module** design in the landing is a bit confusing because it uses the visual pattern of error messages. It looks like an app error instead of actual information regarding the subject of the app.
  - Modify visual design and iconography use.
  - Change the label or make it more specific.



## VISUAL HIERARCHY

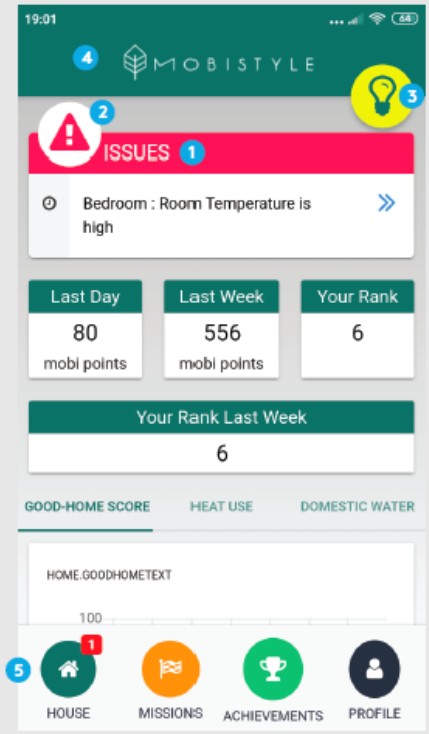
Visual hierarchy is related to visual look&feel but also to the correct reading of information.

In interfaces one of the most important concept we deal with is sizes of elements.

A correct size of elements has an impact on the harmony of the UI. But also helps the user easily identify which elements are more important and which are less.

- Mobistyle Game interface you needs a better balance of the sizes of elements. For example:
  · Label text (1) shouldn't be so prominent as the important information is the content under that label.
  · Icons (2) also should be smaller, they are only a guide to the user eye but they don't need to be the protagonist of the UI.
  · There is secondary information that should be smaller, information that is not the main focus of the UI (3).

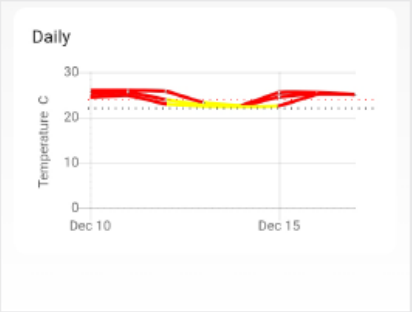
  Also spaces should be very optimized specially when talking about mobile screens. Header (4) shouldn't take so much space. Bottom menu (5) space could be optimized and menu labels are not essential here.




# INFORMATION DISPLAY

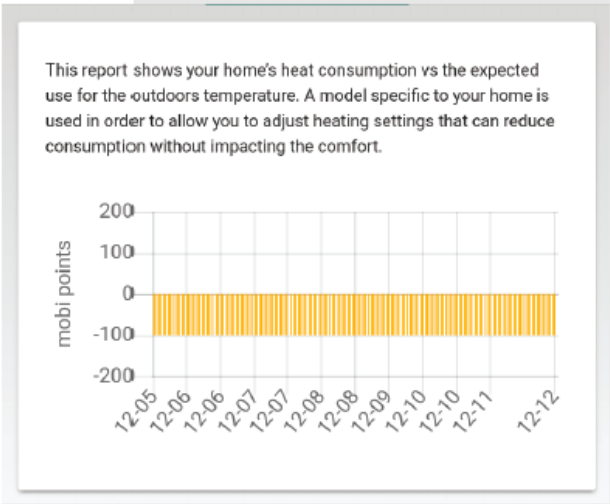
## CHARTS

- Charts design make it very difficult to read the information. It is not optimal for mobile screens. Some improvement tips may be:
  - A cleaner design: reduce the non necessary elements, like lines.
  - Optimize the size and hierarchy of different elements: different types of text, bars, etc
  - Make bars and other graphics more comprensible.

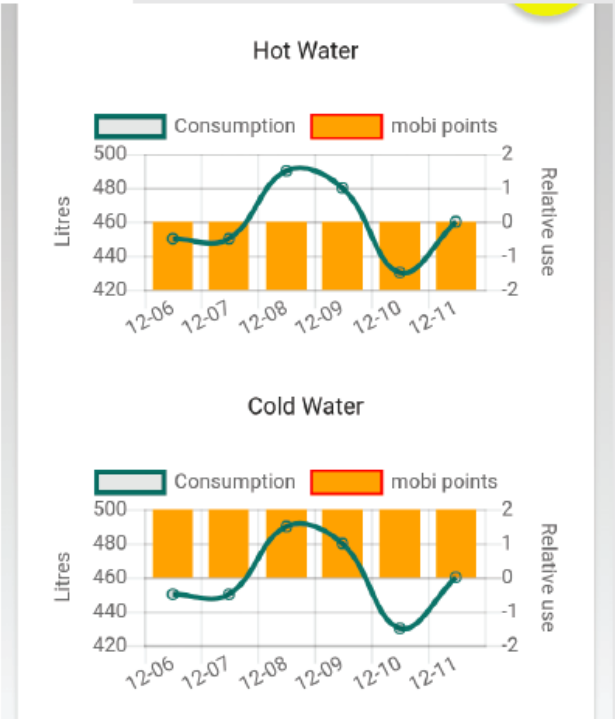

## CHARTS

- The chart doesn't show a clear difference between the 2 types of data that is showing.



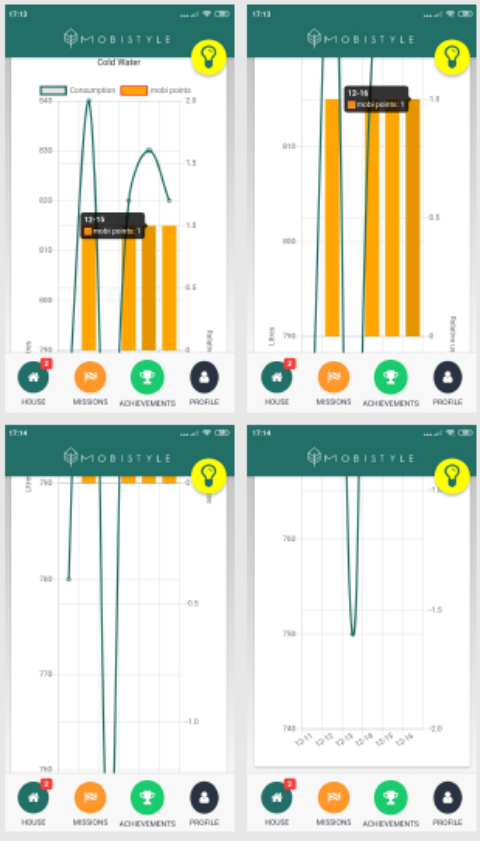
## CHARTS

- Chart is very complex.
- It is not clear what the label **Relative use** refers to.
- Relationship between **Consumption** and **Mobi Points** is not clear: it seems user gets more points for bigger consumption.
- Legend design is not very clear.
  - Line and blocks icon/representation should be more accurate.



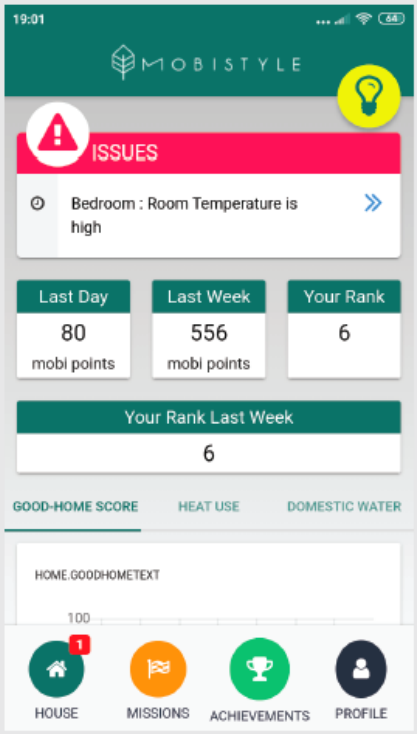

## CHARTS

- Size of the chart should be adjusted to a mobile screen reduced space. The images on the right shows one graphic scrolled down.



## POINTS AND RANKING INFO

- In the UI it is not clear what **mobi points** are or how the **ranking** works (i.e. who else it is involved in the ranking).
  - Explain the functioning of the app and points in an onboarding tutorial when the user use the app for the first time.
  - Extend information in another screen.
- The four boxes regarding to **mobi points** and **ranking** are not very prominent in the landing. Also for readability purposes similar information works better if it is grouped together.
  - Highlight this area using visual design.
  - Re-arrange elements in the screen so mobi points boxes are visually connected and ranking boxes too.



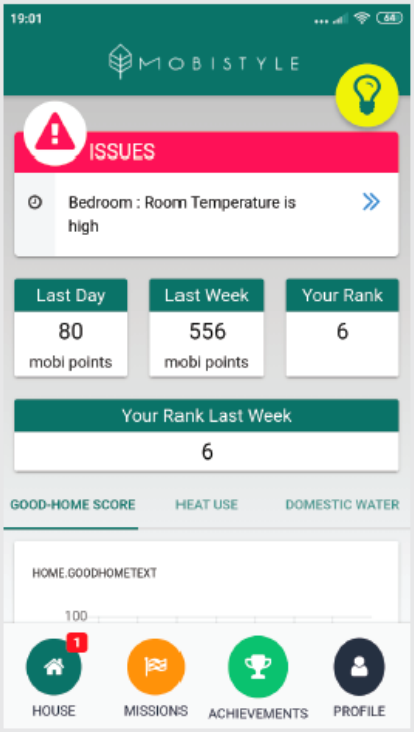

# GAMIFICATION

## GAMIFICATION

- The concept of the app is a game and it intends to work and engage users through gamification. But the game feeling is not very present in the app itself.

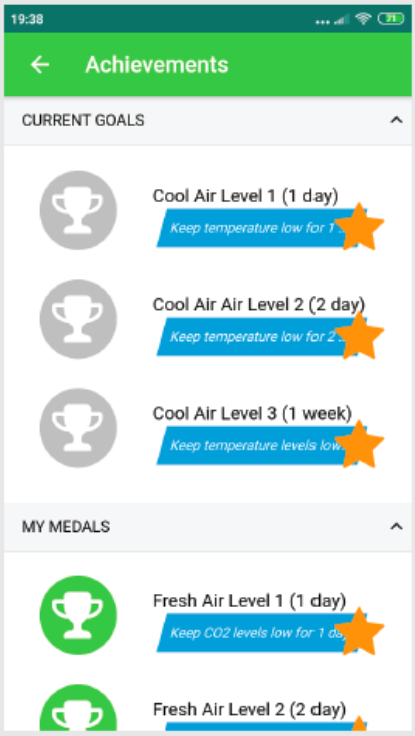
  The landing screen that is the first one the user will see and the first feeling they are going to get doesn't reflect the gamification concept. Points and ranking are present but are not very prominent in the screen and also there are not graphic elements that reinforces the idea of gamification.

  Also, the general design is very serious/sober. Apps and services based on gamification usually looks more playful and the goal for this is to engage the user with a fun competition game. Visual design should feel fun and show elements related to games.




## ACHIEVEMENTS

- To get the gamification feeling the achievements screen should be a summary of all elements regarding to gamification in the app, including points and more details about the ranking.
- The information shown in this screen is not self-explanatory, it is not clear what each item is. Also it is not clear the difference between **Current Goals** and **My Medals**.
- Design is too crowded. The size and hierarchy of elements could be improved.
- Text is cut in some items.

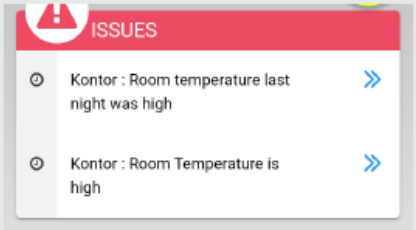


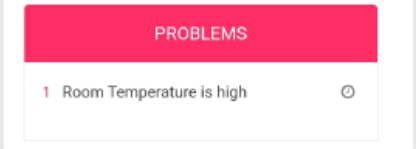
# CONSISTENCY

## CONSISTENCY

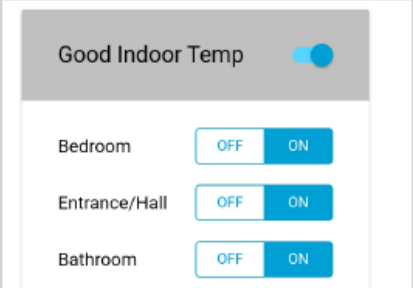
The system should keep consistent through all screens. Elements that have the same behaviour, or labels that designate the same concept should be similar in all screens.

- **Issues** and **Problems** are referring to the same concept but with 2 different names.
- Color should also be the same for both elements



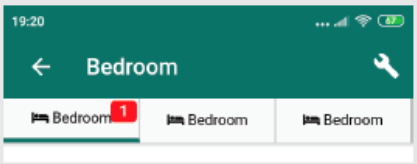



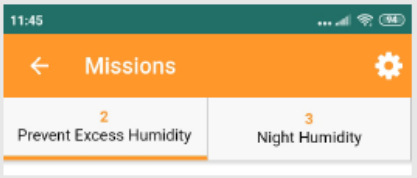

- Switches should have the same design in all cases. Otherwise user may expect them to do different actions.



## CONSISTENCY

- **Call to Actions** with the same use should have the same design. **Spanner** and **screw** icons refers to a setup/editing information in this screens. The concept they refer to is quite similar, they should use the same visual element.
  - The edition of the **rooms labels** may occur in one single screen the same as the edition of preferences in **Mission** section.

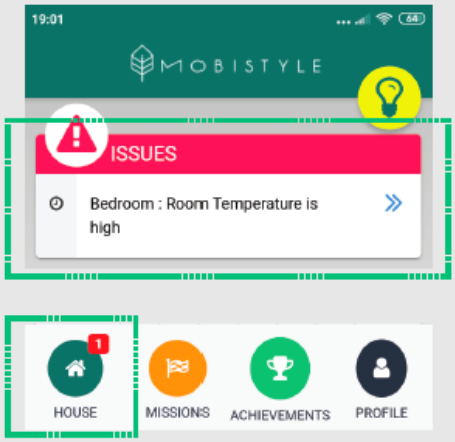



# FEEDBACK AND NOTIFICATIONS

## FEEDBACK AND NOTIFICATIONS

- System is built around the notifications idea, which is a good choice for this kind of service as user is always updated with status information without the need of searching in the whole app to look for it.




## RECENT INFORMATION AND HISTORY

When a system works with notifications it has to deal with the recency of the information it is showing.

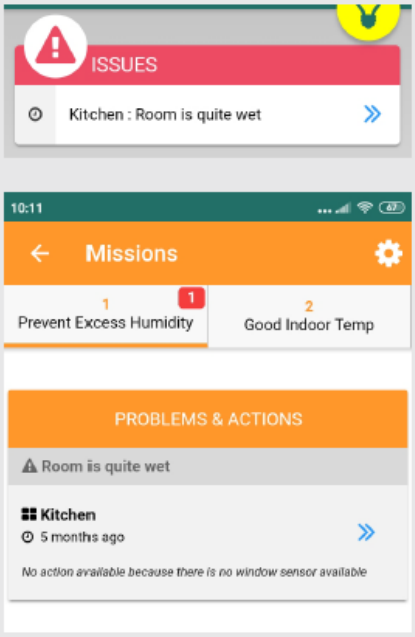
Notifications have the implicit quality of being recent. They have the purpose to warn the user so they can take an action in the moment. When a notification becomes obsolete it turn into history.

- The app should handle what information is shown in the landing page as notification and how to manage obsolete notifications.

  In the images on the right we can see a notification that happened 5 months ago but it is still showing in the landing as a notification.

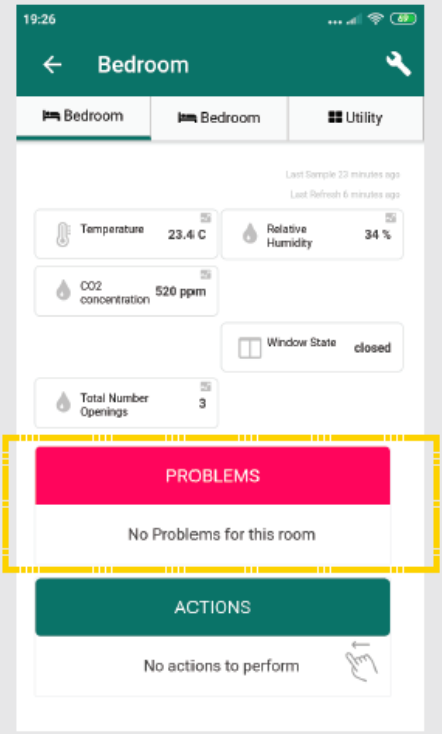
  Some possible solutions for this issue may be:

  - Show in the landing only recent issues.
  - Move old issues to a history section or just remove them (depending on the relevance that a history of notifications have for the purpose of the app).
  - Use different design for recent notifications and history.



## APP FEEDBACK

- If there is no information to show in one block/section (i.e. the Problems area) this block shouldn't show.
  - Alternatively a positive feedback can be shown. I.e. a message like "Congratulations! Everything is ok." with a design reinforcing the positive feeling.




# SEMANTIC COLORS

## SEMANTIC COLORS

For digital interfaces there is a convention in the use of colors. Some colors have semantic properties which mean they have meaning in relation with the content.

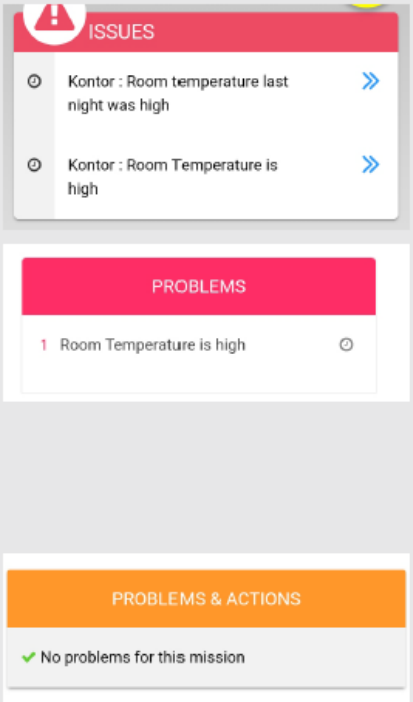
Semantic most used colors are **green**, **red** and **orange/yellow** to illustrate positive, negative and not so negative communications.

Other colors have the role of neutral colors, like **blue** or **gray**.

We have to have in mind these colors meaning when using them in the interface.

## SEMANTIC COLORS

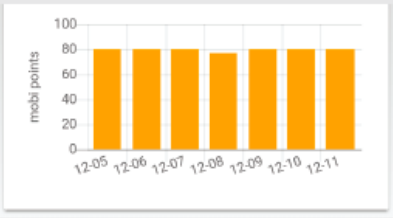
- The app is using a shade of red for issues, which is a good choice.
- But it should be more clear with the positive color in the case of the "No problems" message (green should be predominant).

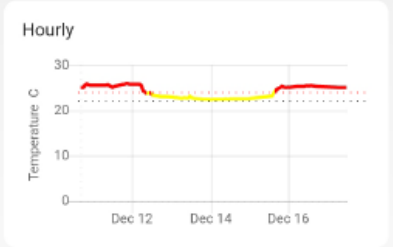


## SEMANTIC COLORS

- This same code should be translated into the charts and use the semantic colors depending on the type the information showing.
  - Good results may be coloured green versus red for bad results.
  - Alternatively charts may keep color neutral with a neutral color like blue.

But use of color should be consistent with the rest of the colors showed in the app.



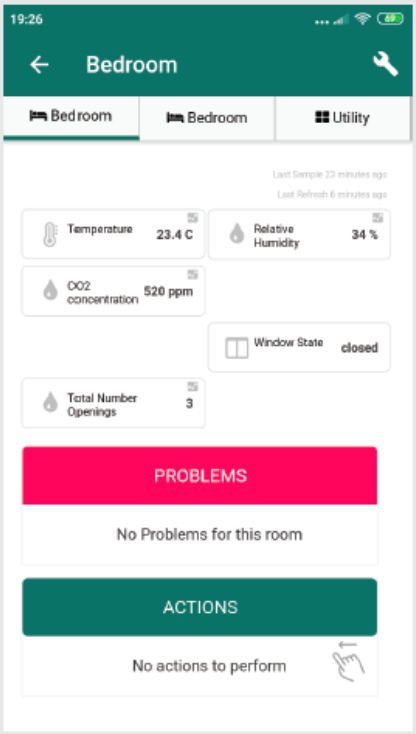





# TEXTS

## TEXTS

- Predefined labels nay be more descriptive. To help users have context (even if they can edit the names of rooms) predefined labels shouldn't be different for different rooms (i.e. bedroom 1, bedroom 2...).




## Summary

The app strong points are information architecture and the usefulness of the content it is offering. For the user it is easy and effortless to receive the relevant information.

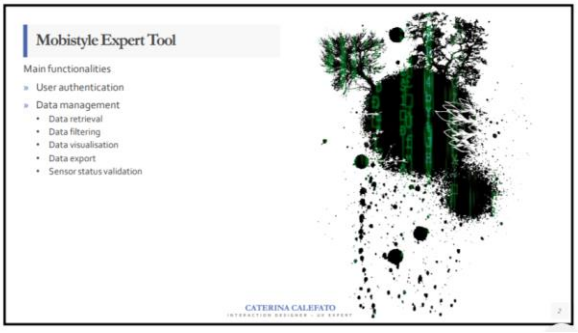
It should improve the visual appearance to get a more appealing product.

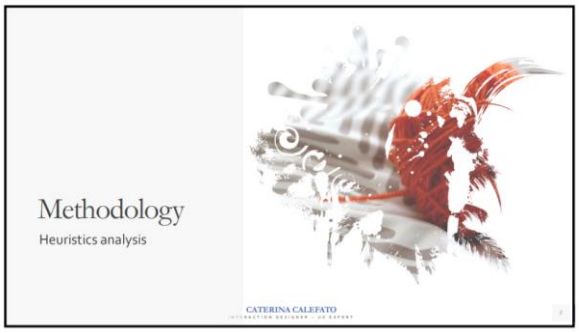
Also with small fixes it can make a good improvement in the navigation/interaction. Though the main navigation has been very well ideated, it needs some small tweaks to get an excellent experience in this area.

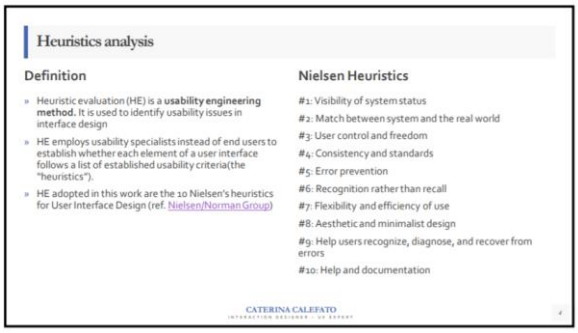
Finally, I would recommend to put a bit more effort in get the gaming feeling to get the user more involved and engage.


:-) Thanks for watching!
MariCarmen Trevijano · UX Specialist · mcarmen@mcarmen.com

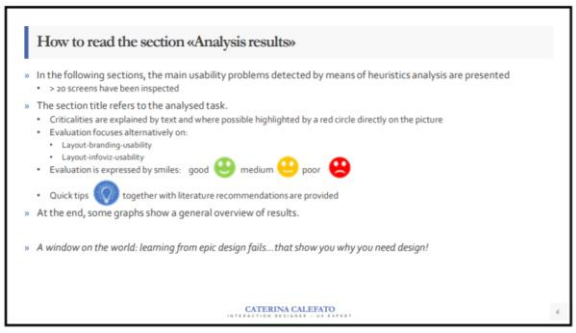
## Annex 3: MOBISTYLE Expert Tool

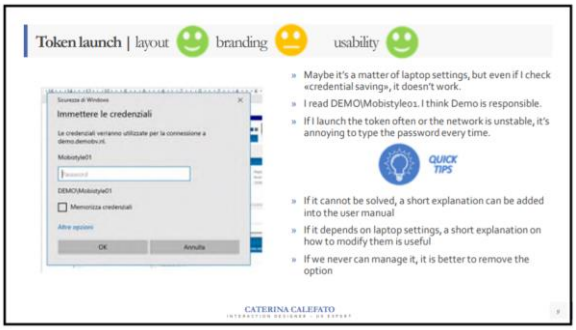










Token launch | layout branding usability
Immettere le credenziali
» Maybe it's a matter of laptop settings, but even if I check «credential saving», it doesn't work.
» I read DEMO\Mobistyle01. I think Demo is responsible.
» If I launch the token often or the network is unstable, it's annoying to type the password every time.
QUICK TIPS
» If it cannot be solved, a short explanation can be added into the user manual
» If it depends on laptop settings, a short explanation on how to modify them is useful
» If we never can manage it, it is better to remove the option
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Login
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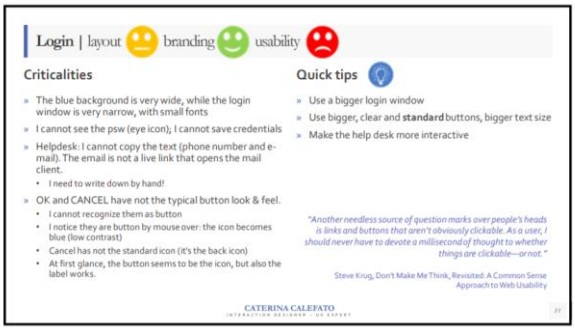
Login | layout branding usability
Criticalities
» The blue background is very wide, while the login window is very narrow, with small fonts
» I cannot see the psw (eye icon); I cannot save credentials
» Helpdesk: I cannot copy the text (phone number and e-mail). The email is not a live link that opens the mail client.
• I need to write down by hand!
» OK and CANCEL have not the typical button look & feel.
• I cannot recognize them as button
• I notice they are button by mouse over: the icon becomes blue (low contrast)
• Cancel has not the standard icon (it's the back icon)
• At first glance, the button seems to be the icon, but also the label works.
Quick tips
» Use a bigger login window
» Use bigger, clear and standard buttons, bigger text size
» Make the help desk more interactive
"Another needless source of question marks over people's heads is links and buttons that aren't obviously clickable. As a user, I should never have to devote a millisecond of thought to whether things are clickable—or not."
Steve Krug, Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability
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Login error message | layout branding usability
» The layout of the error message popup is old-style
» The resulting graphics effect is not pleasant and it affects the brand perception
QUICK TIPS
» Use a graphic layout for po up messages/dialogs compliant with the whole software layout and graphics
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Who am I?
DON'T LEAVE IT ON THE BEACH
PUT IT IN THE BIN!
A matter of identity
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User profile | layout branding usability
Criticalities
» Once I'm logged in I do not know who I am and which are my permissions
» The following functions are missing:
• User profile (name, surname, company, permission on functions)
• Account management (creating new account, giving permission)
» Who is who? Who can do what?
» Feeling trapped: where is the logout?
Quick tips
» Add the typical «User profile» functions
» Add clear logout!
» Add the «Account management» (admin) functions
» Make clear who am I and what I can do and what I can't (account permissions and restriction)
"The fact that the people who built the site didn't care enough to make things obvious—and easy—can erode our confidence in the site and the organization behind it.".
Steve Krug
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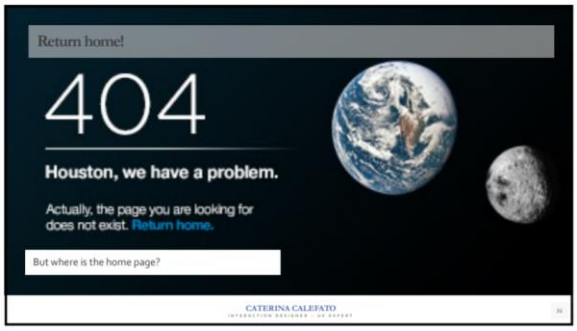
Welcome to the home page
Expectations vs Reality
Screen design
Navigation & Visual hierarchy


Return home!
404
Houston, we have a problem.
Actually, the page you are looking for does not exist. Return home.
But where is the home page?
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## Welcome to the home page

- A clear self-evident home page is missing
- Where am I? If I feel lost, how can return to the home?
- What is crucial to be noticed at each login?

QUICK TIPS

- Without an home page, users feel lost
- In the home page sum up data and overview info can be provided, together with reminders for the user (e.g. last connection, checking suggestions, warnings, what is new)
- The home page can offer controlled tasks, leaving the possibility to explore the data freely.
- A combination of visual and textual information is recommended

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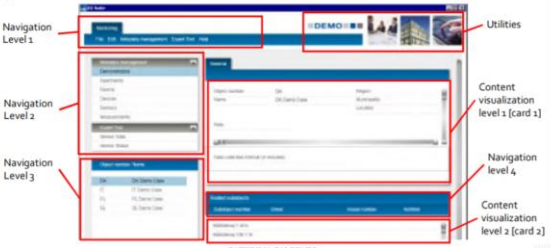
## Expectations - understanding at first glance

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## Reality - understanding at first try


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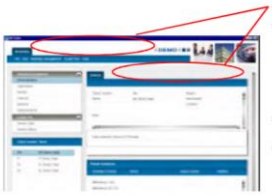
## Screen design | layout infoviz usability



- There is a lot of wasted space
- There are a lot of interdependencies, but the screen construction and the visual hierarchy were not designed together and they not support each other.

QUICK TIPS

- Considering that there are a lot of info to be scrolled, space shall be better exploited
- Visual hierarchy must be designed and managed, in order to ease the navigation and the interdependencies

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## Screen design | layout infoviz usability

- The design of the data visualization is totally absent.
- Which are the potential and the limitation of this tool?
  - With a poor low-level syntax of the interface users may not be able to focus on the meaning of what they see

QUICK TIPS

- The user journey must be build on data Discovery goal
  - Usable data visualization requires users to manipulate visual as well textual representations
  - Keep the history of the investigation!

*Information visualization is a way to answer questions you didn't know you had. It gives support to decision-making. Data representation should be understandable by end-users and help them to make decisions.*

Catherine Plaisant - The Challenge of Information Visualization Evaluation -

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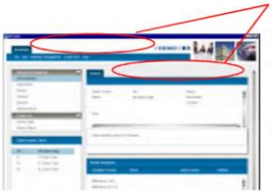
## Screen design | layout infoviz usability



- The main problem in the screen construction is the lack of an home page or a main dashboard
- The division into functional areas can be improved, but does not present many criticalities.
- Problems are related to the mapping of functions on areas.

QUICK TIPS

- A starting point is needed!
  - If we get inspired by web interaction, we need an home page
  - If we get inspired by sw panels, we need a main dashboard

***Make it easy to go home!***

*Having a home button in sight at all times offers reassurance that no matter how lost I may get, I can always start over, like pressing a Reset button or using a "Get out of Jail free" card.*

Steve Krug

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## Navigation – your digital assistant

remember this location

Ok, I'll remember that

what did I ask you to remember

I remember you told me.

"This location"

When you get lost thanks to navigation

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## Navigation | layout I infoviz usability

- It is not possible to identify by layout the navigation hierarchy
  - Home page > level 1 > level 2 > level n
- Titles and navigation menus have the same look and feel
  - It is impossible to discriminate
- The use of grey is totally out of the range of used colours
  - Grey looks like "work in progress" or "disabled"

QUICK TIPS

- Define the navigation structure before (e.g. a menu tree), then design the layout accordingly
- Use a consistent colour palette.

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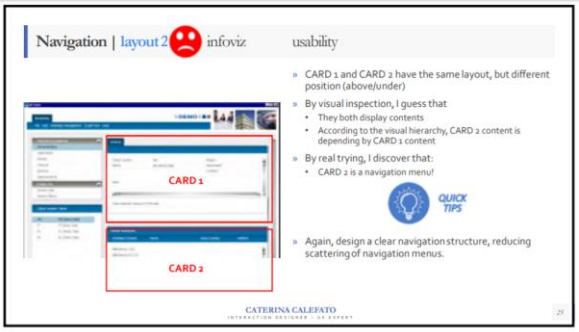
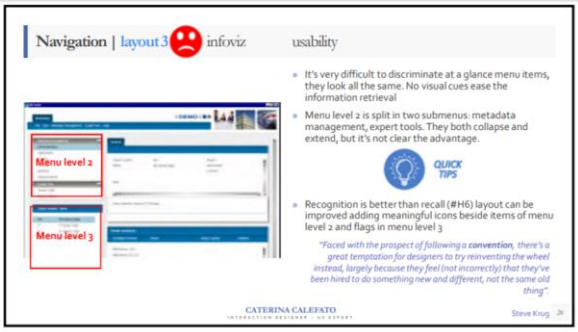
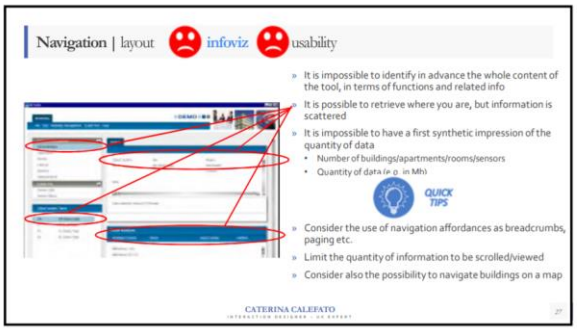

Navigation | layout 2 infoviz usability
» CARD 1 and CARD 2 have the same layout, but different position (above/under)
» By visual inspection, I guess that
• They both display contents
• According to the visual hierarchy, CARD 2 content is depending by CARD 1 content
» By real trying, I discover that:
• CARD 2 is a navigation menu!
QUICK TIPS
» Again, design a clear navigation structure, reducing scattering of navigation menus.
CARD 1
CARD 2
CATERINA CALEFATO


Navigation | layout 3 infoviz usability
» It's very difficult to discriminate at a glance menu items, they look all the same. No visual cues ease the information retrieval
» Menu level 2 is split in two submenus: metadata management, expert tools. They both collapse and extend, but it's not clear the advantage.
QUICK TIPS
» Recognition is better than recall (#H6) layout can be improved adding meaningful icons beside items of menu level 2 and flags in menu level 3
"Faced with the prospect of following a convention, there's a great temptation for designers to try reinventing the wheel instead, largely because they feel (not incorrectly) that they've been hired to do something new and different, not the same old thing".
Steve Krug
Menu level 2
Menu level 3
CATERINA CALEFATO


Navigation | layout infoviz usability
» It is impossible to identify in advance the whole content of the tool, in terms of functions and related info
» It is possible to retrieve where you are, but information is scattered
» It is impossible to have a first synthetic impression of the quantity of data
• Number of buildings/apartments/rooms/sensors
• Quantity of data (e.g. in Mb)
QUICK TIPS
» Consider the use of navigation affordances as breadcrumbs, paging etc.
» Limit the quantity of information to be scrolled/viewed
» Consider also the possibility to navigate buildings on a map
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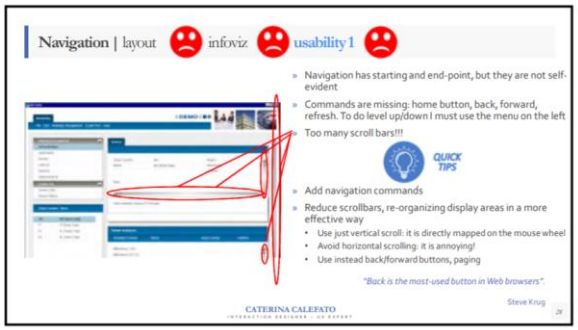
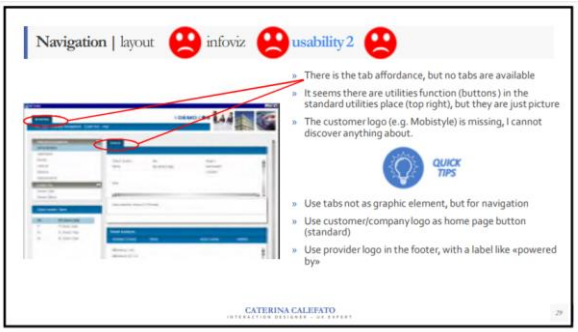

Navigation | layout infoviz usability 1
» Navigation has starting and end-point, but they are not self-evident
» Commands are missing: home button, back, forward, refresh. To do level up/down I must use the menu on the left
» Too many scroll bars!!!
QUICK TIPS
» Add navigation commands
» Reduce scrollbars, re-organizing display areas in a more effective way
• Use just vertical scroll: it is directly mapped on the mouse wheel
• Avoid horizontal scrolling: it is annoying!
• Use instead back/forward buttons, paging
"Back is the most-used button in Web browsers".
Steve Krug
CATERINA CALEFATO


Navigation | layout infoviz usability 2
» There is the tab affordance, but no tabs are available
» It seems there are utilities function (buttons) in the standard utilities place (top right), but they are just picture
» The customer logo (e.g. Mobistyle) is missing, I cannot discover anything about.
QUICK TIPS
» Use tabs not as graphic element, but for navigation
» Use customer/company logo as home page button (standard)
» Use provider logo in the footer, with a label like «powered by»
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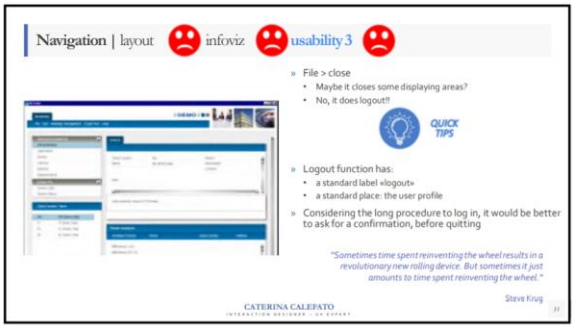
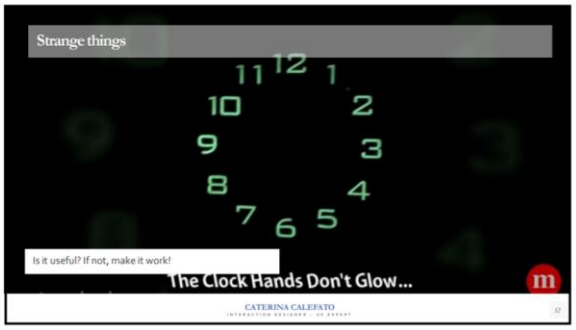
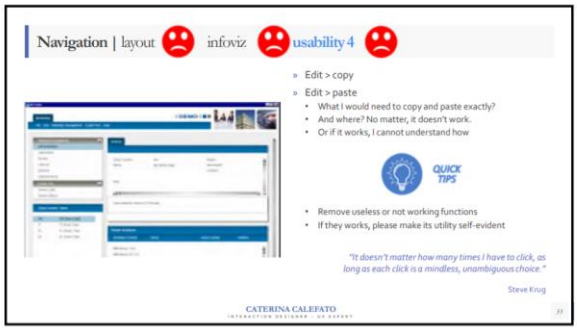
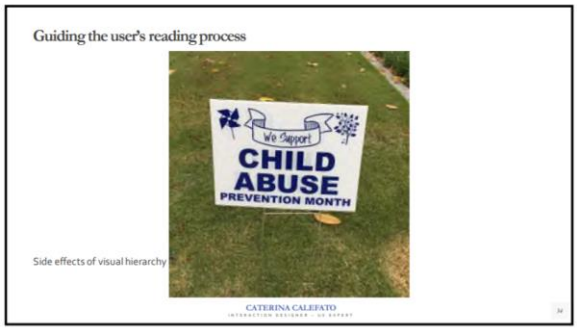
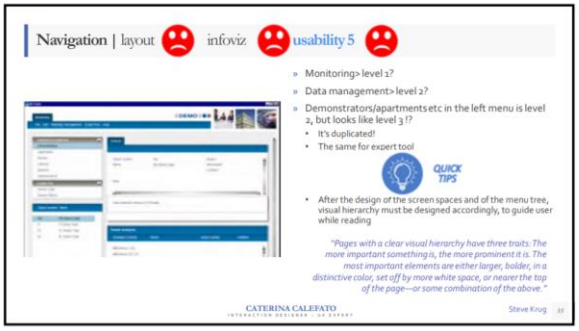
Where is the logout?
Almost Broke My Leg
CATERINA CALEFATO


Navigation | layout infoviz usability 3
» File > close
• Maybe it closes some displaying areas?
• No, it does logout!!
QUICK TIPS
» Logout function has:
• a standard label «logout»
• a standard place: the user profile
» Considering the long procedure to log in, it would be better to ask for a confirmation, before quitting
"Sometimes time spent reinventing the wheel results in a revolutionary new rolling device. But sometimes it just amounts to time spent reinventing the wheel."
Steve Krug
CATERINA CALEFATO


Strange things
Is it useful? If not, make it work!
The Clock Hands Don't Glow...
CATERINA CALEFATO


Navigation | layout infoviz usability 4
» Edit > copy
» Edit > paste
• What I would need to copy and paste exactly?
• And where? No matter, it doesn't work.
• Or if it works, I cannot understand how
QUICK TIPS
• Remove useless or not working functions
• If they works, please make its utility self-evident
"It doesn't matter how many times I have to click, as long as each click is a mindless, unambiguous choice."
Steve Krug
CATERINA CALEFATO


Guiding the user's reading process
Side effects of visual hierarchy
We Support
CHILD ABUSE
PREVENTION MONTH
CATERINA CALEFATO


Navigation | layout infoviz usability 5
» Monitoring> level 1?
» Data management> level 2?
» Demonstrators/apartments etc in the left menu is level 2, but looks like level 3 !?
• It's duplicated!
• The same for expert tool
QUICK TIPS
• After the design of the screen spaces and of the menu tree, visual hierarchy must be designed accordingly, to guide user while reading
"Pages with a clear visual hierarchy have three traits: The more important something is, the more prominent it is. The most important elements are either larger, bolder, in a distinctive color, set off by more white space, or nearer the top of the page—or some combination of the above."
Steve Krug
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Help and support
Online help
Technical support
Info
Je instellingen in 3 eenvoudige stappen.
This page can't be displayed


Help and support | branding usability layout
» Online help > nothing happens > does it work?
» Technical support > ask for credential > browser opens (in Dutch!) > nothing happens > does it work?
» Contact supplier > browser opens > error message > does it work?
» Info > display dialog with info (company, license and helpdesk) > they cannot by copied or activated
Je instellingen in 3 eenvoudige stappen.
This page can't be displayed
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User Journey
Data management


Intents were goods
But the design not enough...
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Data Management – User Journey
Step 1 Demonstrators
Step 2 Apartments
Step 3 Rooms
Step 4 Devices
Step 5 Sensors
Step 6 Measurements
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## Data Management layout infoviz usability

### Criticalities

- There are 6 different steps to explore the whole data structure
- Pages are all the same: no visual hints to help you easily recognise where you are
- A lot of space is empty (and wasted)
- No summary (e.g. charts, statistics) are provided to support the understanding of the coverage of the dataset (sensors per rooms; rooms per apartment/building)
  - Hence also zoom and filters utilities are missing
- So much text is ineffective: it prevents a quick and effective visual inspection of the content («scrolling the page in a glance»), typical of visual information seeking process

### Quick tips

- Use a meaningful dashboard to show results of data management exploring
- Focus on the user goal, while designing: users are seeking for information, hence:
  - We cannot expect a rigid reading order
  - Preserve data to graphic dimensionality
  - Integrate text wherever relevant
  - Put the most data in the least space
  - Provide multiple levels of detail
  - Support in formulate cause & effect reasoning

*"Visual Information-Seeking Mantra"*

1. Overview first
2. Zoom and filter
3. Relate
4. Extract
5. History

B. Shneiderman. The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations. In Proc. of the IEEE Symposium on Visual Languages, pages 336–343. IEEE Press, 1996.

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## Energy measurement dashboard - Examples

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## Expert tool – User Journey

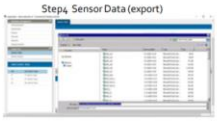
Step1 Selected data from data management

Step2 Realize Data Management and Expert Tool are disconnected

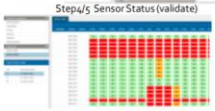
Realize that the selection done in data management is not valid for the expert tool and I have to restart

Step3 Select

Step4 Sensor Data (export)



Step4/5 Sensor Status (validate)



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## Expert Tool | layout infoviz usability

### Sensor data

- We cannot discriminate the operative environment from the layout (Data Management vs Expert Tool)
- There is a lot of blank space
- If there are interdependencies among filters, they are not evident by graphics.

QUICK TIPS

- The user can get lost easily: better discriminate the environments
- Avoid blank space/not available functions
- Use icons to discriminate items (the same of the navigation, since items are the same)

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## Expert Tool | layout infoviz usability

### Sensor data

- There is not data overview or sum up
- After pressing «load» the month/year card is displayed.
  - The label is unclear (months of the year? Which year?)
  - Is it possible to navigate along years?
  - I cannot sub-select months. If I want the details of a specific month? Or a specific subset?
  - Anyway the card is empty
  - And also graphs are unavailable. Why?

QUICK TIPS

- If something is wrong (no available data/graphs) it is better to explain the user why. Otherwise the user gets lost.
- Concretize relationships among data/variables

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## Expert Tool | layout infoviz usability 1

### Sensor data

- Label are not used in the most powerful manner
  - «Reset» is not the standard label for clear filter.
  - «Object» is not the most appropriate label for «country»
  - «Sub-object» is not the most appropriate label for «building»
- User thinks to do the wrong actions
  - «Did I wrong?» Is the question that arises more frequently in this interaction

QUICK TIPS

- Use «clear» label, to reset filters
- «Load», «reset» and other actions can be made available also into the Data Management

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## Expert Tool | layout infoviz usability 2

### Sensor data

- Granularity of data aggregation is limited
  - Hour and months
- Field from function to addend are empty and no evident actions are possible

QUICK TIPS

- Granularity for data aggregation can be also per six-month and year
- If data are not available, add a short explanation, otherwise it seems not working.
  - If they are not working, handle it by a meaningful warning

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## Expert Tool | layout infoviz usability 3

### Sensor data

- After selecting objects/sub-objects, etc., if I select certain specific KPI, some of the above filters are removed
- Where are data representation about KPI?
  - Are there any range (success vs unsuccess)?

QUICK TIPS

- Remove conflicting option combinations
  - If consistence is not possible, add clarity
  - A wizard-based approach can be useful
- Preserve data to graphic dimensionality
  - KPI should support in confirming/discarding hypothesis

*"CLARITY TRUMPS CONSISTENCY! If you can make something significantly clearer by making it slightly inconsistent, choose in favor of clarity."*

Steve Krug

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And now?
Rooms
201 - 216
Rooms
217 - 226
Ambiguity, at first
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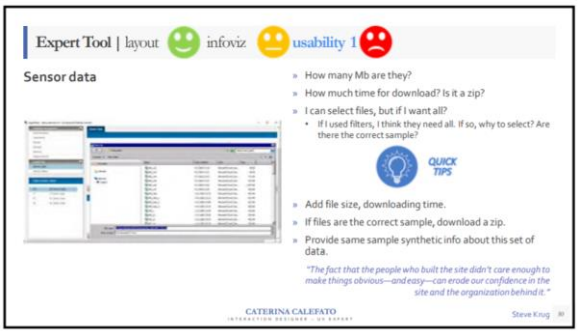
Expert Tool | layout infoviz usability 1
Sensor data
How many Mb are they?
How much time for download? Is it a zip?
I can select files, but if I want all?
If I used filters, I think they need all. If so, why to select? Are there the correct sample?
QUICK TIPS
Add file size, downloading time.
If files are the correct sample, download a zip.
Provide same sample synthetic info about this set of data.
"The fact that the people who built the site didn't care enough to make things obvious—and easy—can erode our confidence in the site and the organization behind it."
Steve Krug
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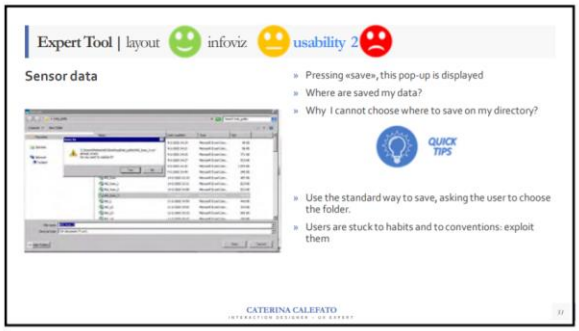
Expert Tool | layout infoviz usability 2
Sensor data
Pressing «save», this pop-up is displayed
Where are saved my data?
Why I cannot choose where to save on my directory?
QUICK TIPS
Use the standard way to save, asking the user to choose the folder.
Users are stuck to habits and to conventions: exploit them
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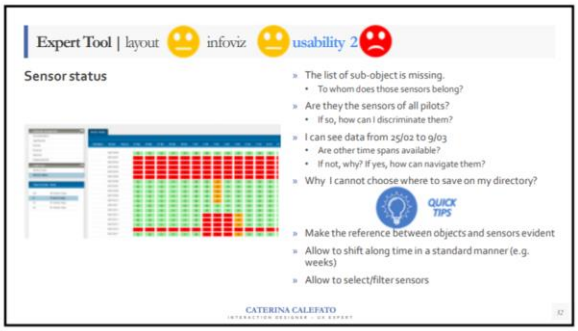
Expert Tool | layout infoviz usability 2
Sensor status
The list of sub-object is missing.
To whom does those sensors belong?
Are they the sensors of all pilots?
If so, how can I discriminate them?
I can see data from 25/02 to 9/03
Are other time spans available?
If not, why? If yes, how can navigate them?
Why I cannot choose where to save on my directory?
QUICK TIPS
Make the reference between objects and sensors evident
Allow to shift along time in a standard manner (e.g. weeks)
Allow to select/filter sensors
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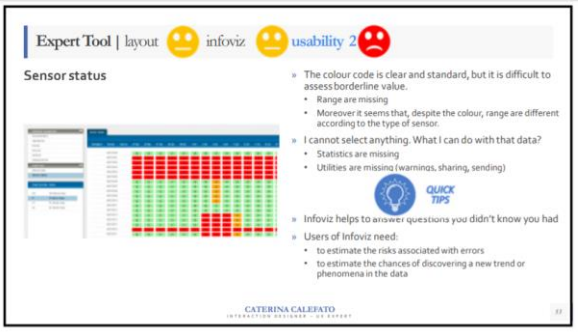
Expert Tool | layout infoviz usability 2
Sensor status
The colour code is clear and standard, but it is difficult to assess borderline value.
Range are missing
Moreover it seems that, despite the colour, range are different according to the type of sensor.
I cannot select anything. What I can do with that data?
Statistics are missing
Utilities are missing (warnings, sharing, sending)
QUICK TIPS
Infoviz helps to answer questions you didn't know you had
Users of Infoviz need:
to estimate the risks associated with errors
to estimate the chances of discovering a new trend or phenomena in the data
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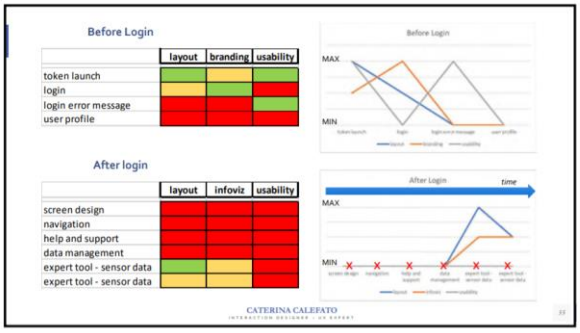
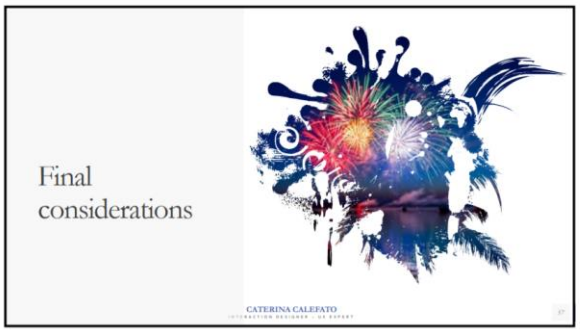
Summary and awareness
The power of «data into a nutshell»
A practical demonstration
About you
Do you consider yourself a person of average ability with digital tools? Maybe below or above average?
Do you consider yourself of average ability with statistical data and infoviz? Maybe below or above average?
"A person of average (or even below average) ability and experience can figure out how to use the thing to accomplish something without it being more trouble than it's worth. Take my word for it: It's really that simple."
Steve Krug
CATERINA CALEFATO


Before Login
layout branding usability
token launch
login
login error message
user profile
MAX
MIN
After login
layout infoviz usability
screen design
navigation
help and support
data management
expert tool - sensor data
expert tool - sensor data
time
CATERINA CALEFATO


Before Login
FOR ALL
FOR EXPERT
layout branding usability
token launch
login
login error message
user profile
After login
FOR ALL
FOR EXPERT
layout infoviz usability
screen design
navigation
help and support
data management
expert tool - sensor data
expert tool - sensor data
MAX
MIN
CATERINA CALEFATO


Final
considerations
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Before leaving
» An effective visualization allows to absorb and remember large amount of information effortlessly
» Even if it is difficult to identify and measure the decision-making process, that uses information from diverse sources, it is possible to trigger it
» Usability is about people and how they understand and use things, not about technology (Steve Krugs)
DON'T WASTE USERS' TIME!
Much of use of tool is motivated by the desire to save time.
As a result, users tend to act like sharks. They have to keep moving or they'll die
(Steve Krugs)
CATERINA CALEFATO


CATERINA CALEFATO
Thanks for attention
Caterina Calefato
+39 3473312680
Caterina.calefato@gmail.com

## Annex 4: MOUP developers validation screenshots

Test1: Subscription

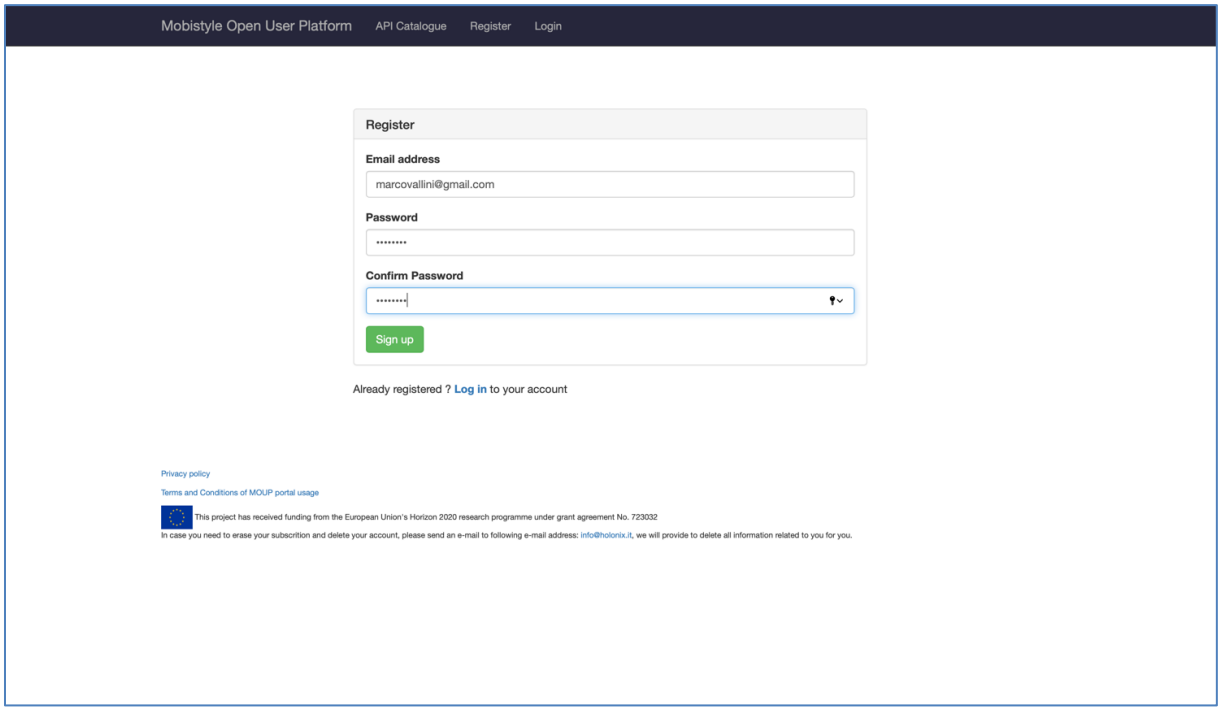


Fig. 34 Subscription

Test2: Access to the MOUP

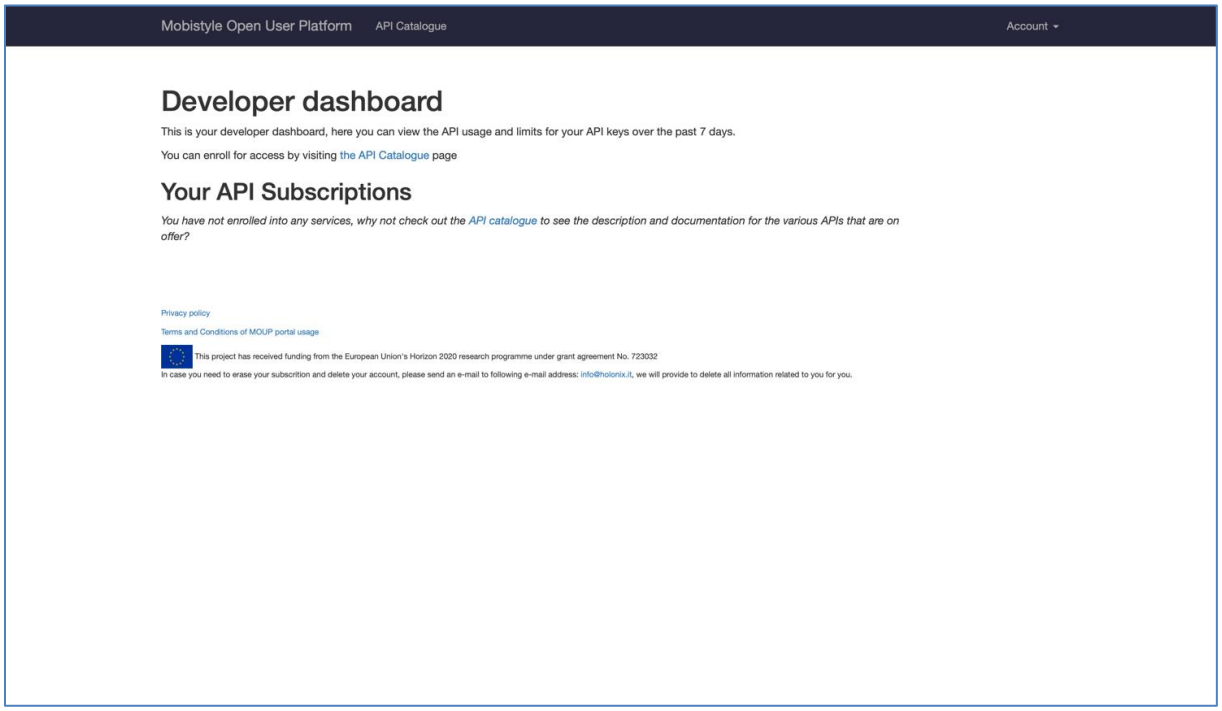


Fig. 35 Login to access the MOUP

Test3: Visualize APIs Catalogue (2 pictures)

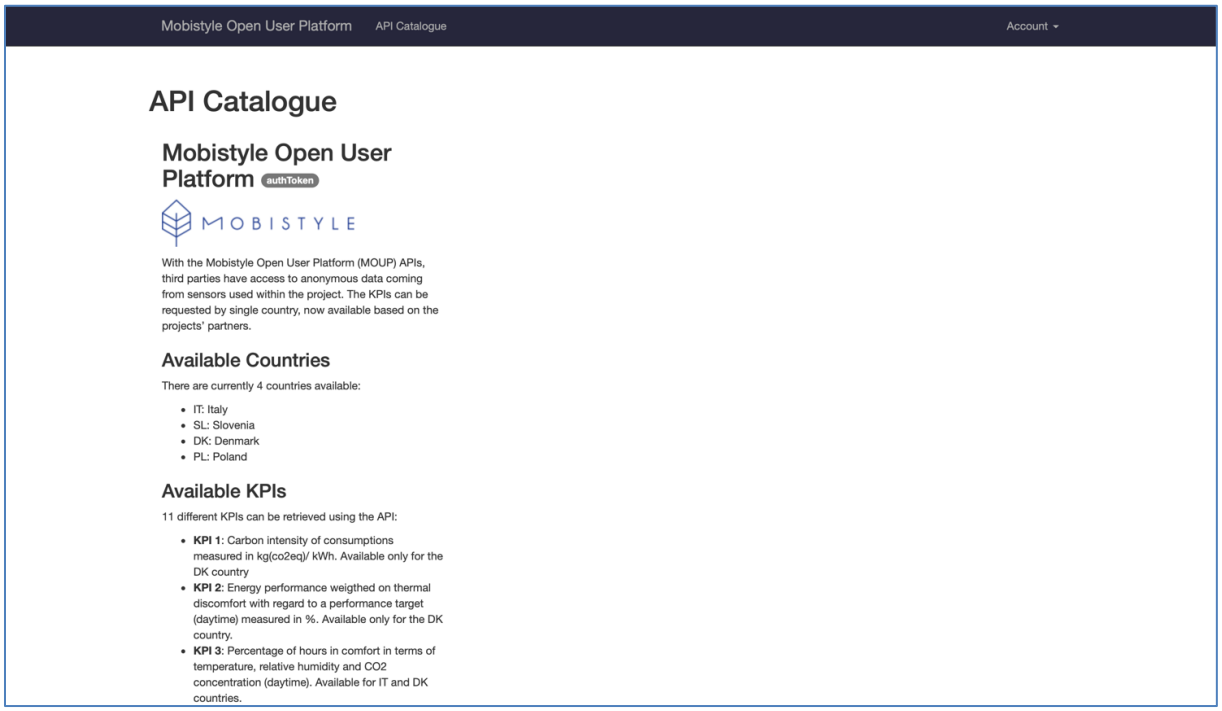


Fig. 36 Access API cataloge 1st page

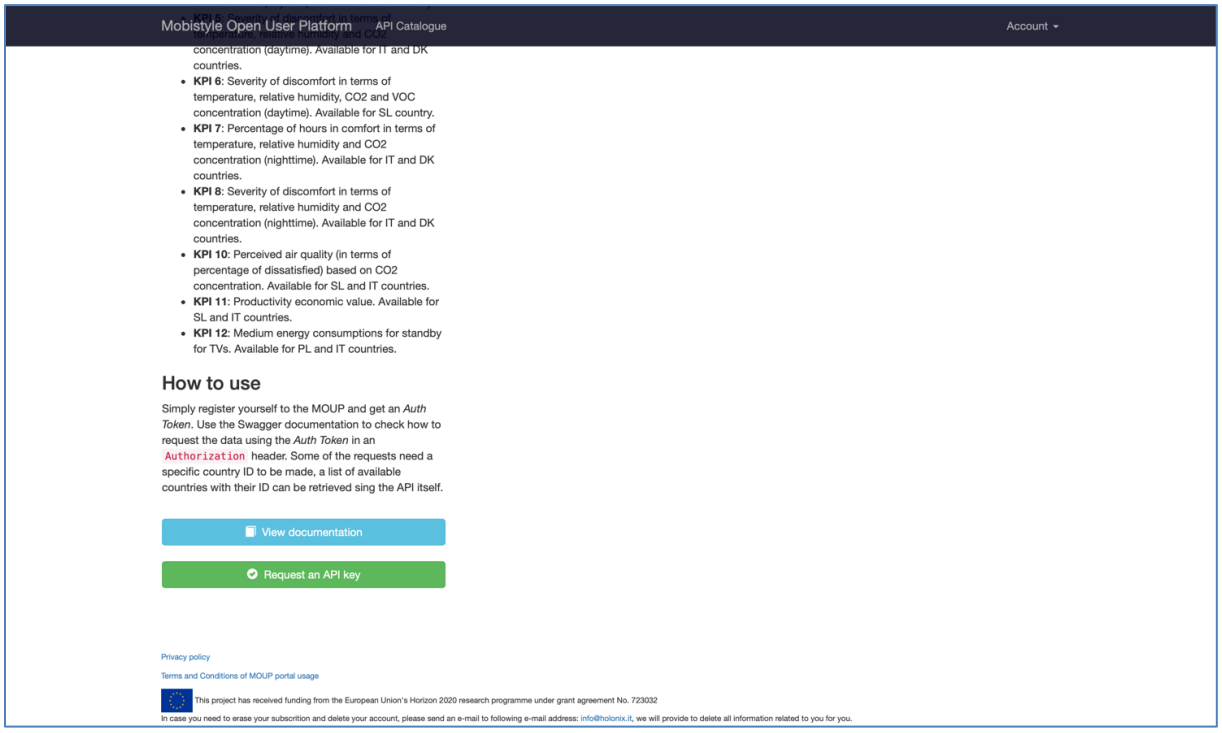


Fig. 37 Access API catalogue 2nd page

Test4: Request the API-Key and receive it (2 pictures)

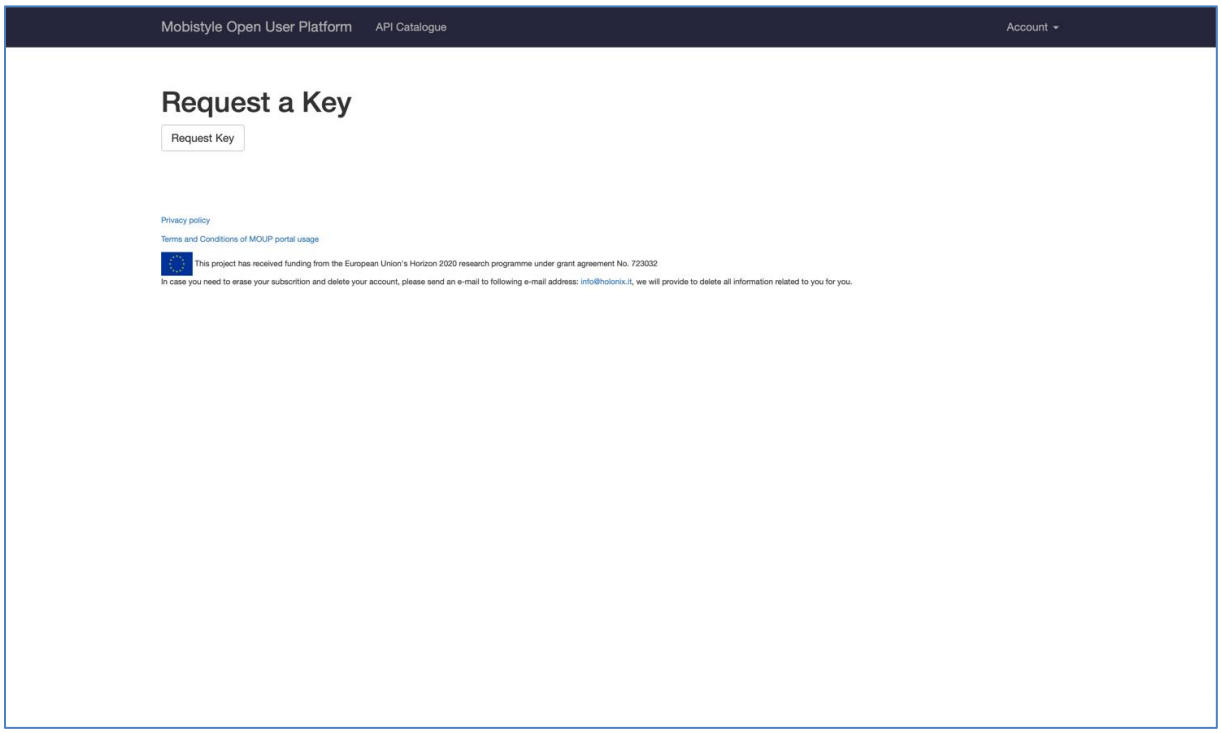


Fig. 38 Request a Key

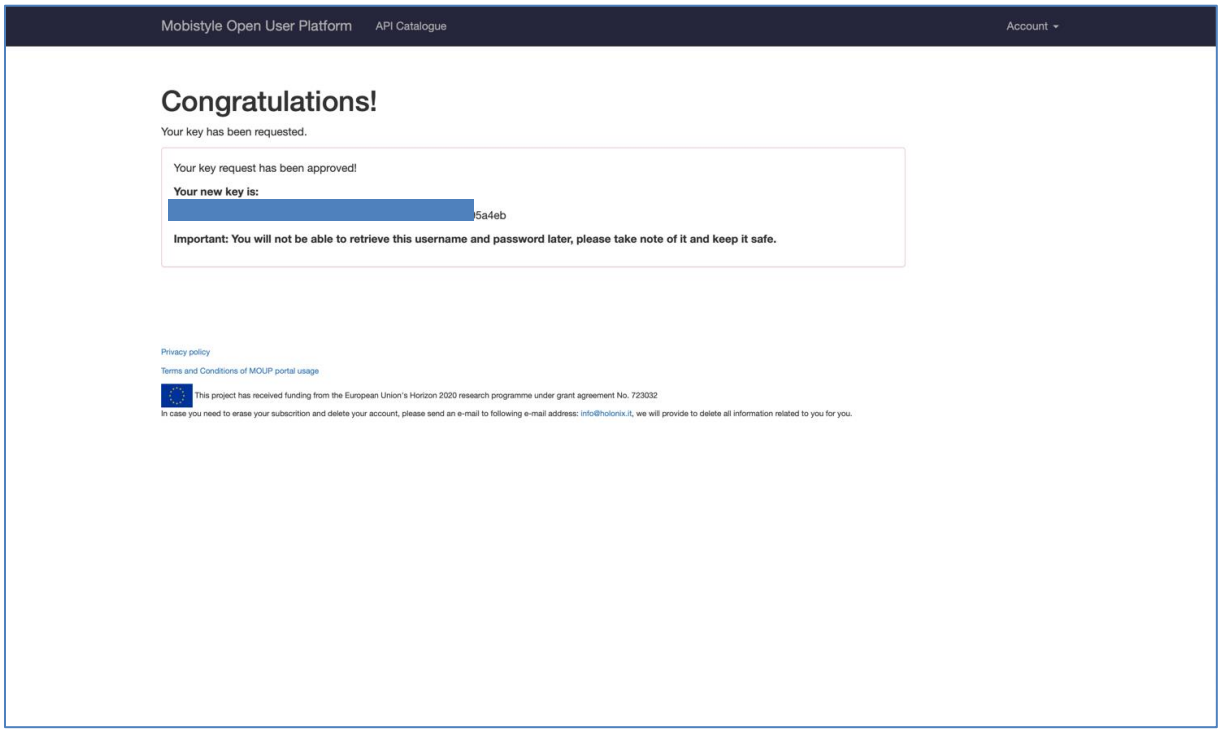


Fig. 39 Receive a Key

In the above image the API Key is partially covered for privacy.

Test5: Overview APIs documentation (3 pictures: introduction, swagger listing the APIs, models section)

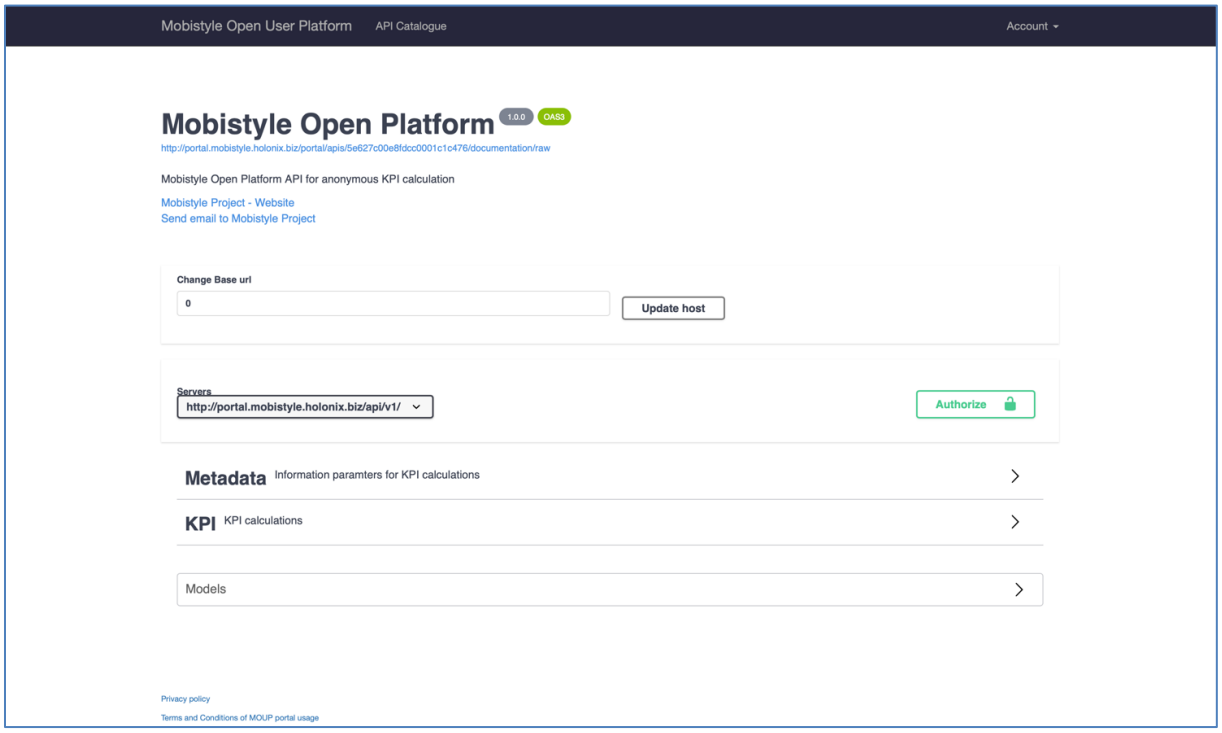


Fig. 40 See APIs documentation introduction

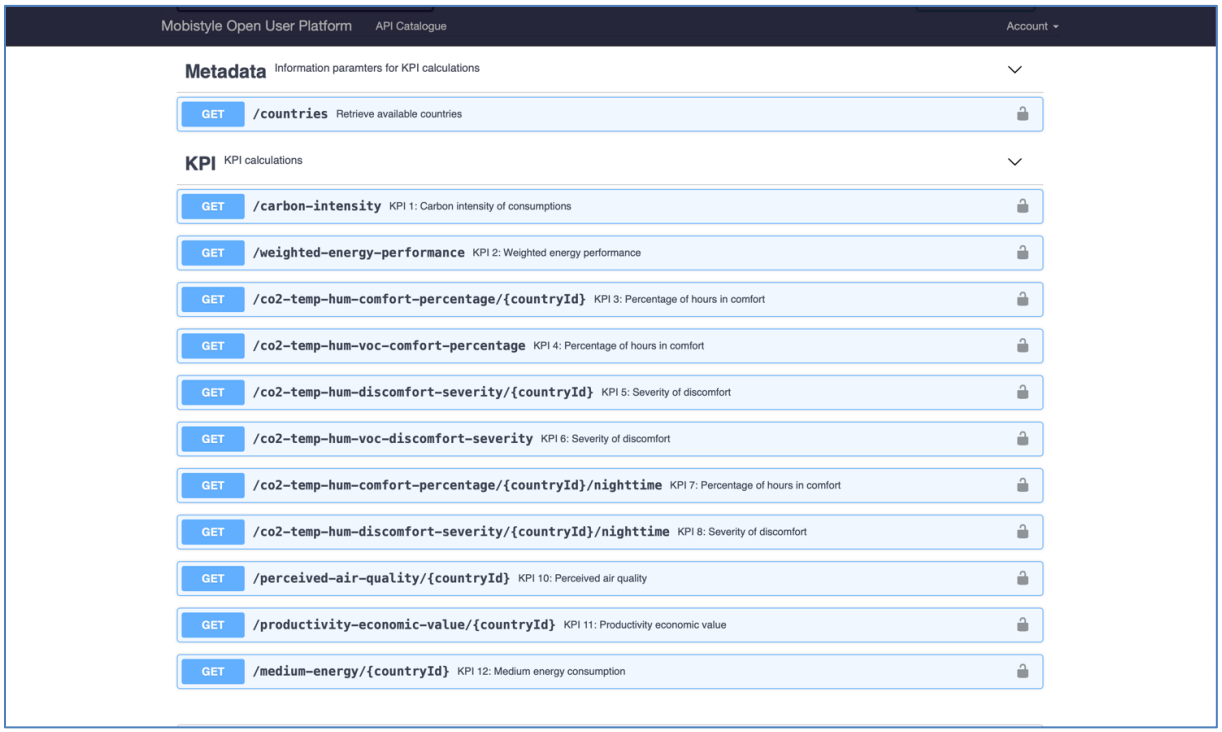


Fig. 41 See APIs documentation Swagger

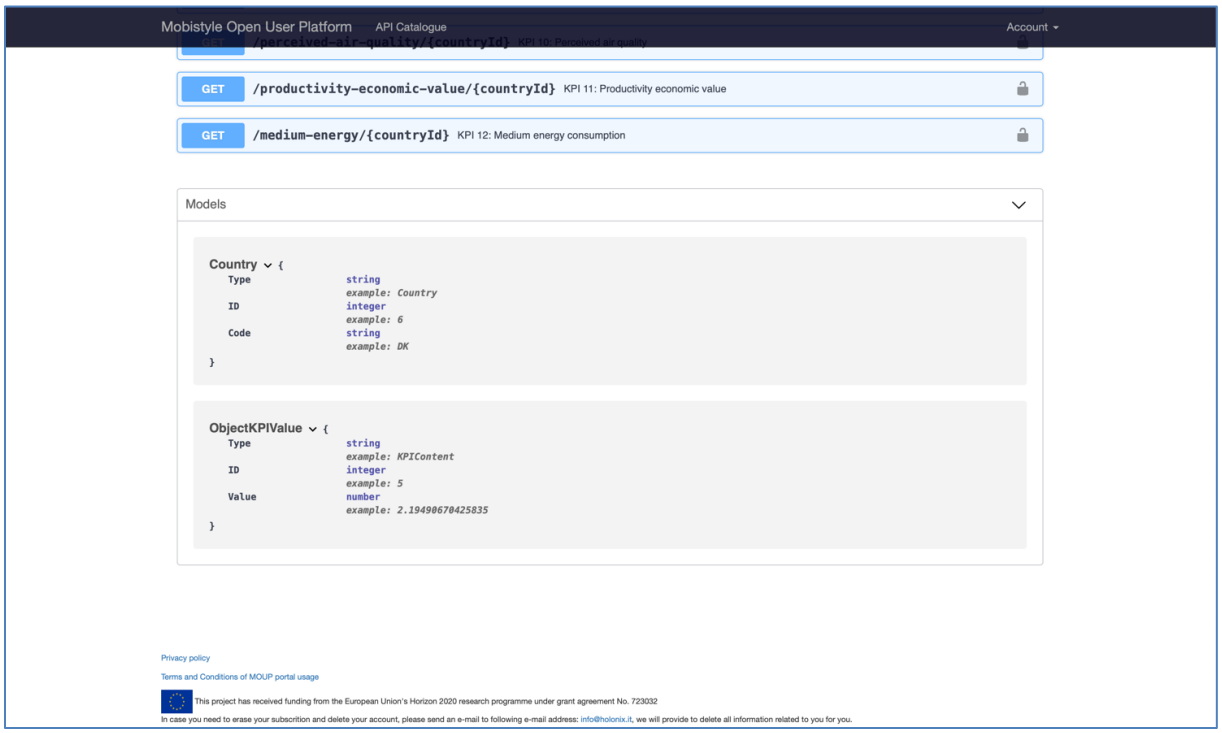


**Fig. 42 See APIs documentation modules**

Tests 6: verification of working APIs through the swagger interface. The obtained results are reported through the following screenshots.

Fig. 51

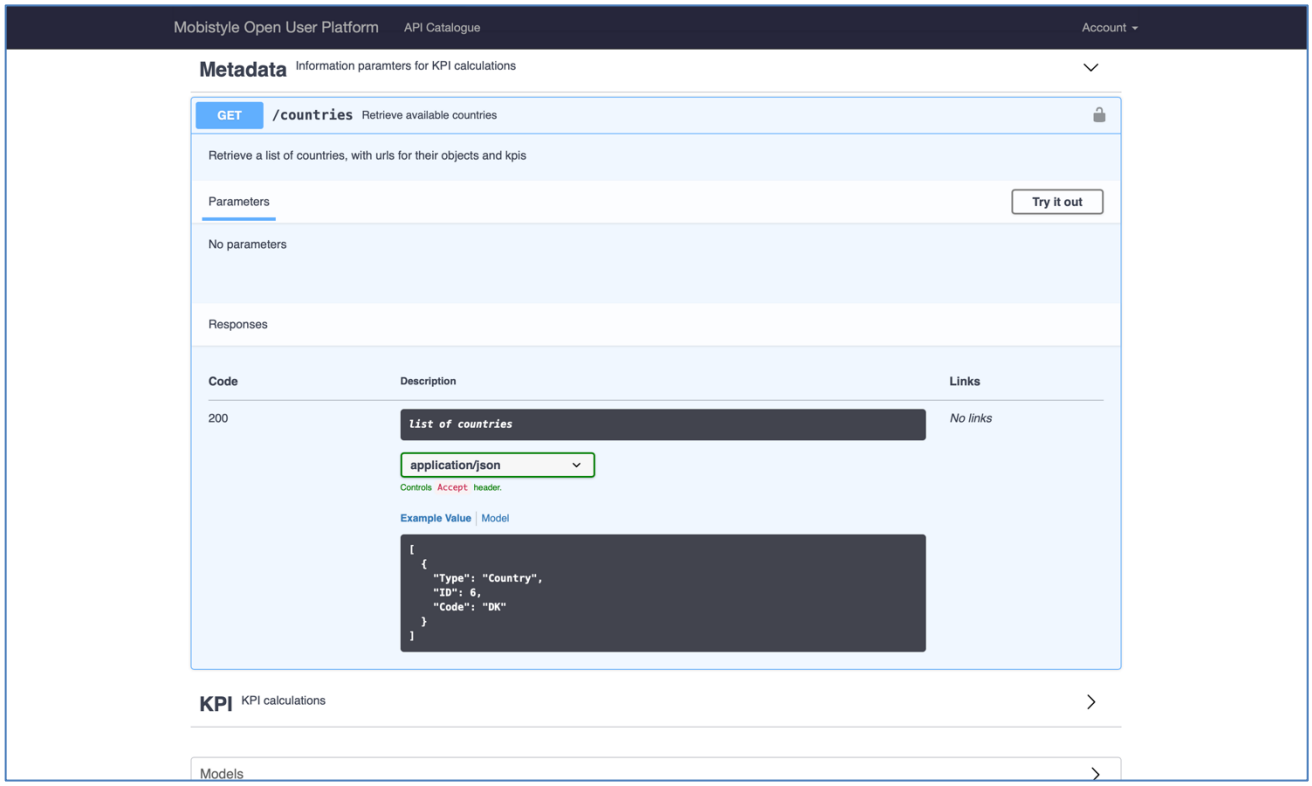


Fig. 43 countries API

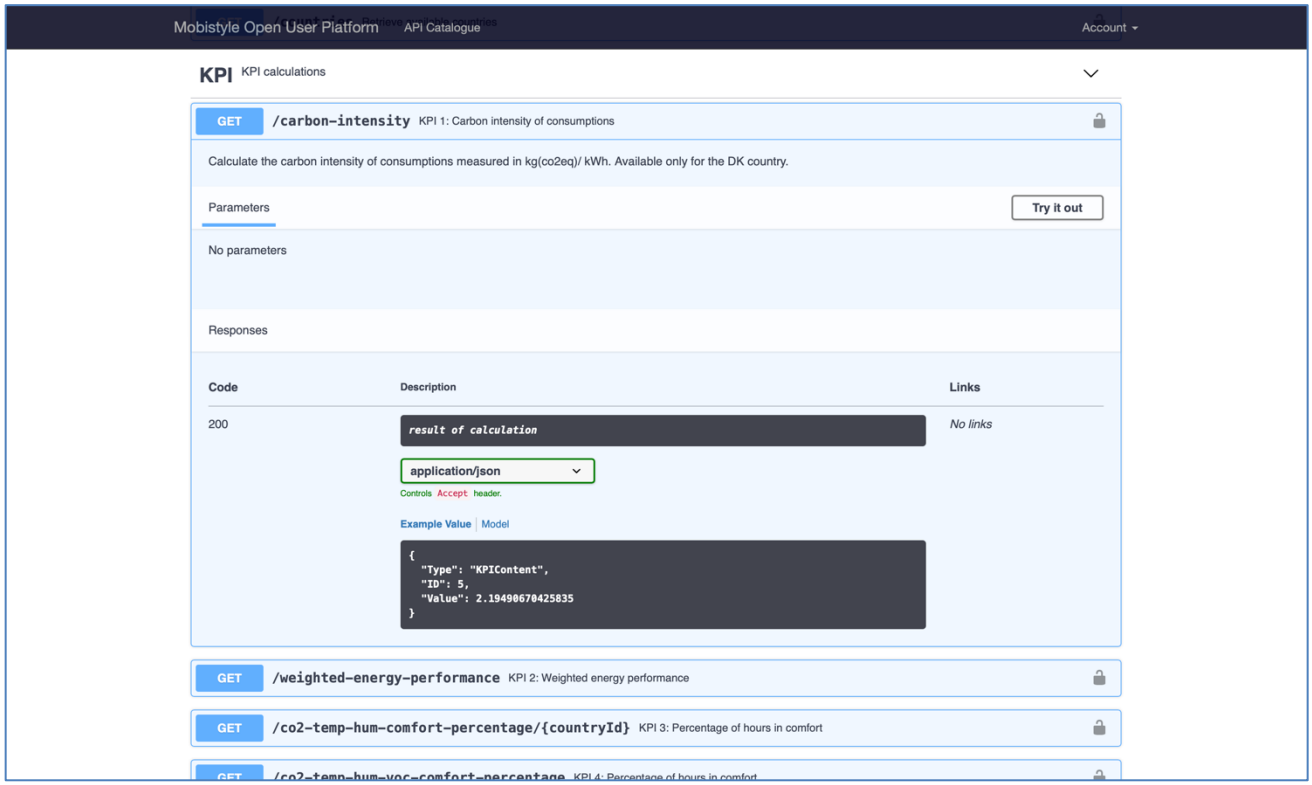


Fig. 44 carbon-intensity API

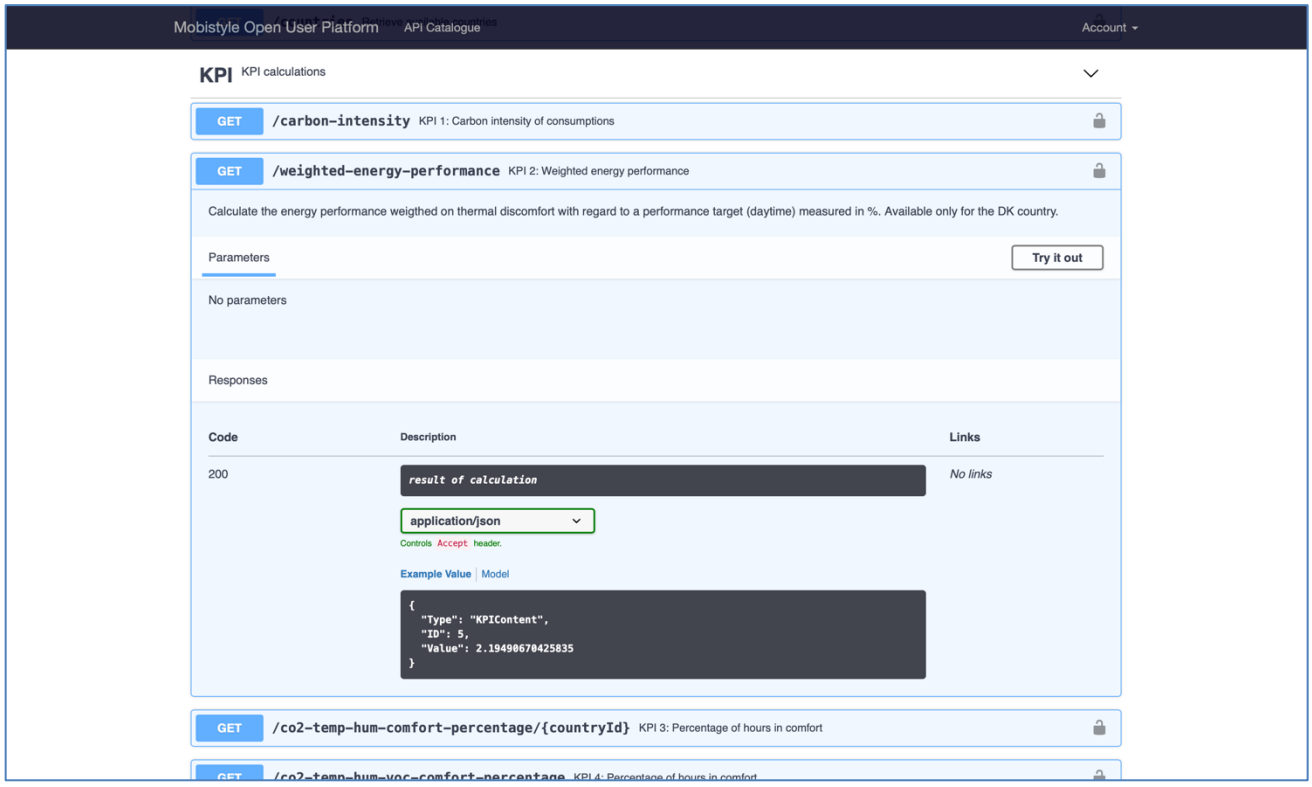


Fig. 45 weighted-energy-performance API

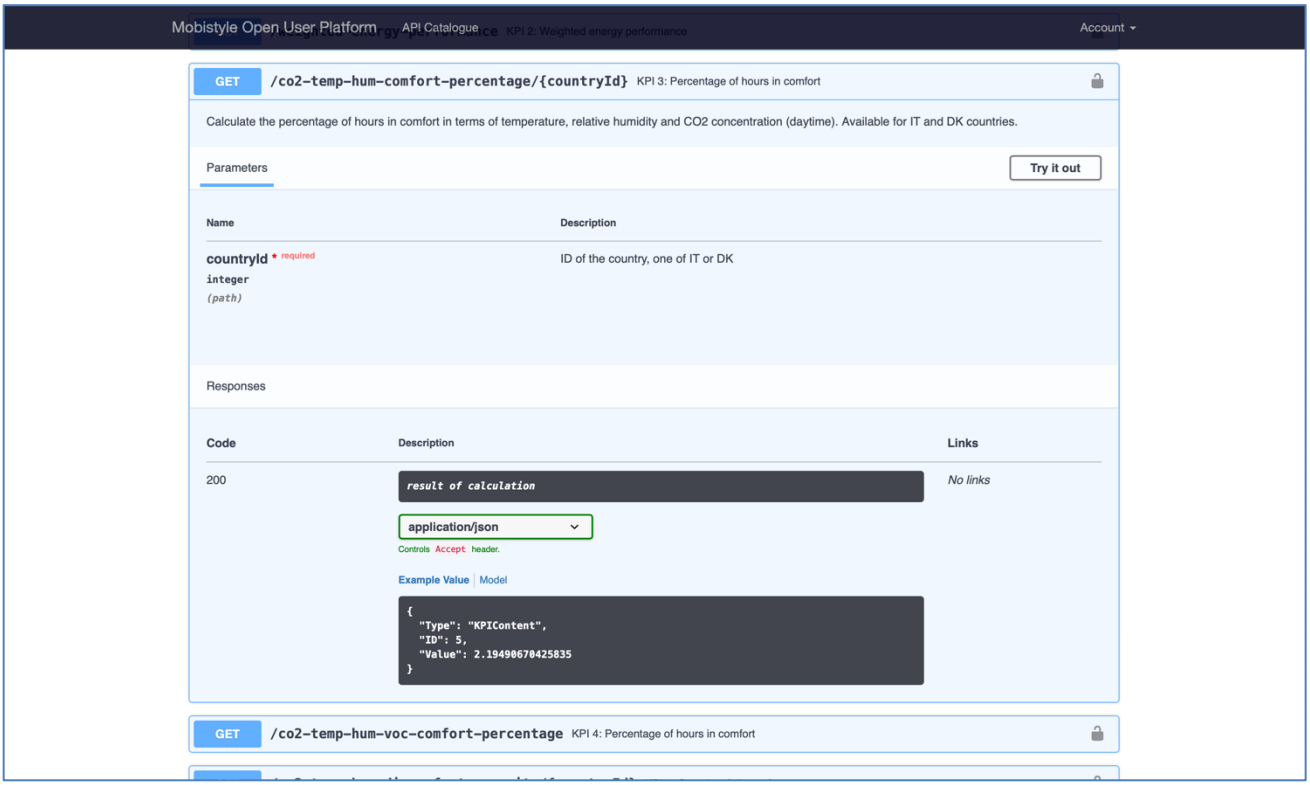


Fig. 46 co2-temp-hum-comfort-percentage/{countryId} API

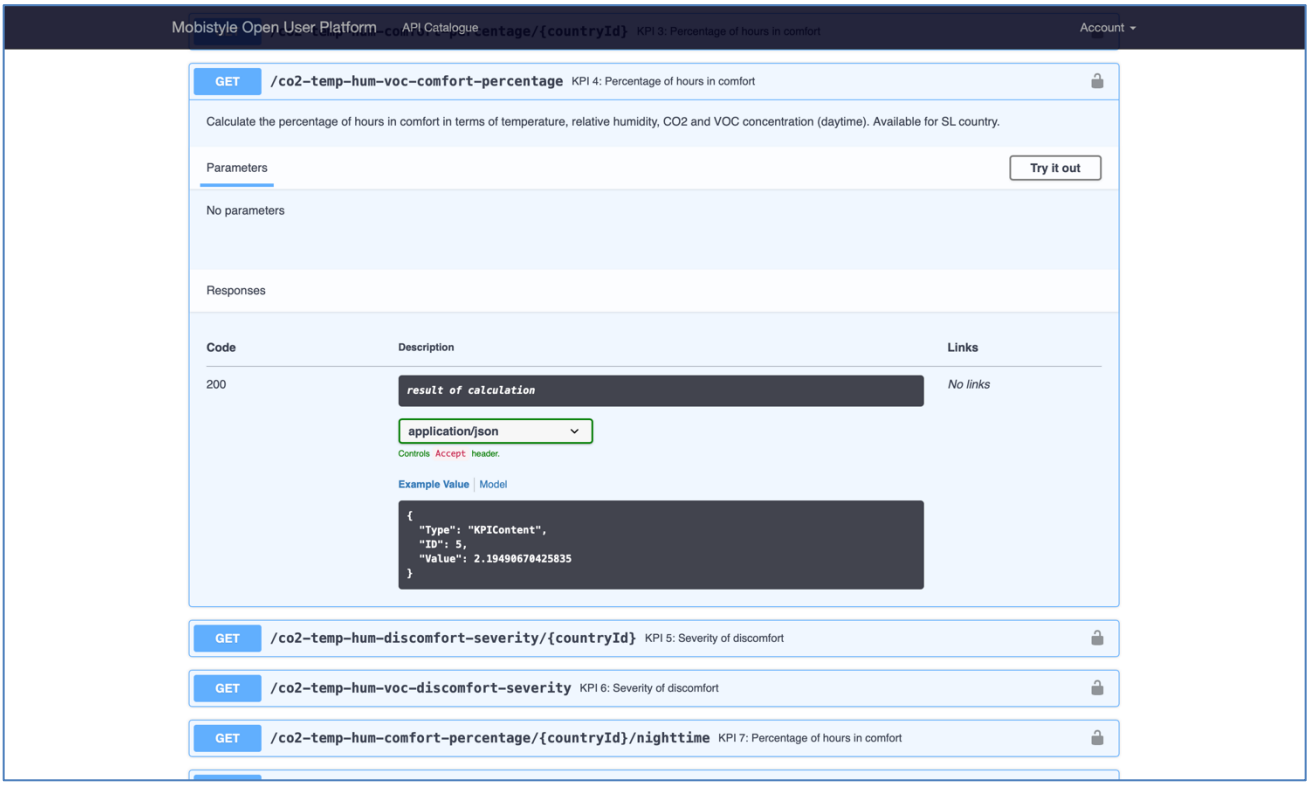


Fig. 47 co2-temp-hum-voc-comfort-percentage API

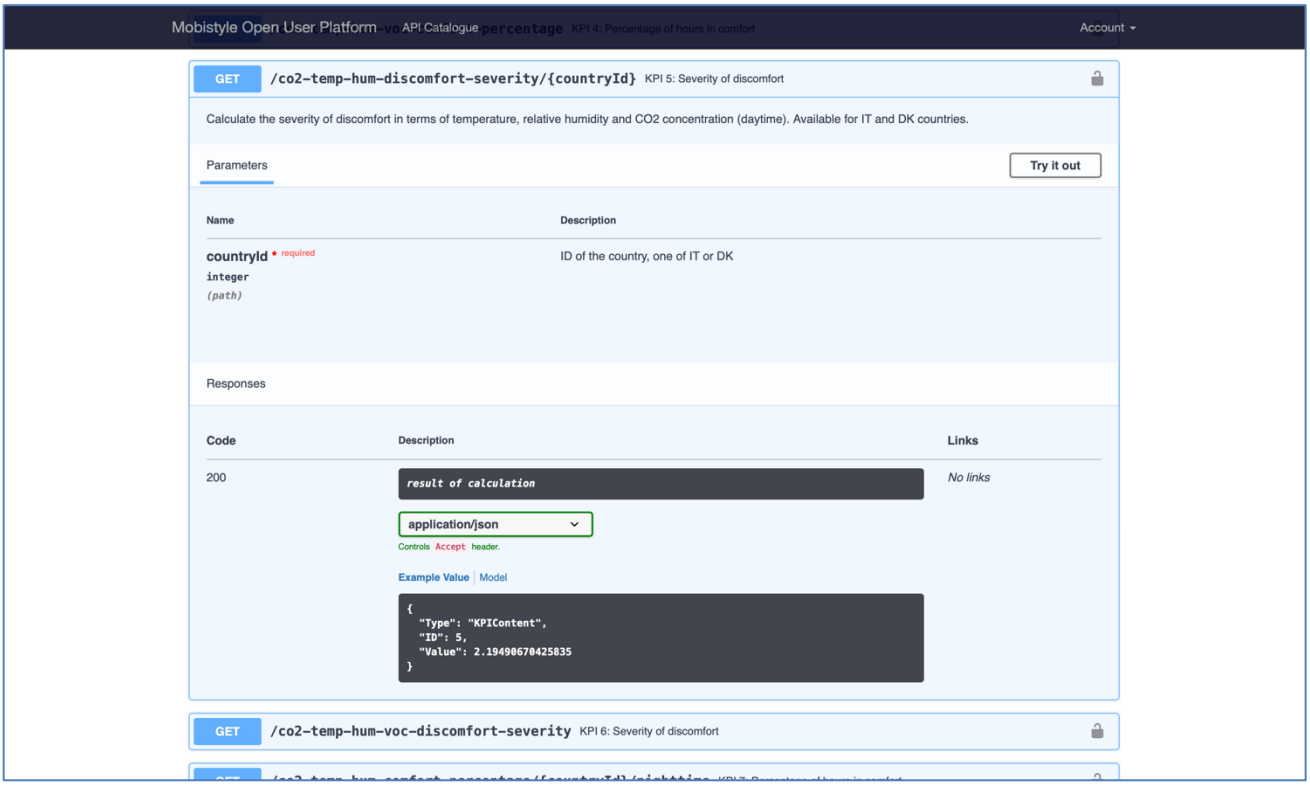


Fig. 48 co2-temp-hum-discomfort-severity/{countryId} API

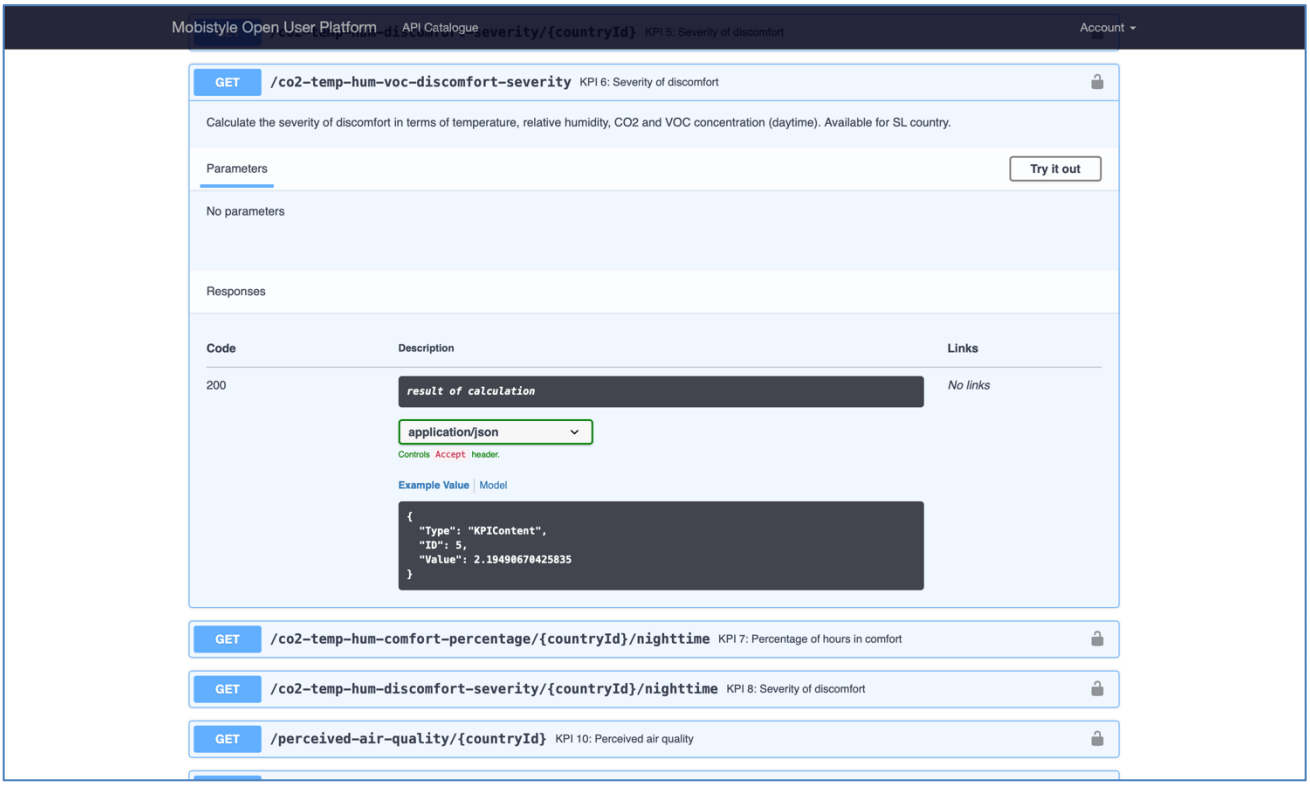


Fig. 49 co2-temp-hum-voc-discomfort-severity API

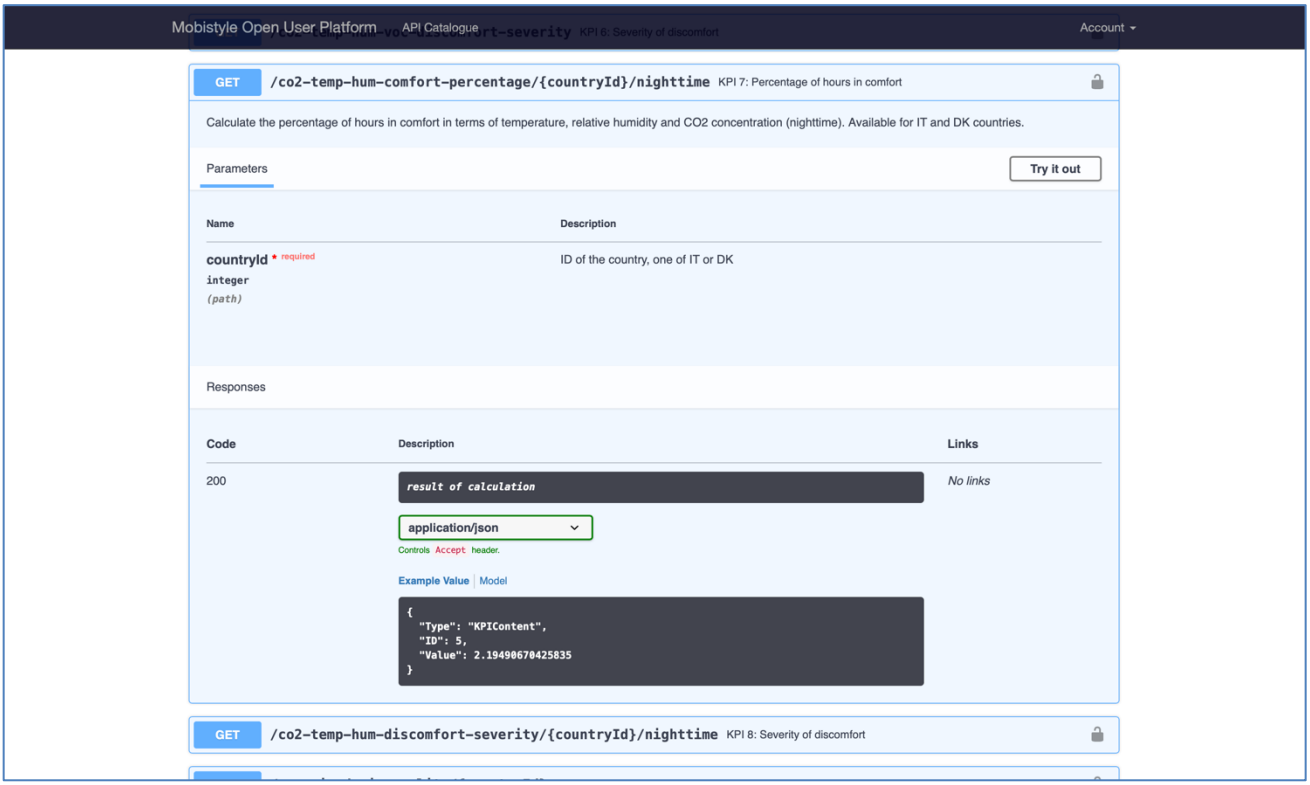


Fig. 50 co2-temp-hum-comfort-percentage/{countryId}/nighttime API

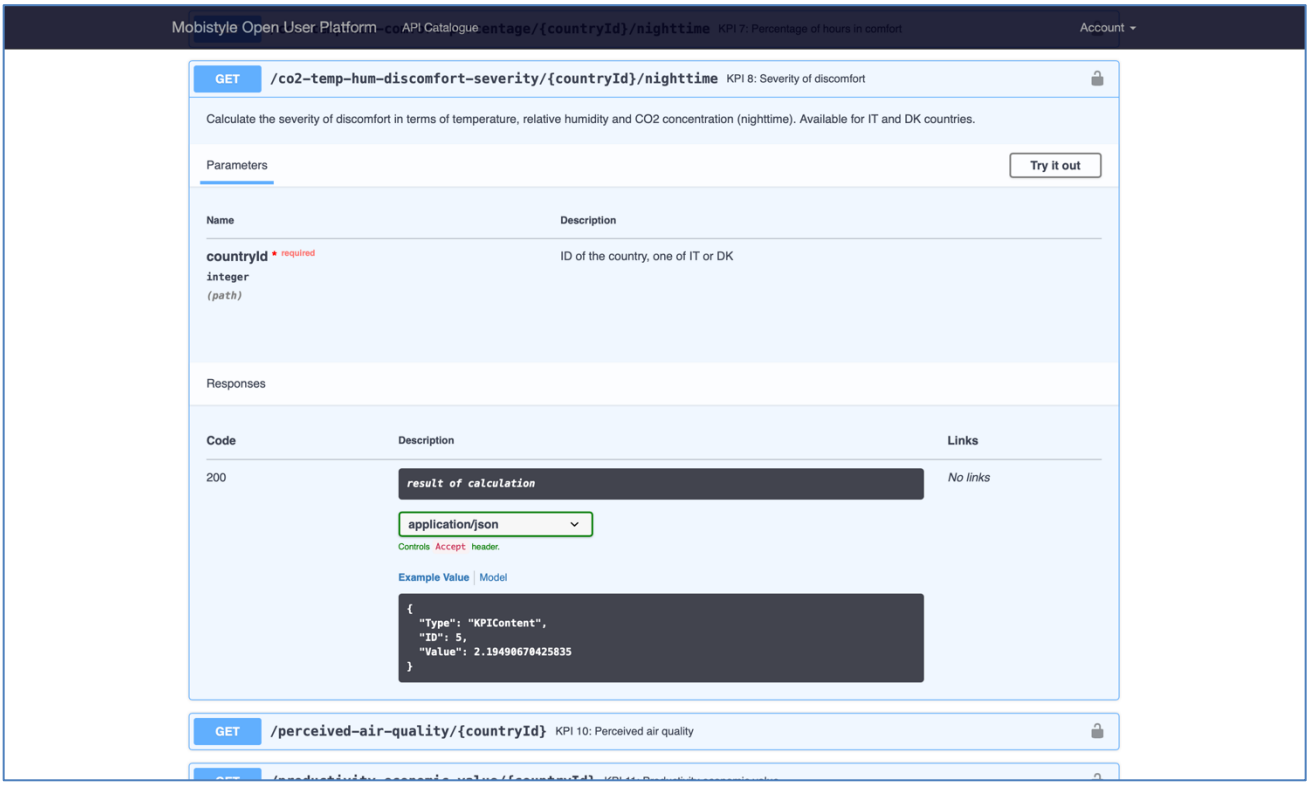


Fig. 51 co2-temp-hum-discomfort-severity/{countryId}/nighttime API

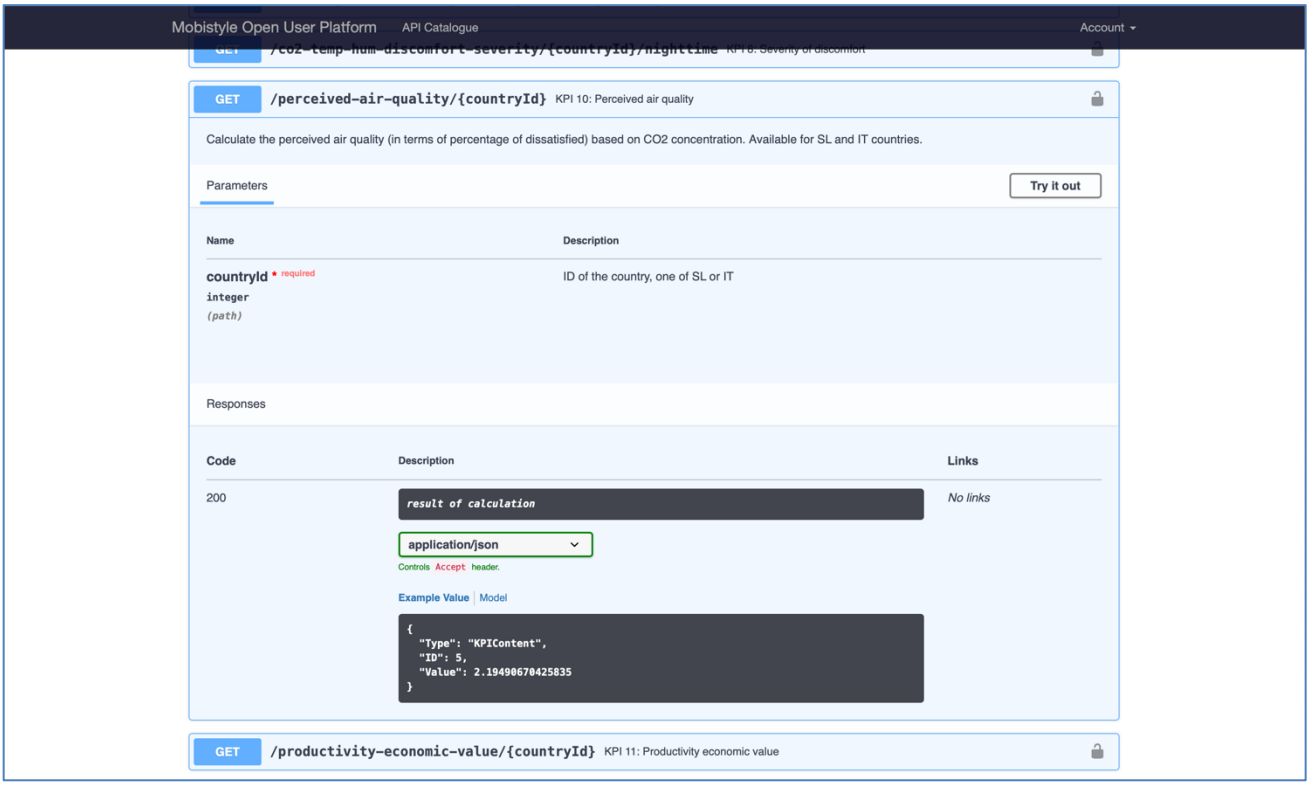


Fig. 52 perceived-air-quality/{countryId} API

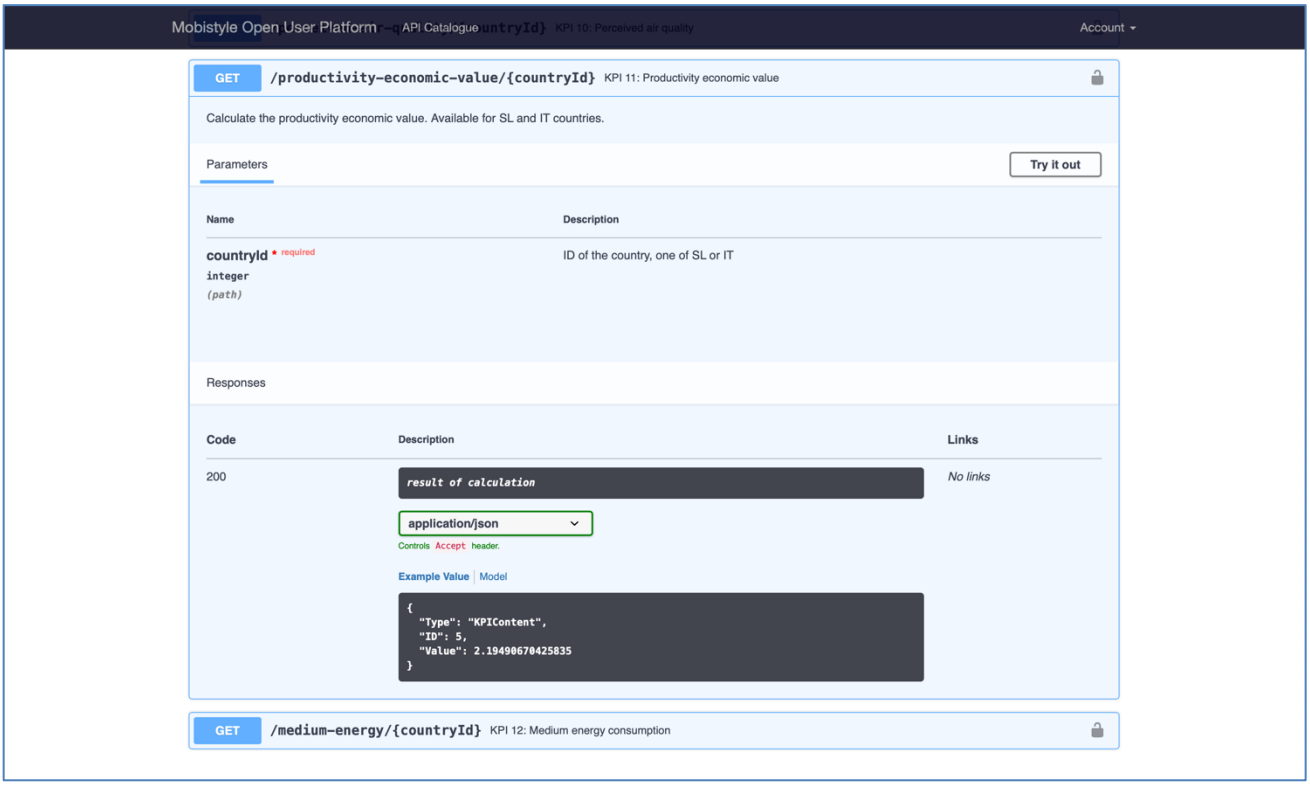


Fig. 53 productivity-economic-value/{countryId} API

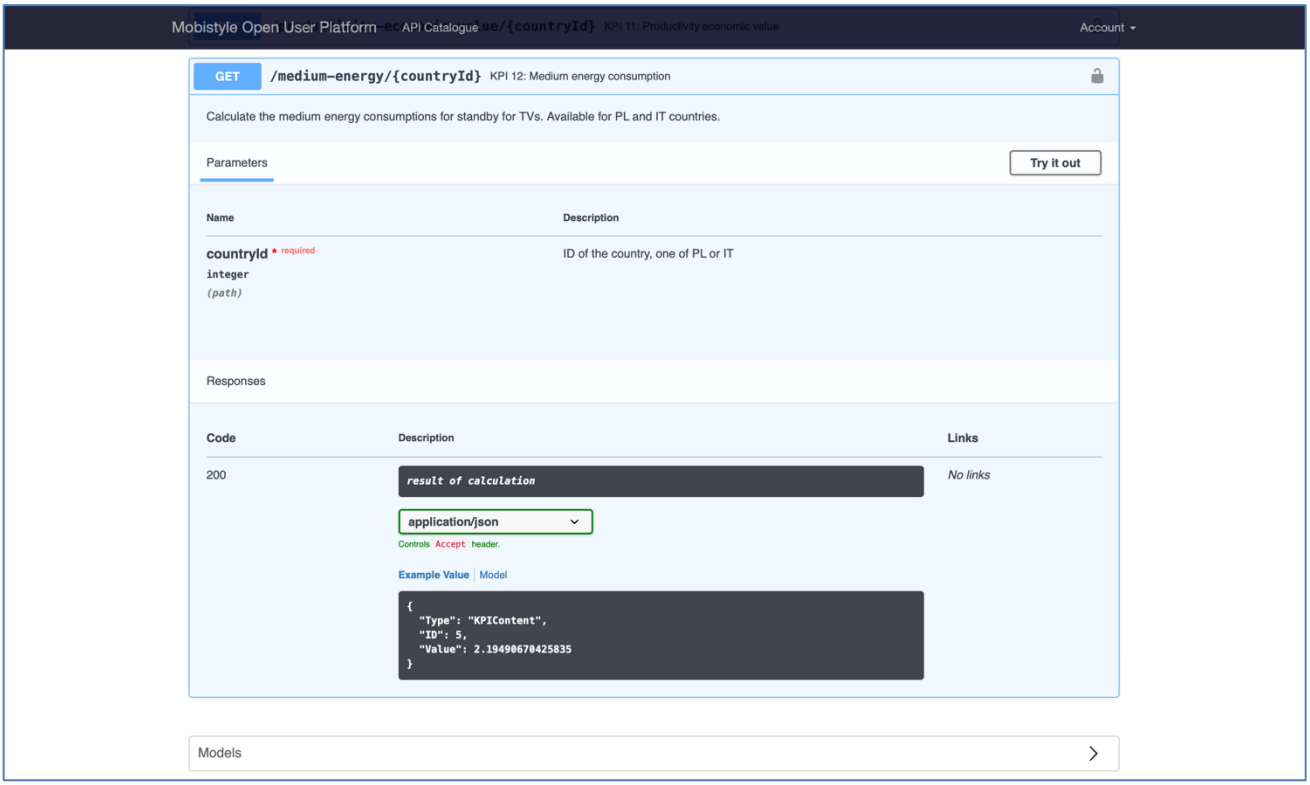


Fig. 54 medium-energy/{countryId} API

Test 7: Invoking APIs from the choosen REST client (CocoaRestClient). Results are reported in following screenshots.

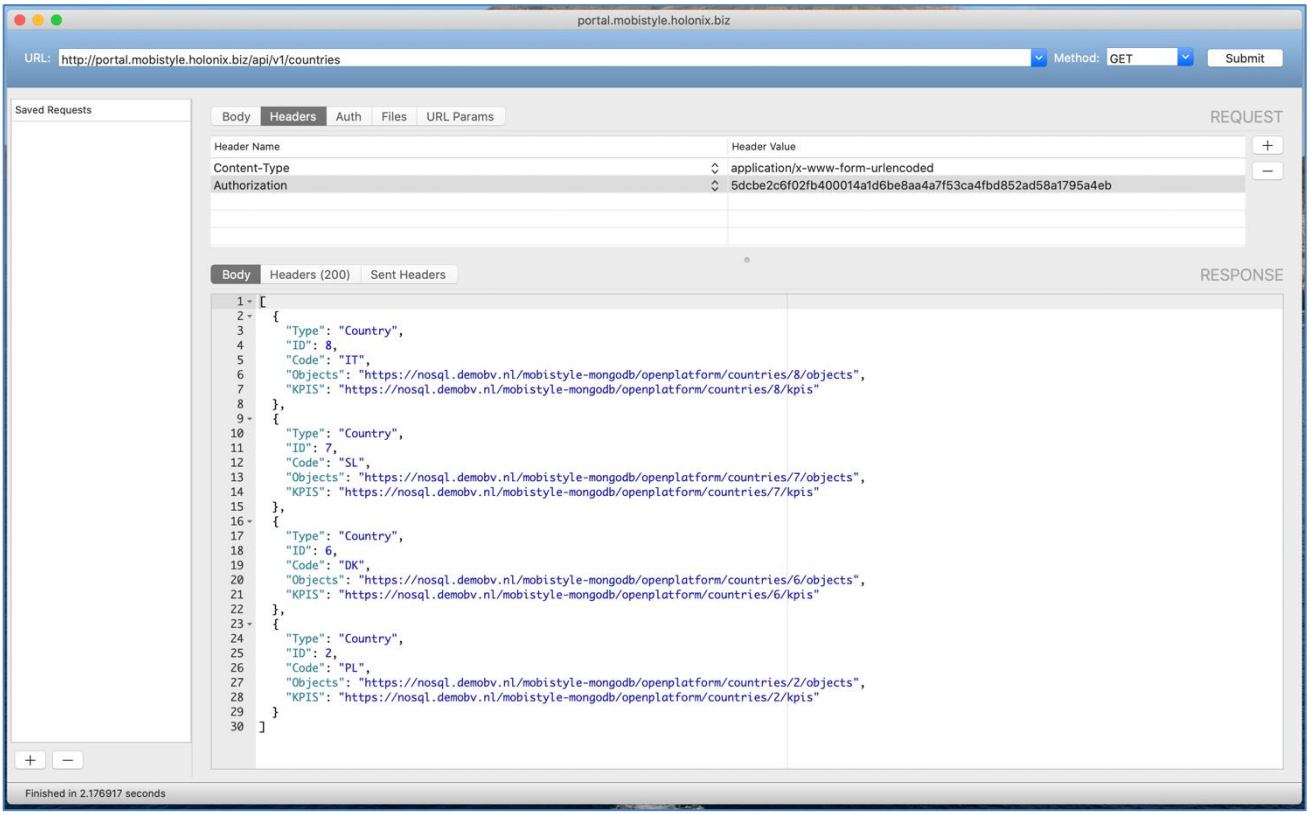


Fig. 55 invoking countries API

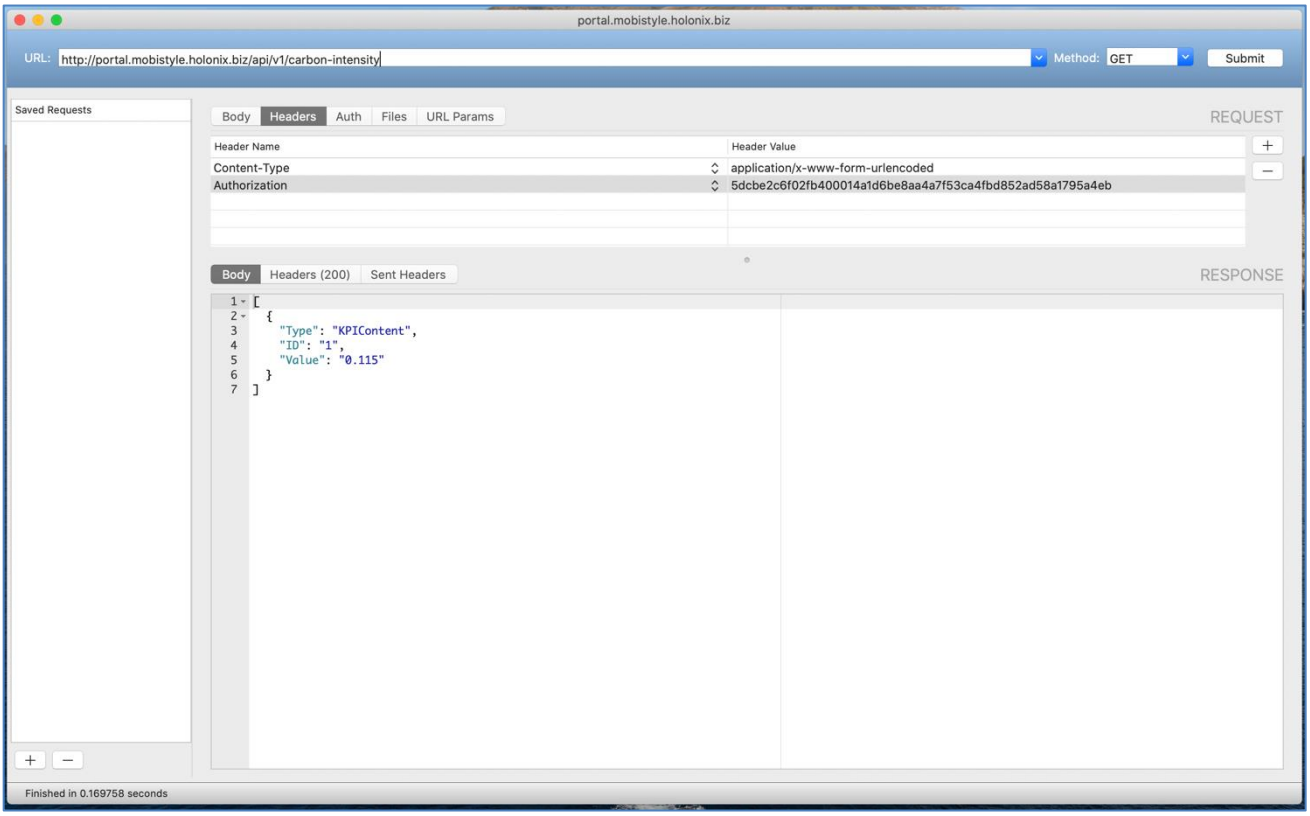


Fig. 56 invoking carbon-intensity API

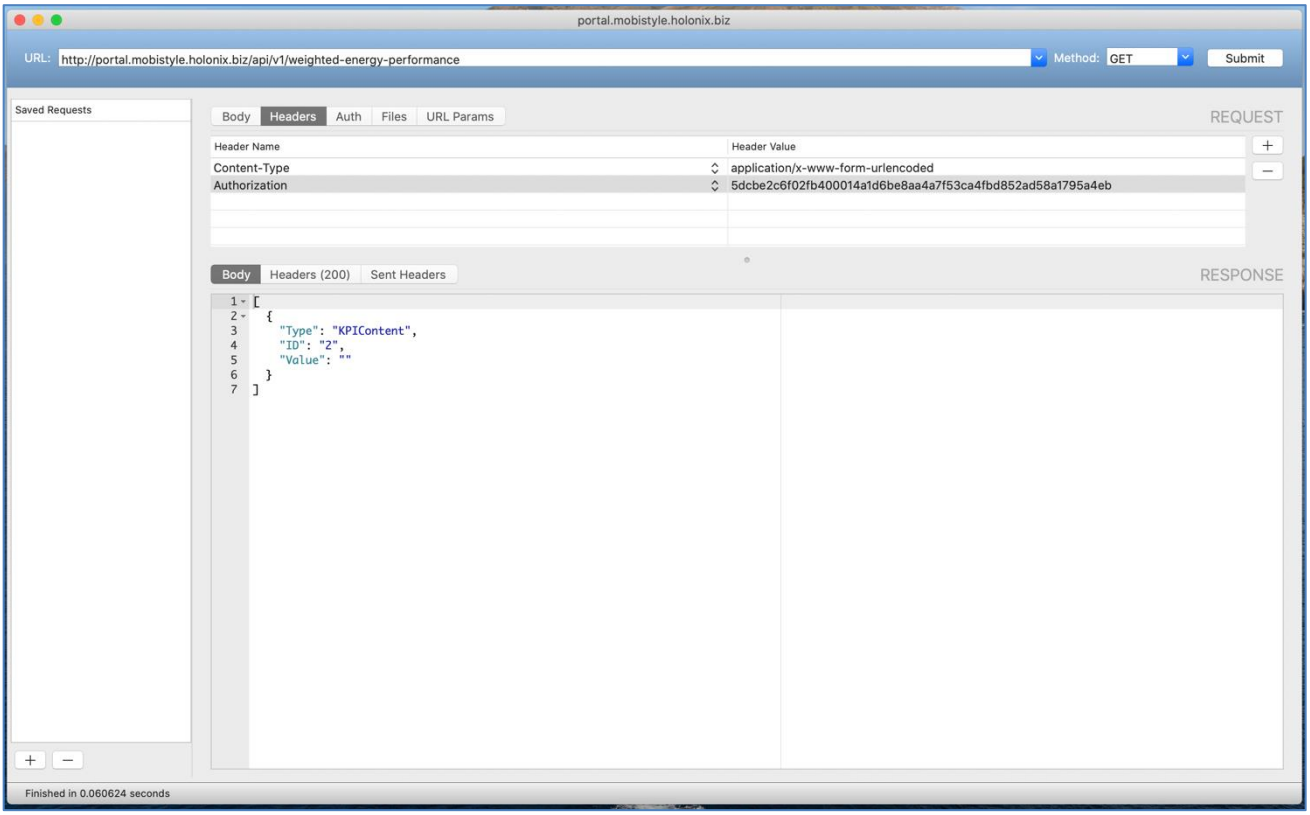


Fig. 57 invoking weighted-energy-performance API

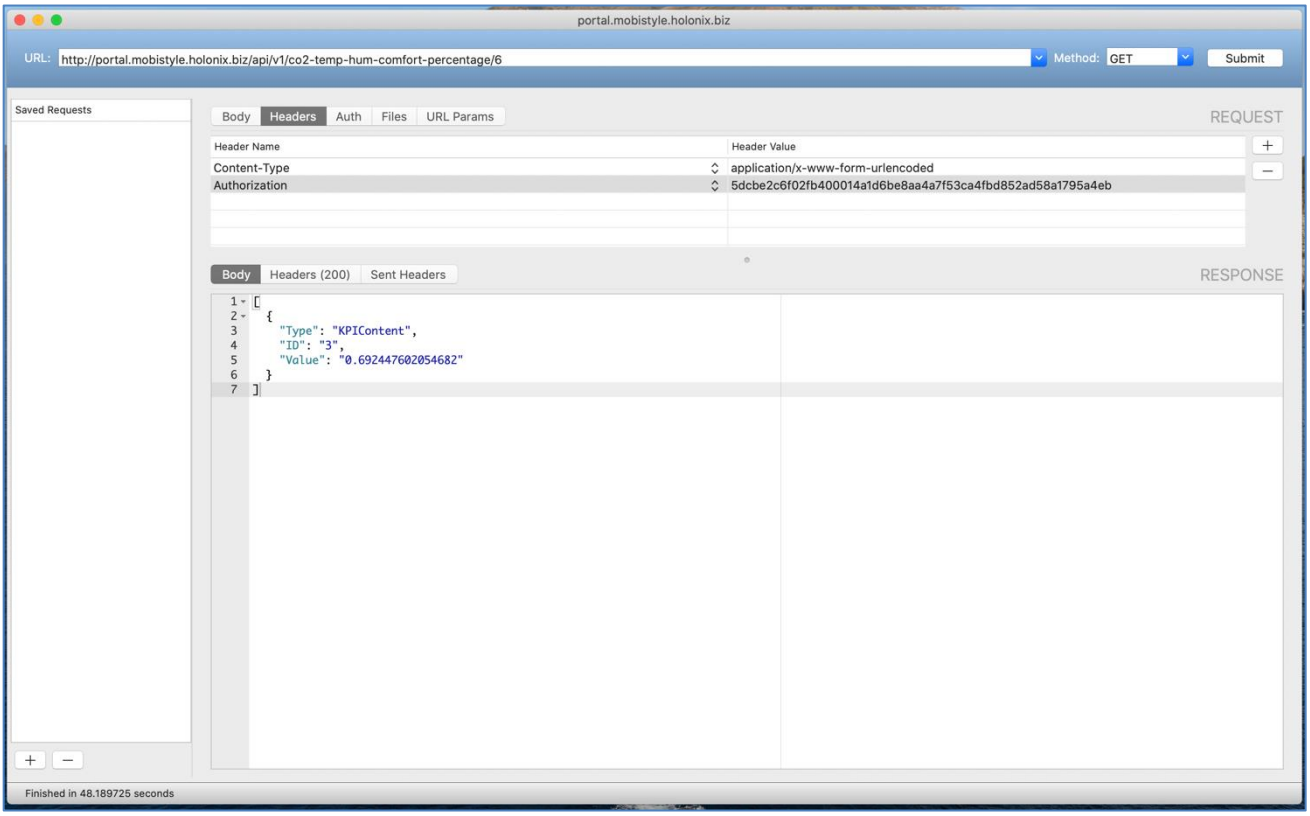


Fig. 58 invoking co2-temp-hum-comfort-percentage API for DK

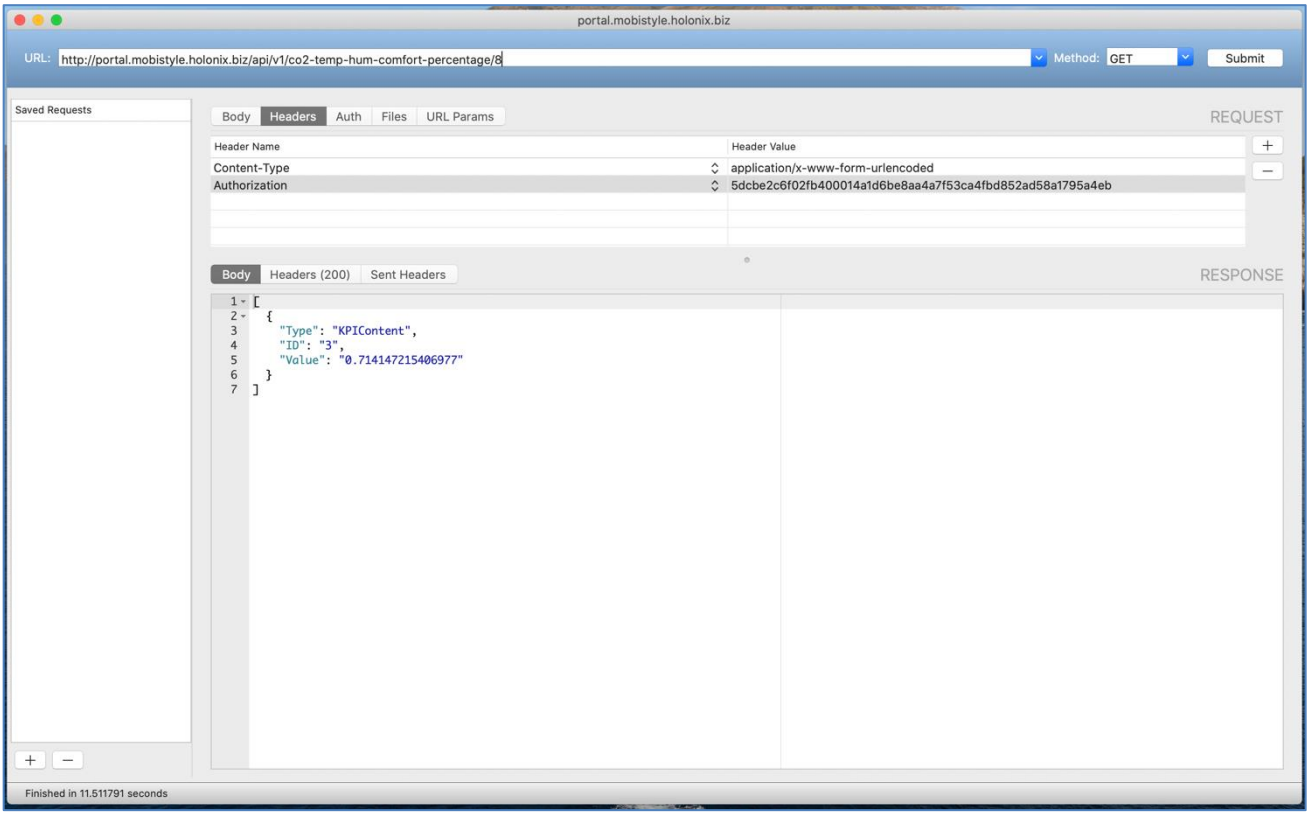


Fig. 59 invoking co2-temp-hum-comfort-percentage API for IT

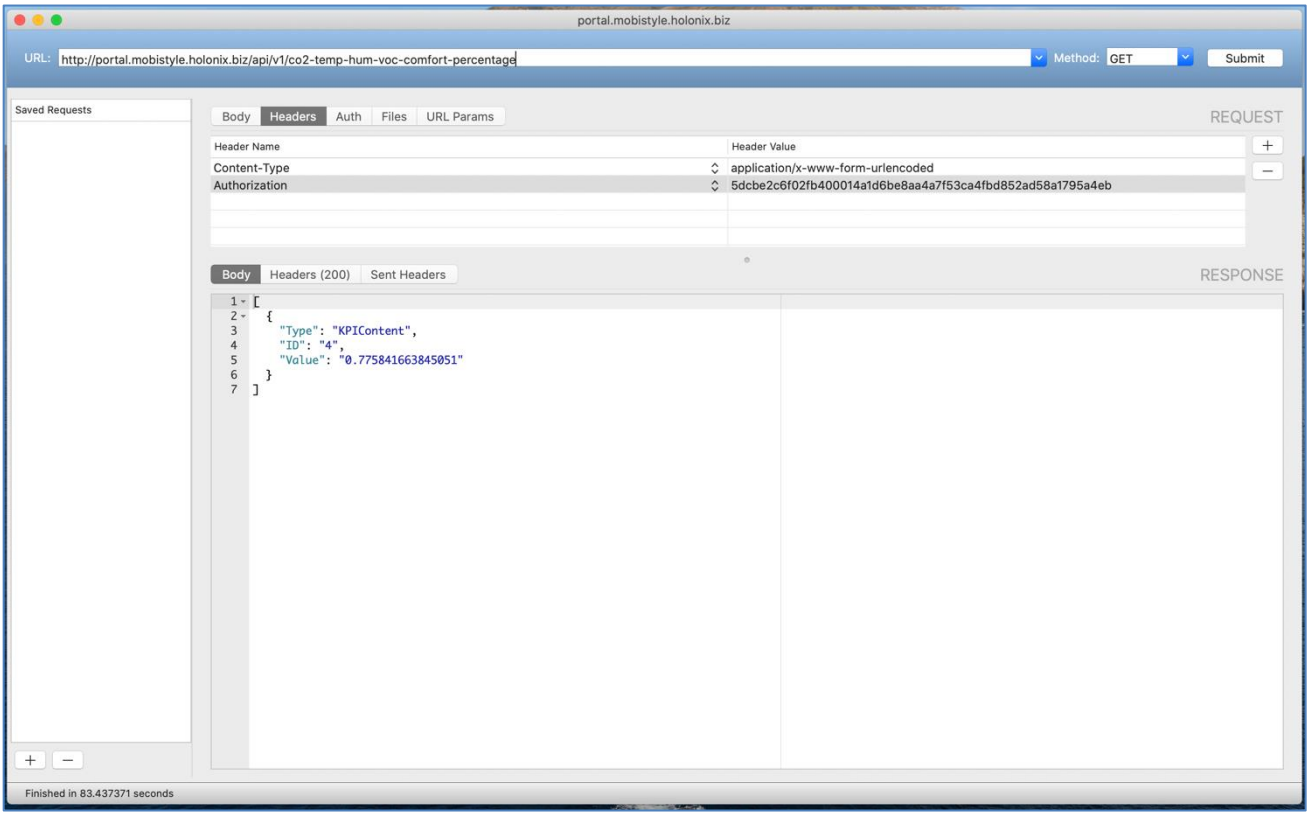


Fig. 60 invoking co2-temp-hum-voc-comfort-percentage API

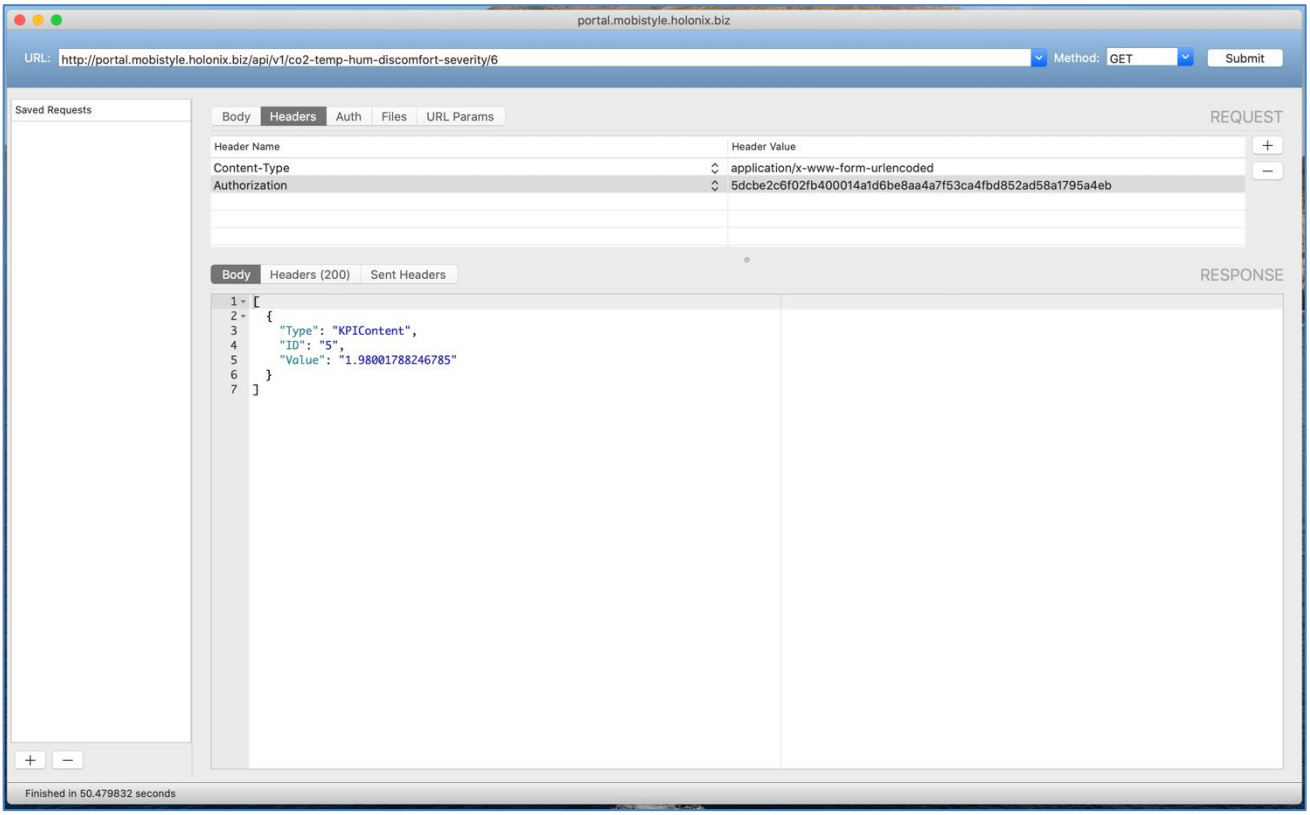


Fig. 61 invoking co2-temp-hum-discomfort-severity API for DK

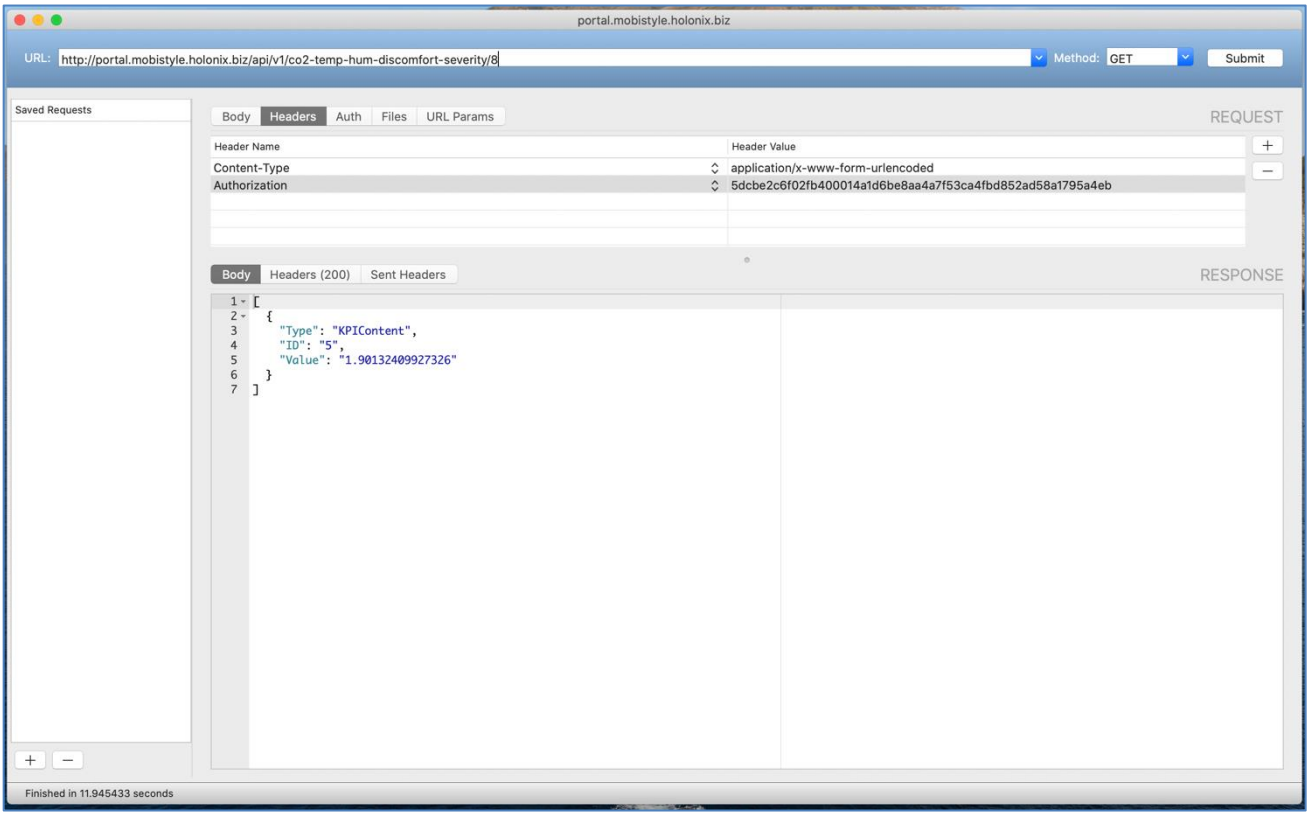


Fig. 62 invoking co2-temp-hum-discomfort-severity API for IT

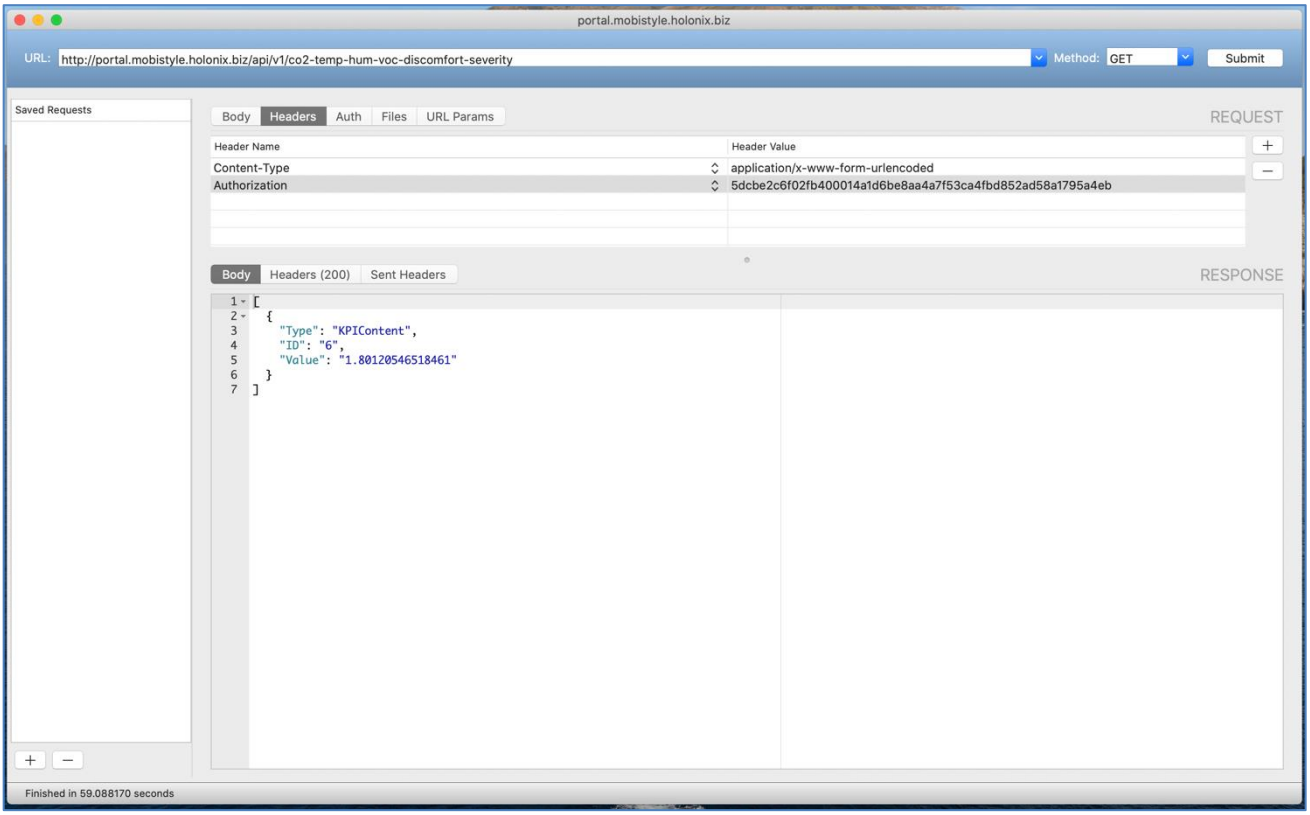


Fig. 63 invoking co2-temp-hum-voc-discomfort-severity API

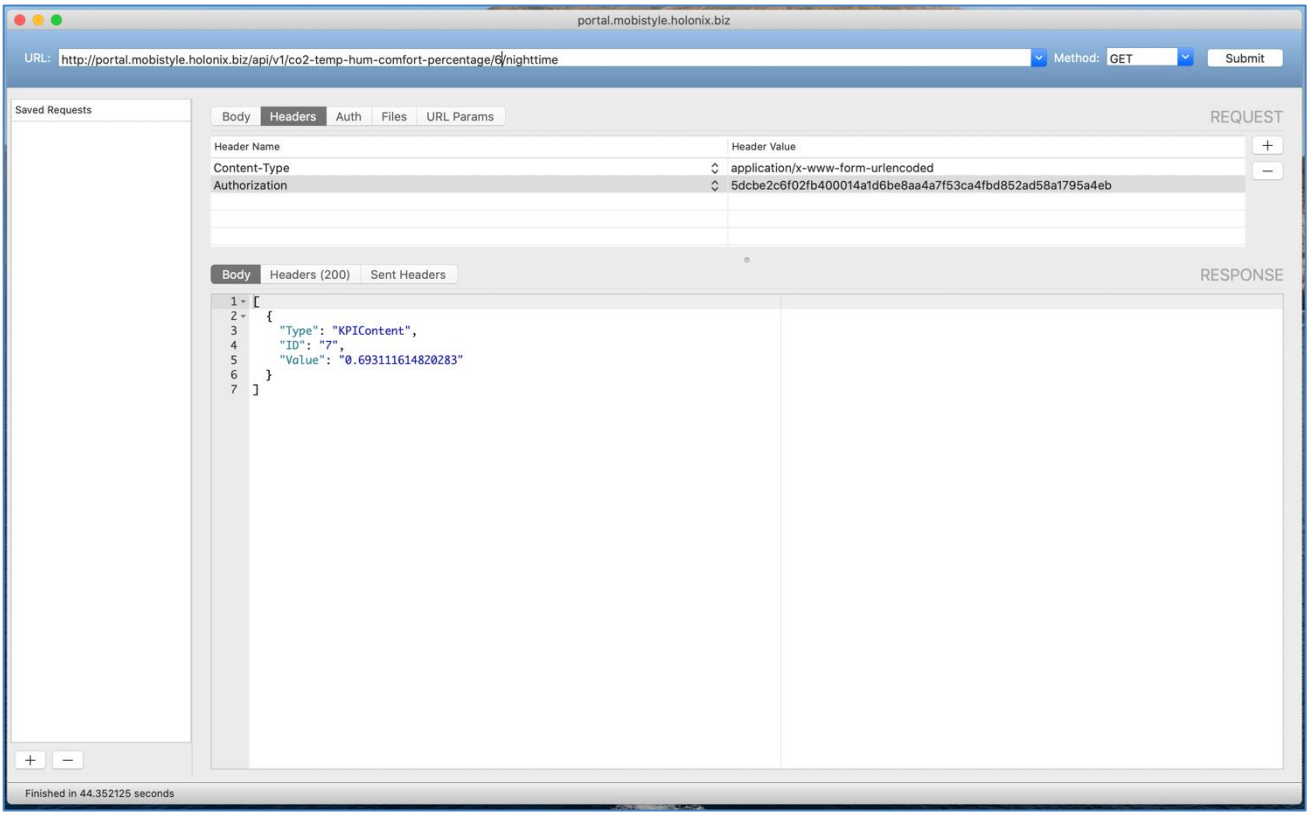


Fig. 64 invoking co2-temp-hum-comfort-percentage API for DK

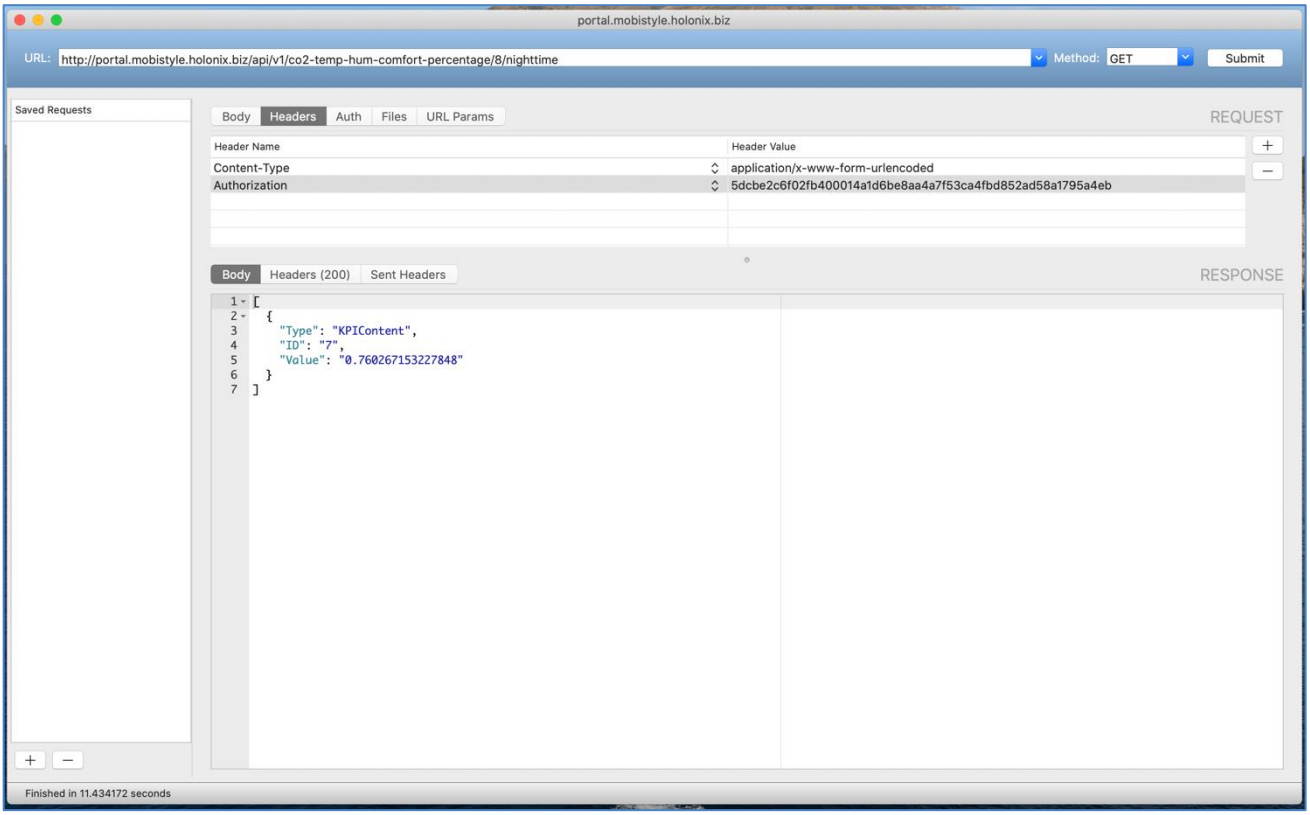


Fig. 65 invoking co2-temp-hum-comfort-percentage API for IT

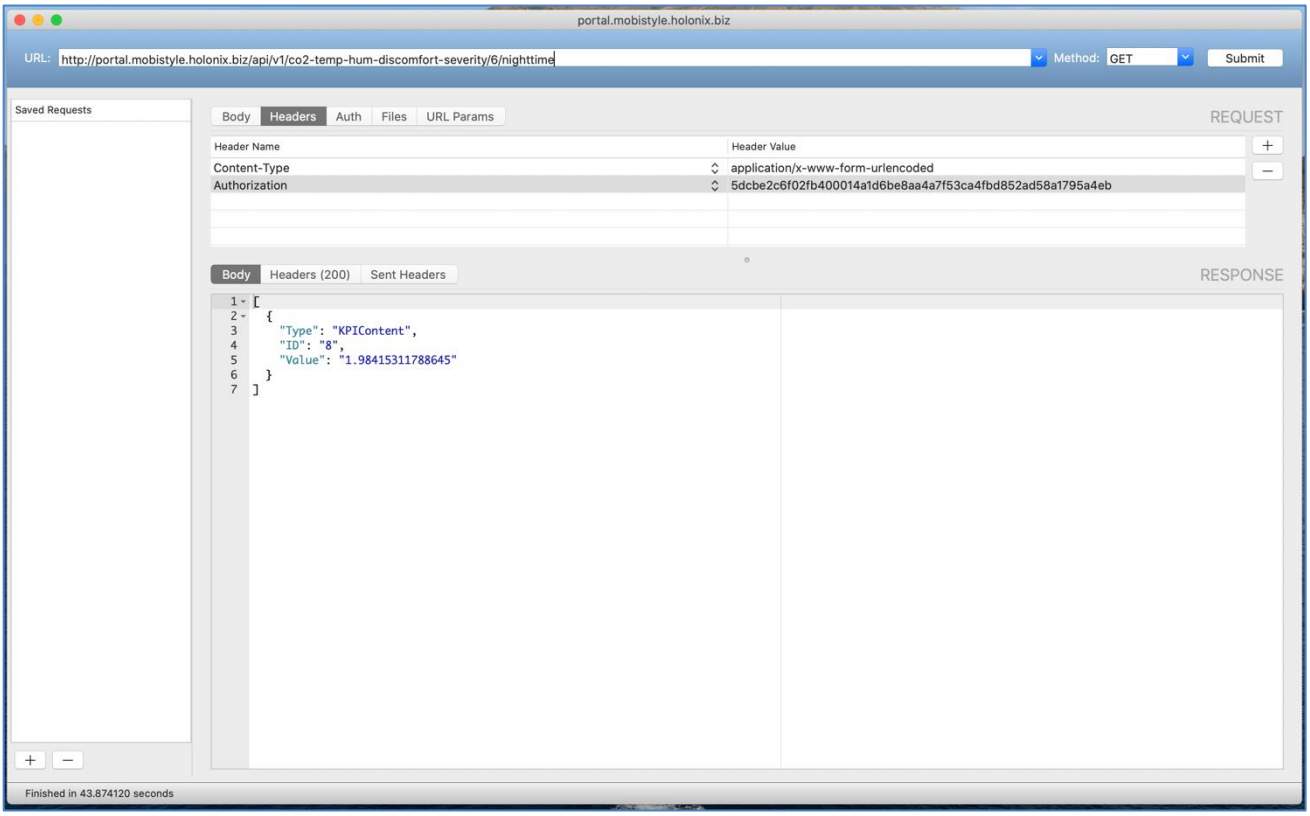


Fig. 66 invoking co2-temp-hum-discomfort-severity API for DK

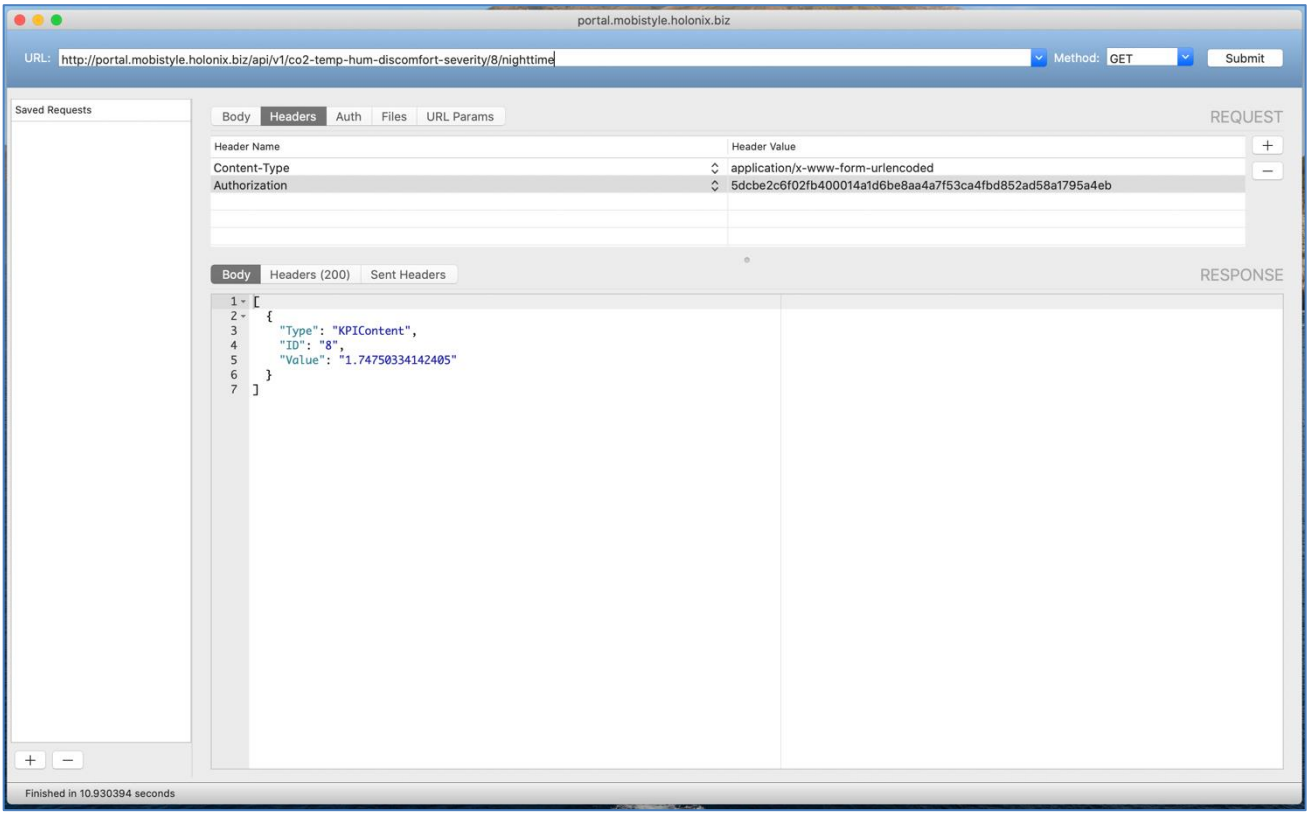


Fig. 67 invoking co2-temp-hum-discomfort-severity API for IT

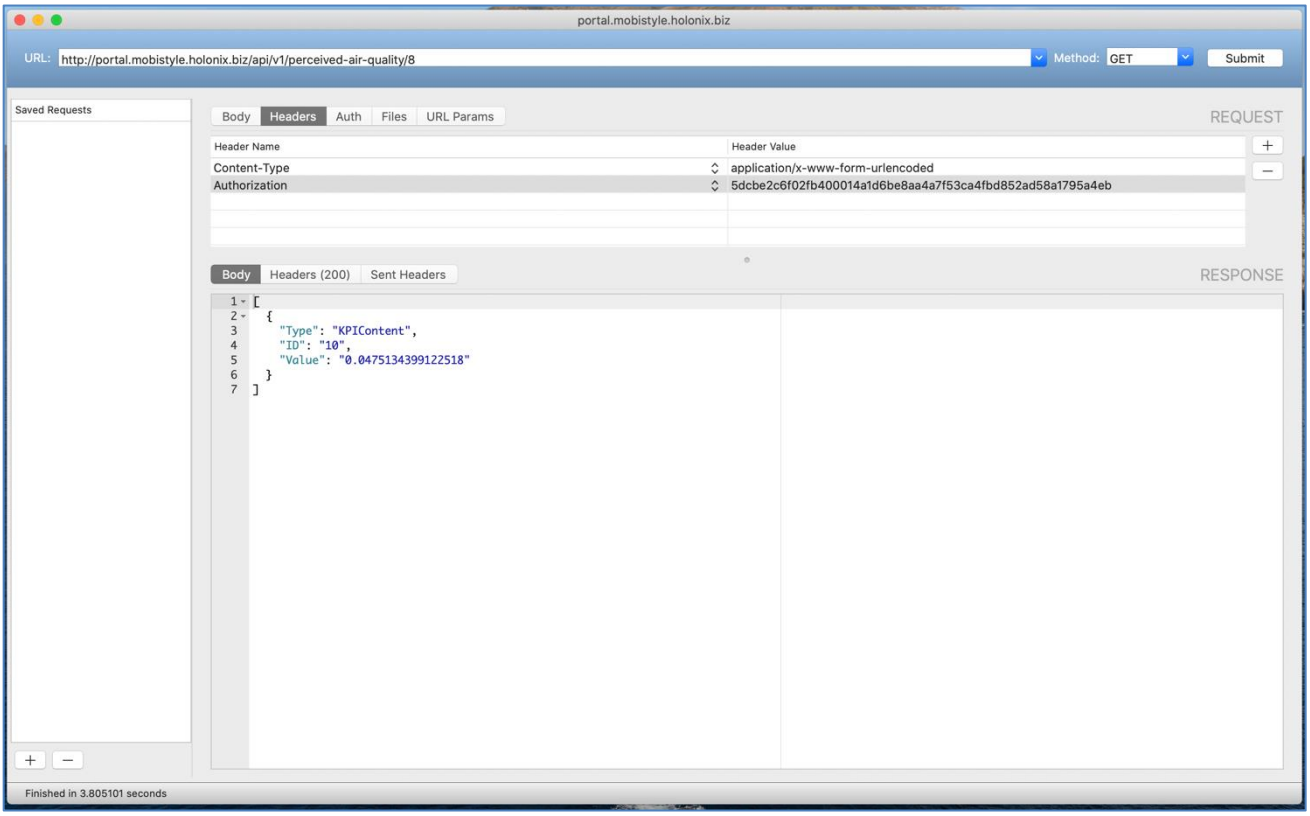


Fig. 68 invoking perceived-air-quality API for IT

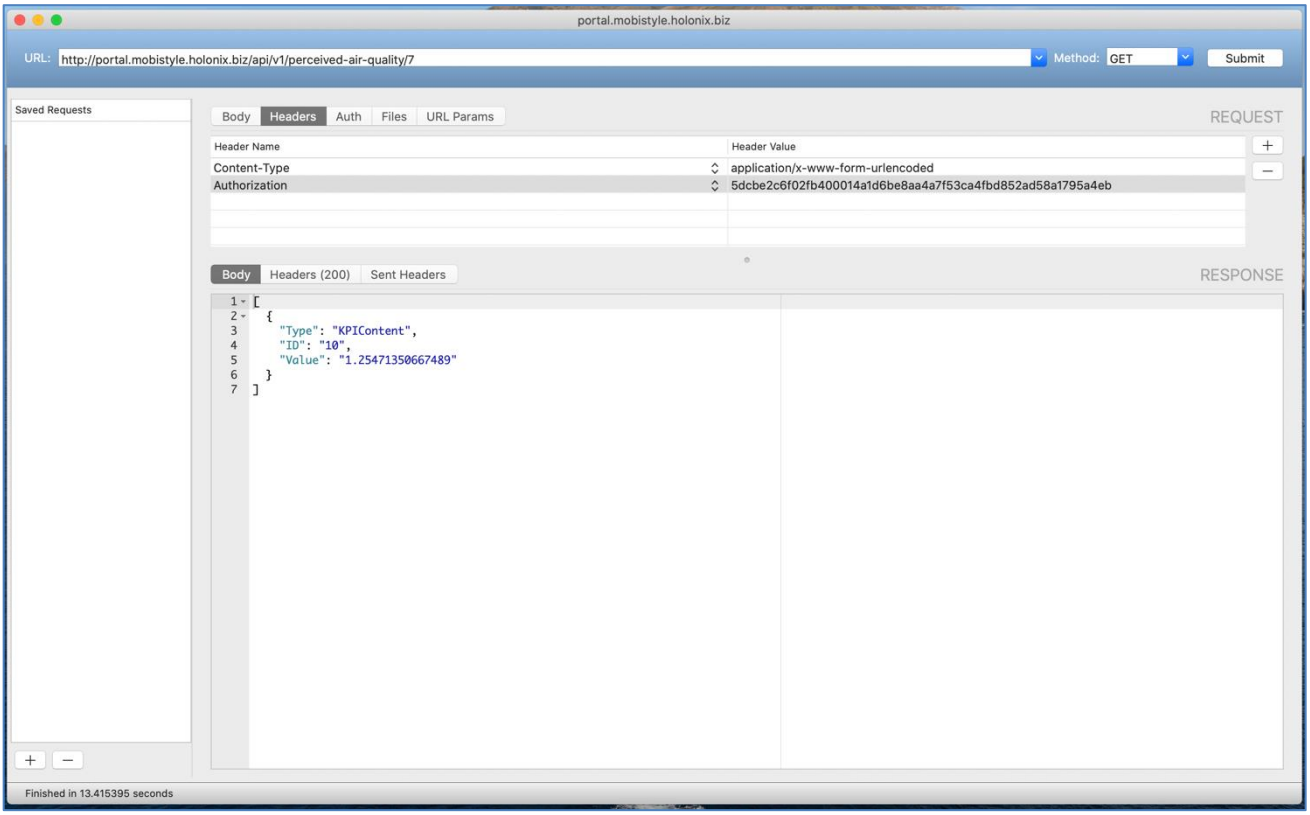


Fig. 69 invoking perceived-air-quality API for SL

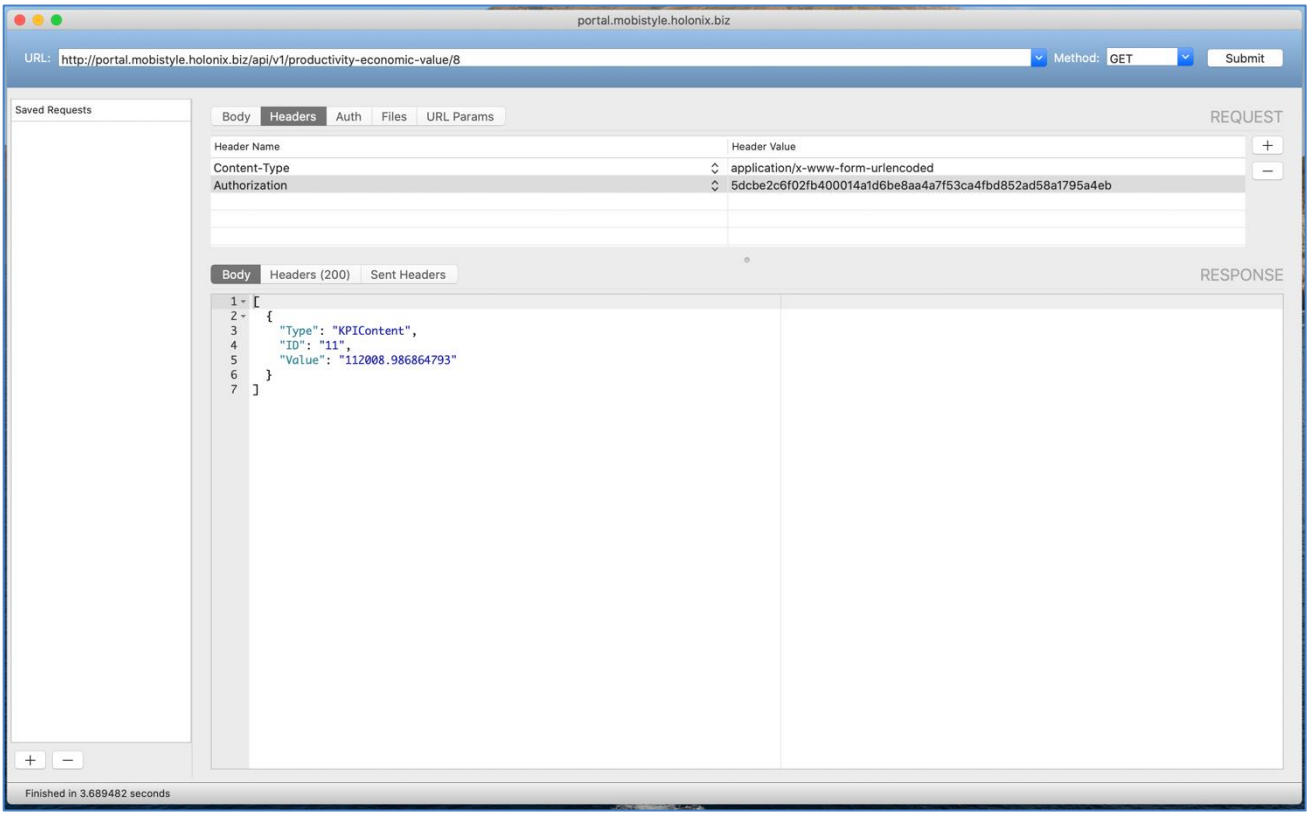


Fig. 70 invoking productivity-economic-value API for IT

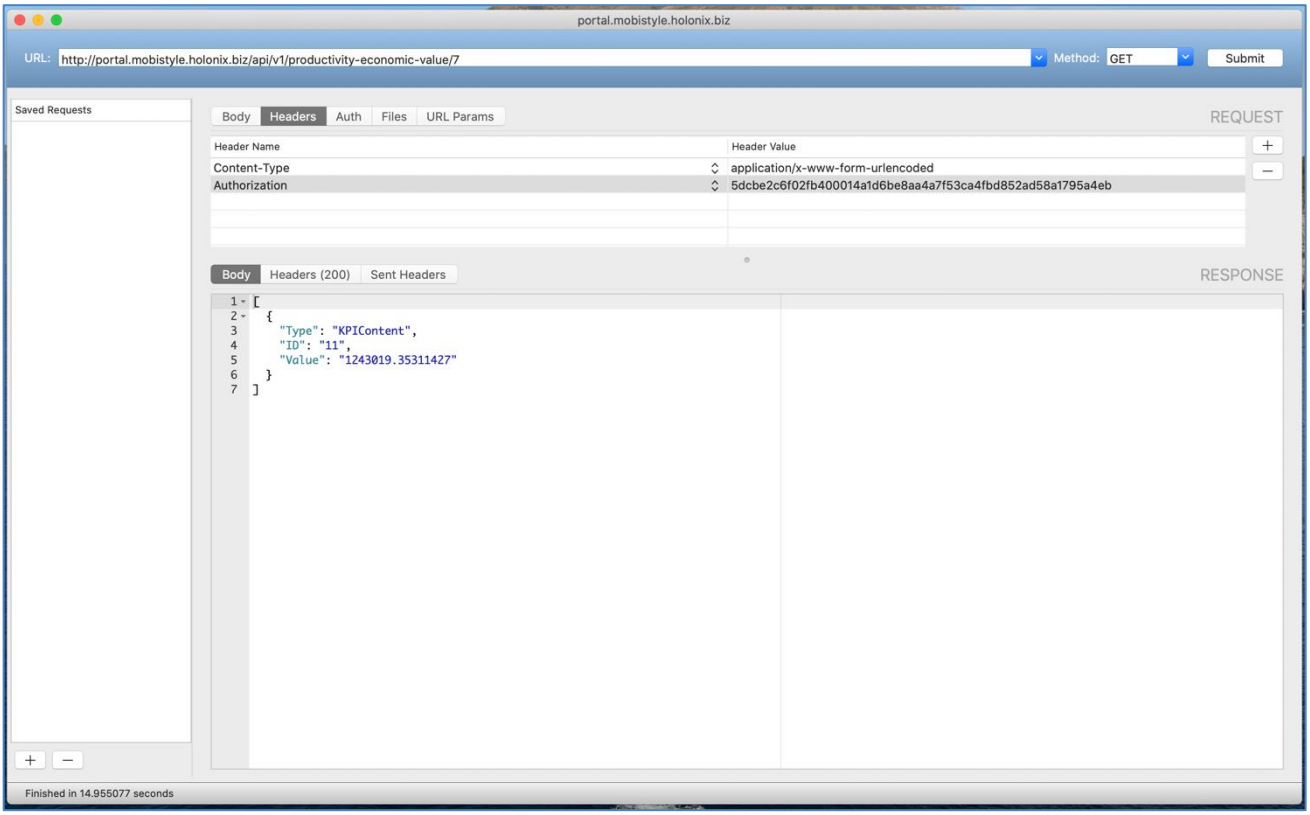


Fig. 71 invoking productivity-economic-value API for SL

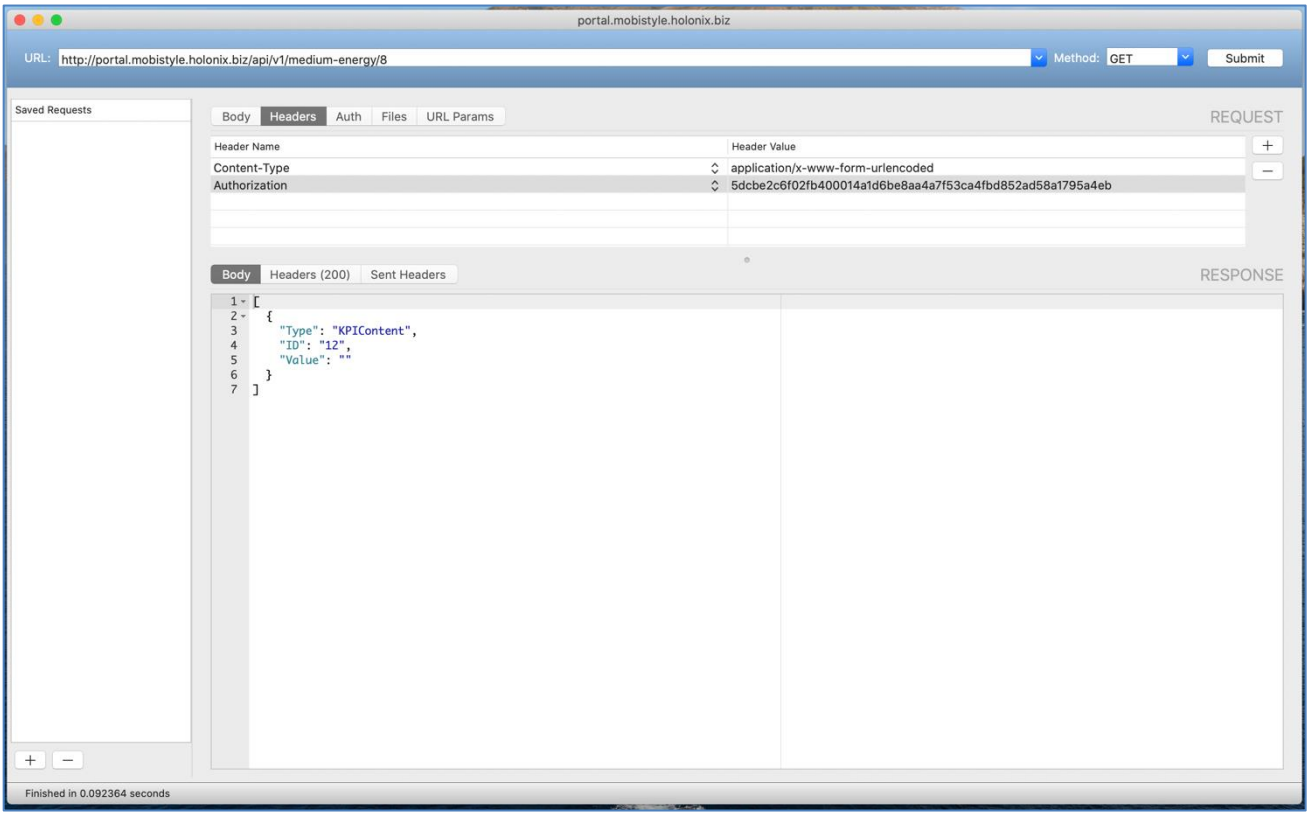


Fig. 72 invoking medium-energy API for IT

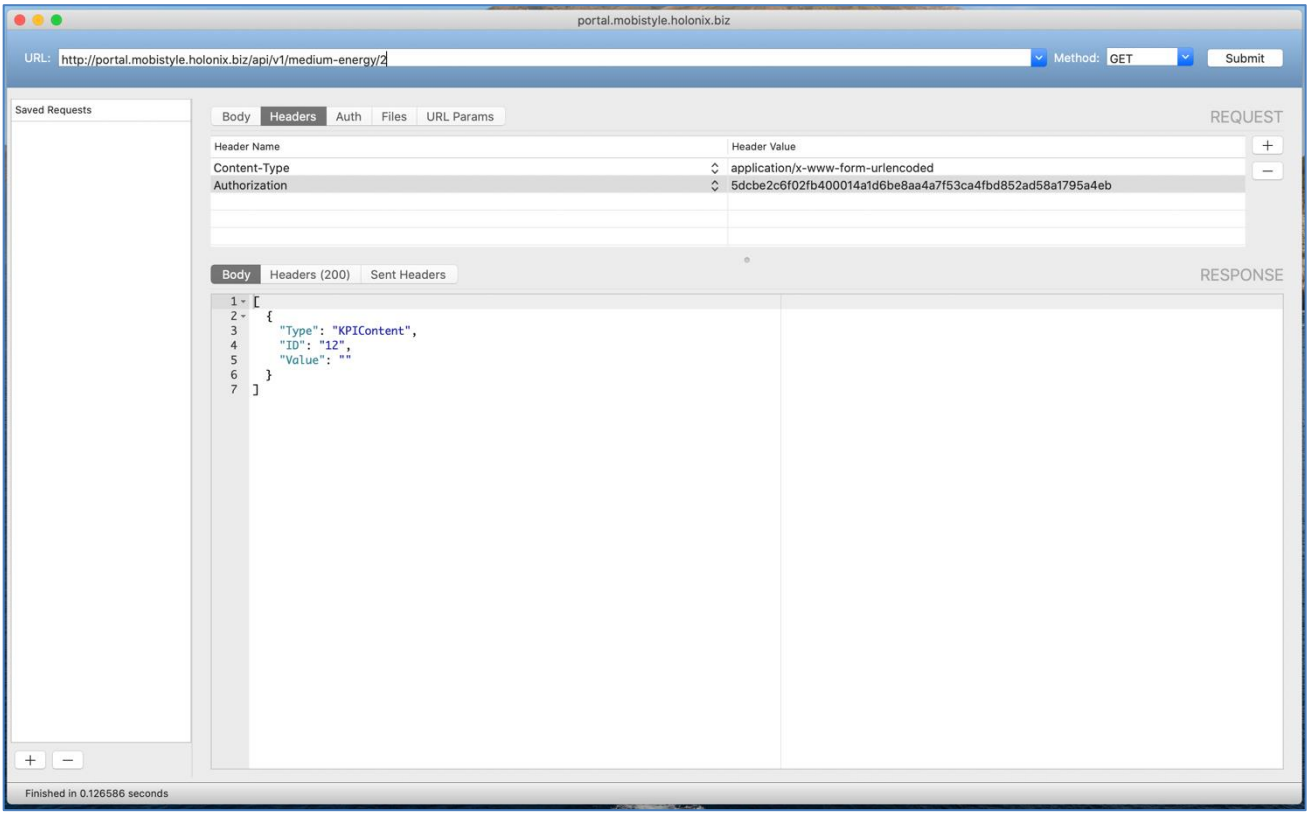


Fig. 73 invoking medium-energy API for PL