COGITO

CONSTRUCTION PHASE DIGITAL TWIN MODEL

cogito-project.eu

D6.10 – Workflow User Interface for Project Managers v2

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0.3	NT	01.11.2022	Sections 1 and 2 updated
0.5	Hypertech	03.11.2022	Draft version review
0.7	NT, Hypertech	21.11.2022	Comments addressed
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0.9	NT, Hypertech	29.11.2022	Comments addressed
1.0	NT, Hypertech	30.11.2022	Submission to the EC portal

Disclaimer

Executive Summary

The goal of this deliverable is to present the second version of the Workflow User Interface (UI) for Project Managers, intended to be used off-site by relevant stakeholders to support them on day-to-day activities. Such a UI should provide up-to-date information about the construction progress, including a detailed overview of the work orders and tasks status, and related KPIs. Through the UI, the Project Managers should have a clear view and understanding of the construction works progress, allowing decisions and optimalisation of project plans. Hence, they should have access to an overview of the actual construction works progress against the planned schedule.

The abovementioned requirements and additional ones that were elicited and documented in "D2.1-Stakeholder requirements for the COGITO system" have been considered to develop and deliver the second version the Workflow UI for Project Managers, which mainly constitutes the off-site frontend solution for the Adaptive Workflow Management and Automation tool, named hereafter Work Order Definition and Management tool (WODM). Therefore, this deliverable should be read in conjunction with the deliverable "D6.6-Adaptive Workflow Management and Automation Tool v2", where the current status of the WODM backend has been described.

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List of Acronyms

Term	Description
COGITO	Construction Phase diGItal Twin mOdel
DTP	Digital Twin Platform
KPI	Key Performance Indicator
PM	Project manager
PMS	Process Modelling and Simulation
SLA	Service Level Agreement
SM	Site manager
UI	User Interface
WODM	Workflow Management Automation Tool
WOEA	Work Order Execution Assistance tool

1 Introduction

1.1 Scope and Objectives of the Deliverable

The main goal of this deliverable is to present the Work Order Definition and Monitoring User Interface (WODM UI) for Project Managers (PM), designed to support their project activities during the construction work, proving up-to-date insight to the status of the whole construction process, including overview of the individual tasks and their results. In the second release of the WODM UI, documented here, the PM can visualise and/or define workflows and work orders, assign them to specific workers, and monitor their progress. Through the WODM UI, the PM has an overview of the construction progress against the planned schedule (extracted from the 5D BIM).

The integration of the WODM UI with the tools produced by "T6.1-Blockchain & Smart Contracts on the Workflow Modelling and Management", "T6.2-Adaptive Processes/Workflow Modelling and Simulation-based Optimization" and "T6.3-Adaptive Workflow Management and Automation" is facilitated through the concurrent design activities of each of these three tasks and the integrated end-product is being delivered as an outcome of WP6. Full integration of WODM with other WP6 tools and the Digital Twin platform is under development and will be completed in the upcoming period under common development activities of WP6 and WP8.

1.2 Relation to other Tasks and Deliverables

This deliverable is closely related to T6.3 and its deliverable "D6.6-Adaptive Workflow Management and Automation tool v2". It is also related to other WP6 tasks, namely T6.1, T6.2, and their deliverables, and to task "T7.1-Digital Twin Platform Design & Interface Specification" and its deliverables. The end-user requirements for the WODM UI were gathered and described in "D2.1-Stakeholder requirements for the COGITO system". Furthermore, the specifications, the functional and non-functional requirements, as well as the interactions of WODM UI with other components of the COGITO ecosystem are presented in "D2.5-System Architecture v2".

1.3 Structure of the Deliverable

This deliverable contains the following sections:

- usage walkthrough,
- technology stack and implementation tools used,
- API documentation,
- licensing information,
- installation instructions, and
- development and integration status overview.

1.4 Updates to the first version of WODM UI

There are significant changes implemented in comparison with the previous version of the WODM UI. First, the integration with the Identity Provider service provided by DTP has been completed, and therefore the UI currently allows authorised users login without any interaction with the KeyCloak UI.

From the point of the technological background, the JavaScript Angular version has been updated to the latest version. The WODM UI is now reflecting all changes done in WODM which are described in D6.6. The UI has an updated graphic layout according to the COGITO design templates. Also, terminology used in UI has been aligned with the COGITO ontology, since the default UI has not been in line with some parts of the data model and names/labels used in COGITO.

Functionalities covered by this version of the UI have been updated according to the evolutions in use cases UC1.1 and UC1.2. These have been tested with the School project data JSON file received from DTP, making it possible to import all project information and data to the WODM's database. All the interactions with the other tools will be tested during ICT integration phase of the project.

2 Workflow User Interface for Project Managers v2

The Work Order Definition and Monitoring User Interface (WODM UI) is a web-based UI that provides to the end-user the ability to visually interact with the WODM backend functionalities that have been described in D6.6. The WODM UI is not developed from scratch. It is a part of the I3D toolkit that has been designed and developed by NT, extended and repurposed to meet the COGITO stakeholder requirements. The detailed description of the WODM functionalities, the prototype overview and the I3D toolkit terminology have been presented in D6.6. To avoid repetition, this section emphasises on the WODM UI's usage walkthrough.

2.1 Usage Walkthrough

2.1.1 Login

To access WODM UI, the user should visit the WODM web page[1] and login. There are two login options, the first one is the "developer access" where only internal authentication integrated in WODM is used. This type of account allows testing and validation of the workflows and the workorders without affecting project data stored in DTP (Digital Twin Platform). The second option is to login with the Identity Provider credentials, where actual data from the DTP are used. There is no option to create or change a COGITO authenticated and authorised account in WODM UI; this is possible only via the webpage of the COGITO Identity Provider[2] (Figure 1), delivered as component of the DTP.

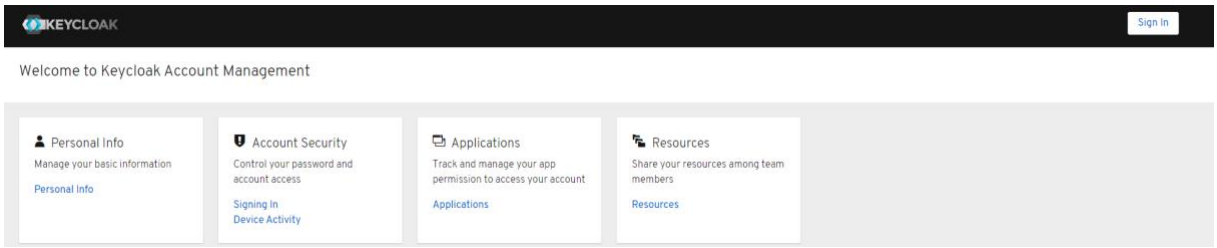


Figure 1 - DTP Identity Provider management console

To create a new user, clicking on "Sign In" on the Identity Provider UI, the login page will be shown (Figure 2).

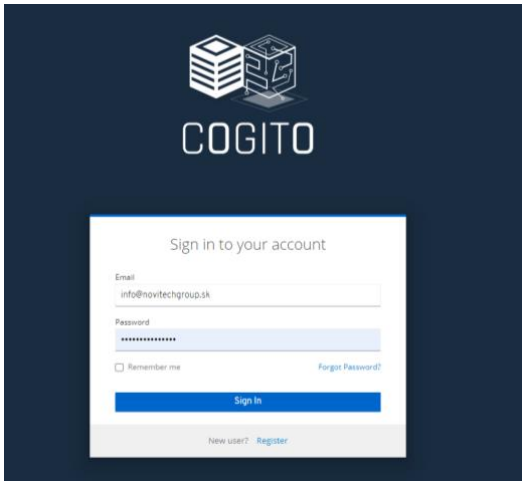


Figure 2 - Identity Provider login

Click on "Register" and fill in all required details in the register form. After this is done, you need to have your account assigned for the specific project you wish to use, which is the School project in our example. To

[1] https://i3d.econtent.lu/i3d2/i3d-frontend/i3d-en-cogito/
[2] https://auth.cogito-project.com/auth/realms/cogito/account/#/

demonstrate the WODM functionalities, a generic COGITO user account and a DTP demo user account have been created, these are mentioned in Section 2.5.

Back to the WODM UI login, after loading the WODM UI page, the login page will be shown (Figure 3). The default mode for login is the Identity Provider login. In case the user wants to use the WODM's internal authentication instead, (s)he clicks on "Developer Access".

Figure 3 – Login page

After a successful login, the user selects a project from a list of running/current user's projects (Figure 4) accessible by him/her. In case of "Developer Access" mode, the list of projects valid for COGITO will be shown, however any changes in workflows or workorders will be not reflected in DTP, so this mode is ideal for initial learning and testing purposes. These projects are stored only in the WODM backend database. In case of Identity Provider login, the list of running projects assigned to the user will be retrieved from DTP.

To Navigate throughout the WODM UI in "Developer Access" mode, two projects have been created and assigned to the COGITO user (CogitoUser) account, the "Construction Prototype" and the "Vyvoj – Prostredie pre vyvoj I3D" as illustrated in (Figure 4). The project "Construction Prototype" contains the "School Project" imported from DTP. In Identity Provider access mode, the project is actually valid in DTP and linked to the current user as it will be shown (at the time of deliverable creation is the School project).

Figure 4 – Project list

Upon selection of a project, the main dashboard of the WODM UI for the specific project is shown (see Figure 5). The main dashboard's content presents the active workflows and work orders. On the left side of the main dashboard, a menu tree is displayed providing access to the different functionalities of WODM (see Figure 6).

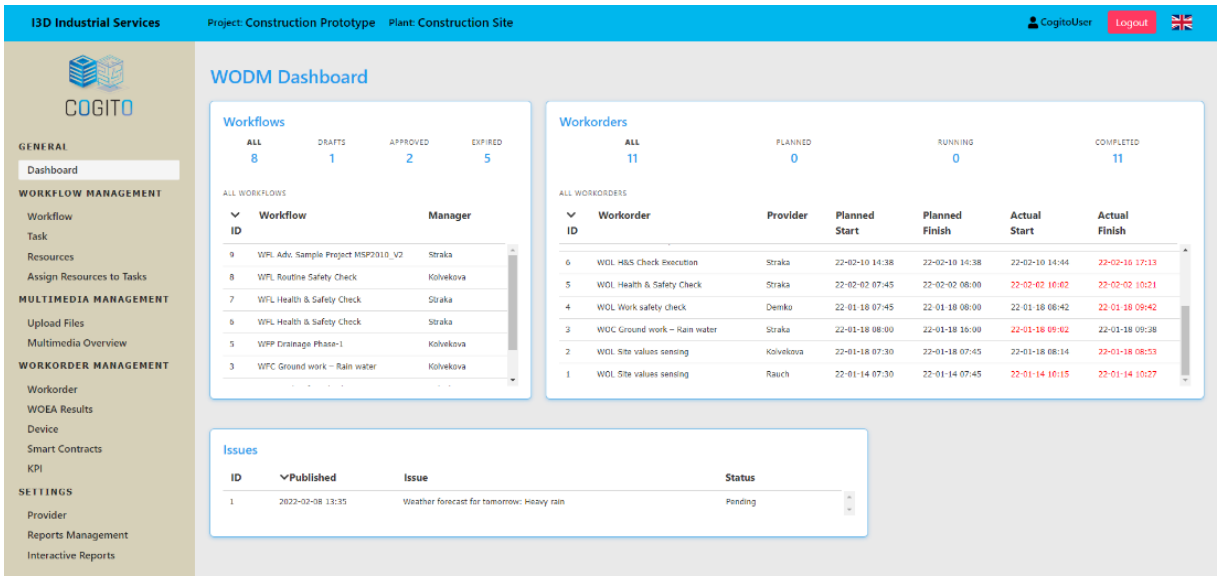


Figure 5 – Main page

Figure 6 – WODM UI menu

2.1.2 Workflow Definition

Workflow represents the most basic process unit in WODM. It is automatically created every time there is an import of a new process model. Regarding the workflow definition process, clicking the "Workflow" tab, the workflow list is shown (see Figure 8). In alignment with the WODM's backend documentation (see D6.6), the main input for the workflow definition is the process model in JSON format agreed with involved partners, designed by the PMS. In the last version of WODM backend, the previously developed ETL service (extract-transform-load) has been rebuilt to accommodate JSON format instead BPMN format that was previously planned. Using DTP as a project repository in COGITO, the JSON project file is automatically uploaded to the WODM. To import the process model manually, on the WODM UI menu, the user clicks on "Workflow". On the loaded page, they select "Create" and then "File import" (see Figure 5).

Figure 7 – Workflows: JSON import

When the Process model is successfully imported, the workflows are shown in the workflow list (see Figure 8) and a manager is able to edit some of the workflow properties, e.g. process name and description, enclosed multimedia and/or documentations, and so forth. For each workflow, information is provided about its ID, Approval Status, Name, Description, Version, and the user that last edited its status. For instance, the last element of the workflow list presented in Figure 6 refers to a unique workflow for the specific project whose ID, Name, Description and Version are “1”, “WFL Site values sensing”, “Site values sensing” and “1.1”, respectively, and whose status has been last edited by “Kolvekova Andrea” and set to “Approved”.

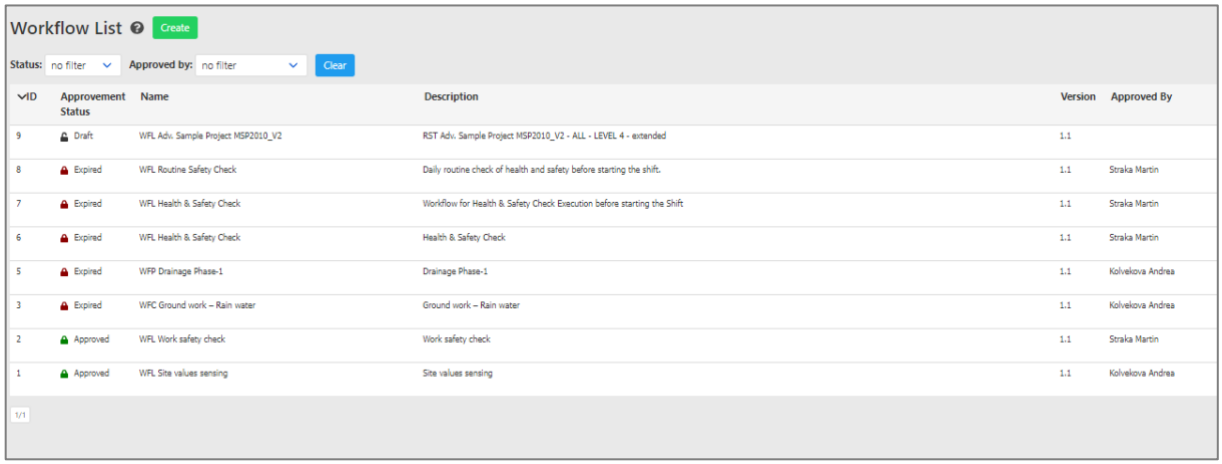


Figure 8 – Workflow list

The workflows can be filtered by their status (field “Status”) or by the user that last edited the approval status (field “Approved by”). The status of a workflow can be draft, approved or expired. A workflow is closed only if its status is set to “approved”, meaning that it is protected against any unauthorised changes. Only an approved workflow can be used to generate a work order. To access the details for a specific workflow, the user chooses the specific workflow in the menu, after which the page with its details is loaded (see Figure 9).

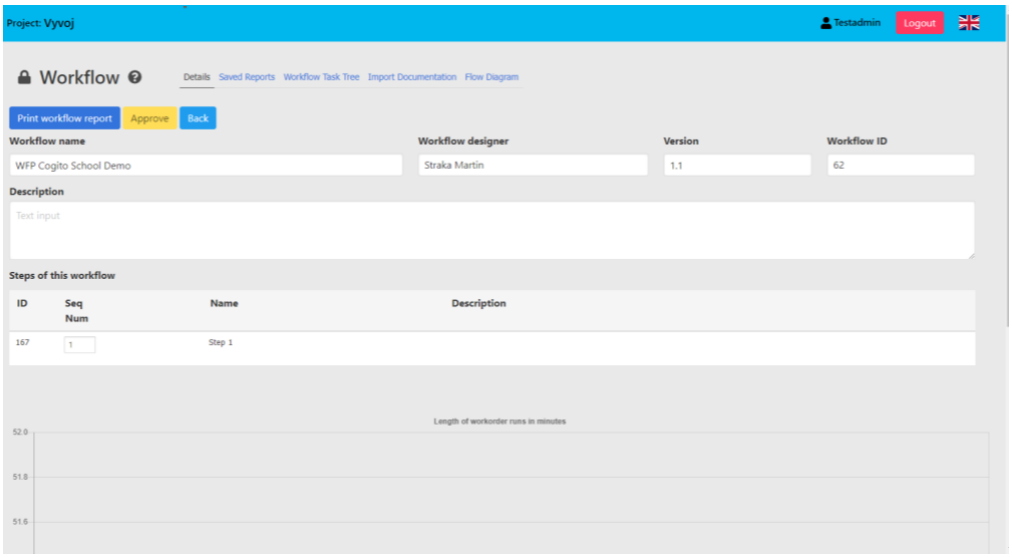


Figure 9 – Workflows: Details

In this detailed view, the user can delve deeper into the steps that need to be performed to complete the selected workflow. On the bottom of the page, a bar diagram with the execution time for the related work orders is visualised.

By clicking on “Workflow task tree” the tree of Actions and Steps is shown (Figure 10). The main difference between these two layers is that the Steps are meant to be assigned to specific locations and contain one or multiple actions all linked to that one assigned location. This is slightly changed in the COGITO solution, having actions (relabelled as tasks) with an ability to have their own locations assigned to them, as explained below. In the Task tree, the W prefixes stand for Workflows, S for Steps, and A for Actions. Every workflow according COGITO ontology only has one Step automatically created with each workflow. Every step consists of one or more Actions (instructions). One Step and “n” Actions creating Task as a component of Workflow. A Task represents the exact work that must be done. For further information about the WODM’s terminology and taxonomy, please refer to D6.6.

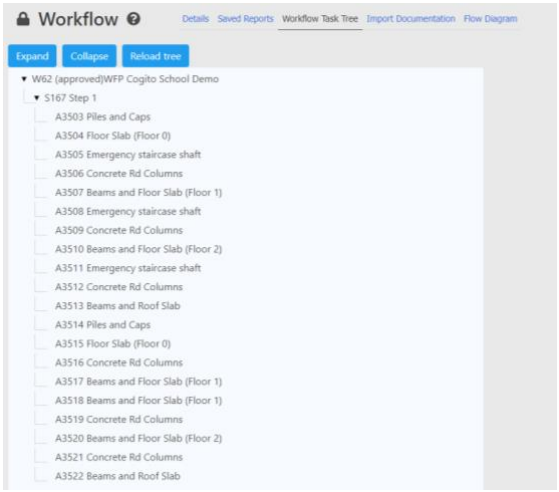


Figure 10 – Workflows: Workflow Task Tree

In line with the COGITO data model, we had to make some changes to the workflow ontology. While we generally use a three-step workflow structure (workflow-step-action), the COGITO data model only uses two-step one (workflow-task). Therefore, the use of steps in COGITO projects was omitted, and now there are only the previously mentioned actions, now relabelled as tasks. This change is mainly on the surface level, however, and every workflow now contains exactly one step, which is conveniently hidden, and it contains the relevant tasks. All these assumptions are relevant only for manual import and manipulation with Workflows, in DTP mode this is fixed model (workflow – task).

When selecting the “Task” from the left side menu, the task list is shown (Figure 11). It's possible to filter the tasks related to specific workflows by choosing that workflow in the drop-down menu.

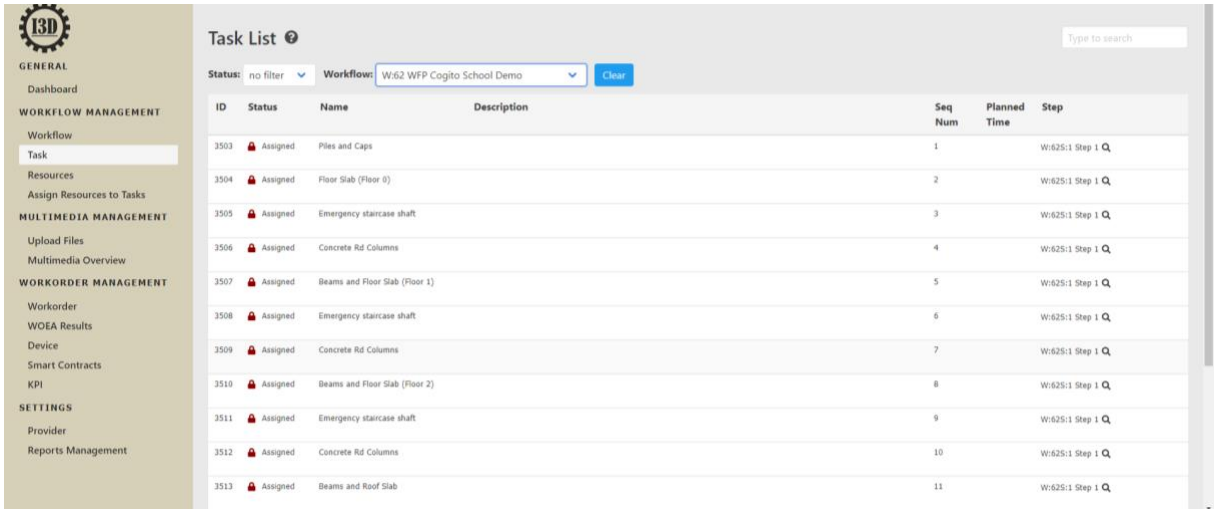


Figure 11 – Workflows: Task list

Clicking on chosen Task you will get Task detail page (Figure 12).

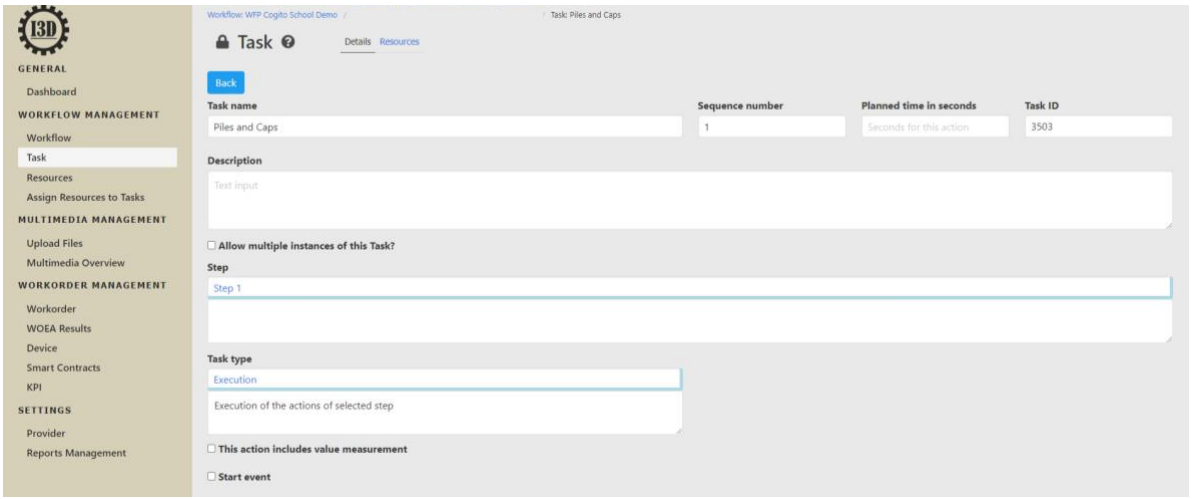


Figure 12 – Workflows: Task detail page

Here you can edit description and define type of task. Also, there is an option to set a required return value for this Task, in case that it contains a measure that needs to be done and recorded, such as temperature, percentage, time, or count (especially for quality assurance tasks). This is provided by clicking on checkbox “This action includes value measurement”. Then details are shown (Figure 13). In this case, during workorder execution, WOEA will require from the user to report not only a simple result (OK/NOK) but also a numerical value. If the reported value is out of defined range (Min – Max), the result will be automatically NOK.

Figure 13 - Value measurement

Clicking on Task Type field, the Task type selection page (Figure 14) is shown. This option allows to define type of the Task, predefined type is “Execution” but it is possible set many types, like Quality check, Safety check etc.

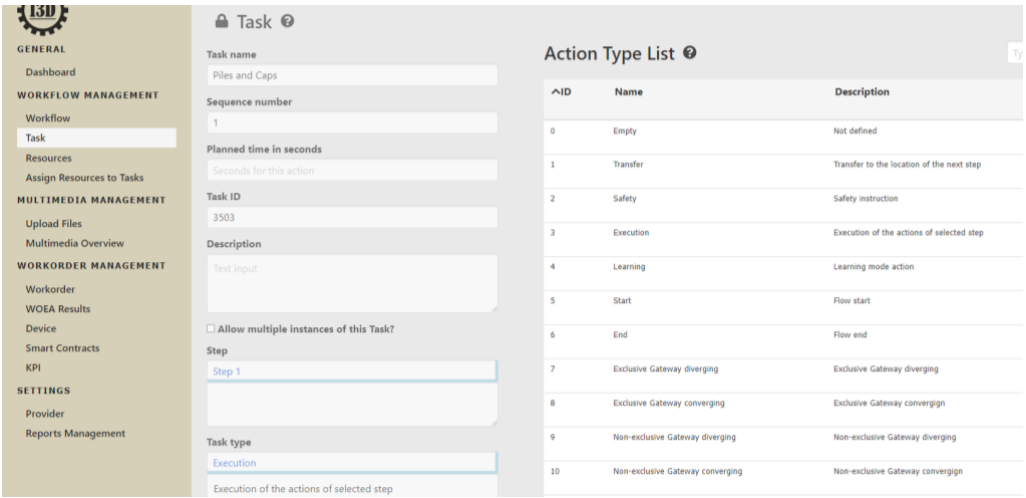


Figure 14 – Workflows: Task type selection

Clicking the “Resources” tab on the menu, the Resources page is loaded, providing the list of equipment and human resources that are required and are available for the selected construction project, along with their tags and description, if it's available (see Figure 15).

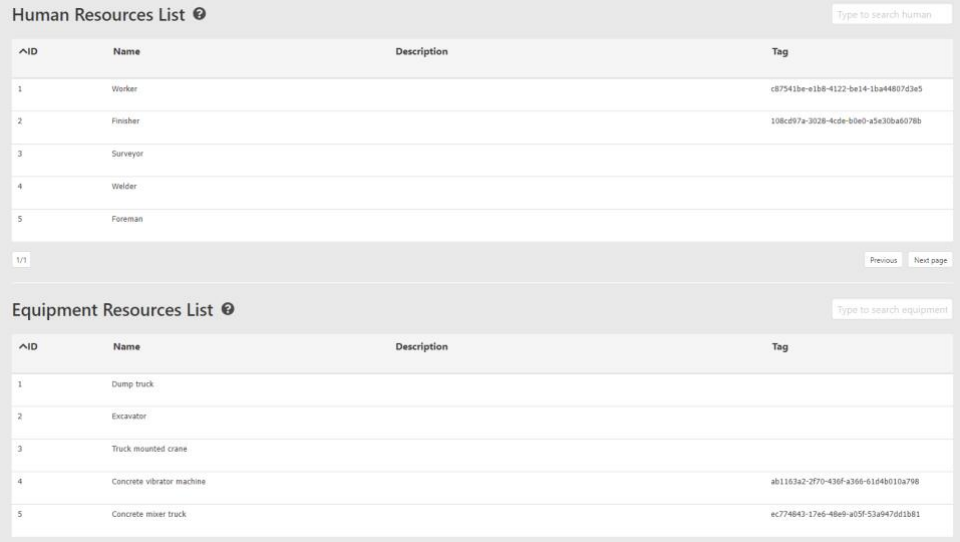


Figure 15 – Workflows: Resources List

Having checked and confirmed the lists of workflows, tasks and their relations, and the list of resources, the user can assign resources to tasks by clicking the “Assign Resources to Tasks” option in the side menu. This option allows the user to create links between resources and tasks. The relationship between the two is N:M, meaning that you can assign multiple resources to each task, and each resource can be shared among multiple tasks. These links between the individual tasks and resources are then displayed in the list and the user can edit them (see Figure 16).

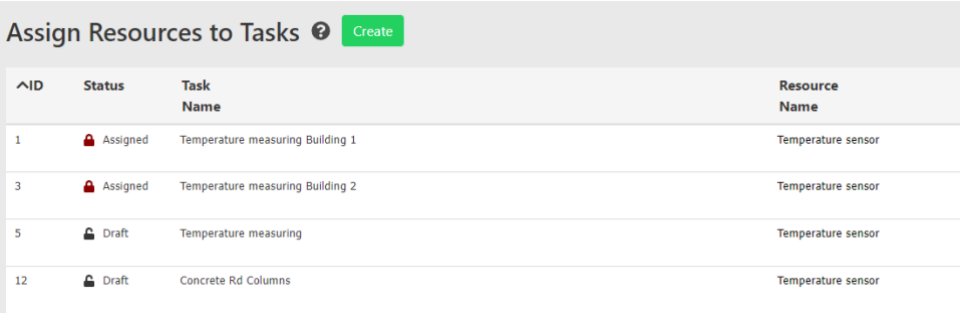


Figure 16 – Workflows: Assign Resources to Actions

2.1.3 Workorder management

To establish the connection between actual human resources (e.g., workers) and workflows, the user clicks the "Workorder" tab on the left menu and receives the list of all created and active work orders (Figure 17).

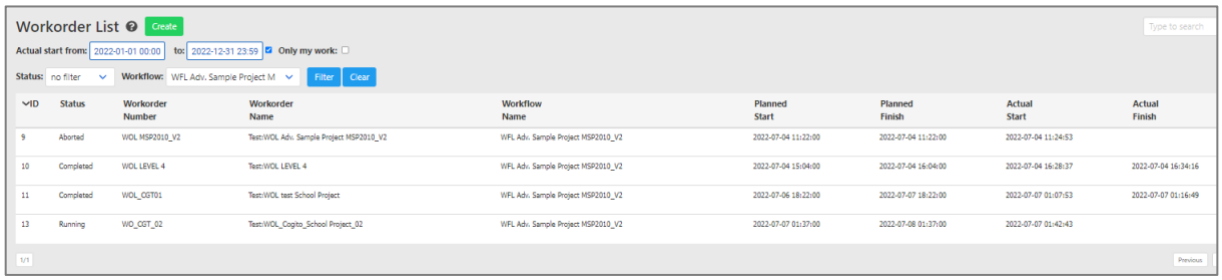


Figure 17 – Workorder: Workorder List

Clicking on the line of a workorder, the description page of that workorder is loaded (see Figure 18). On the first tab, the user can see the main properties of the selected workorder, its status, its planned start and end times, and the description of the work to be shown on the worker's device. Through this page, the user can assign a specific worker to this work order (Main provider) and attach the device that the worker is going to use to report progress on that workorder (e.g., RW HMT-1).

Clicking the "Related Task List" tab, a page with the list of actions related to this workorder and their results is loaded (see Figure 19). The results correspond to all actions progress report, recorded, collected and delivered by the worker assigned to that workorder using the WOEA application (for further details please refer to D6.8). For each action, the Answer type can be "Yes", "Problem", "Failure", or "Empty". If the action execution went without all problems, the expected answer is "Yes". In case of a temporary problem that needs attention, the expected answer is "Problem". If there's a critical failure not allowing the workers to continue with the workorder, the expected answer is "Failure". The default answer is "Empty".

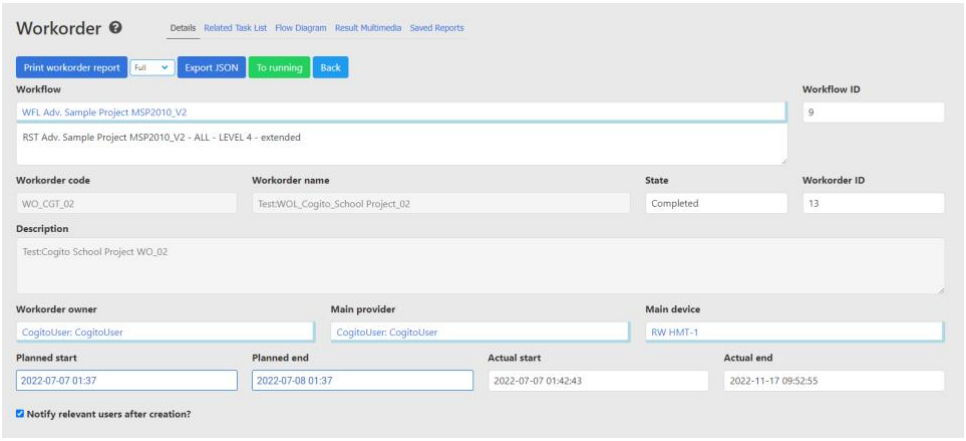


Figure 18 – Workorder: Details

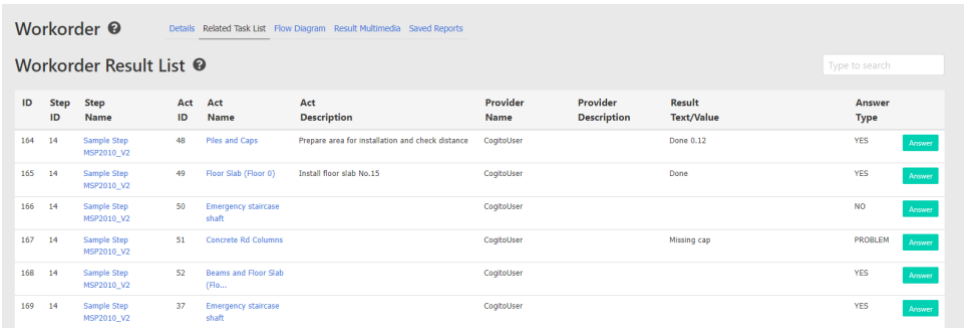


Figure 19 – Workorder: Related Task List

Clicking the green box on the right of an action, recorded multimedia (voice, video, images) are shown. Another option to access the recorded multimedia linked with the selected work order is to click the "Result multimedia" tab, where the list of recorded multimedia related to actions of the work order is loaded. Each record can be selected and displayed using with embedded media player on left side of page (Figure 20).

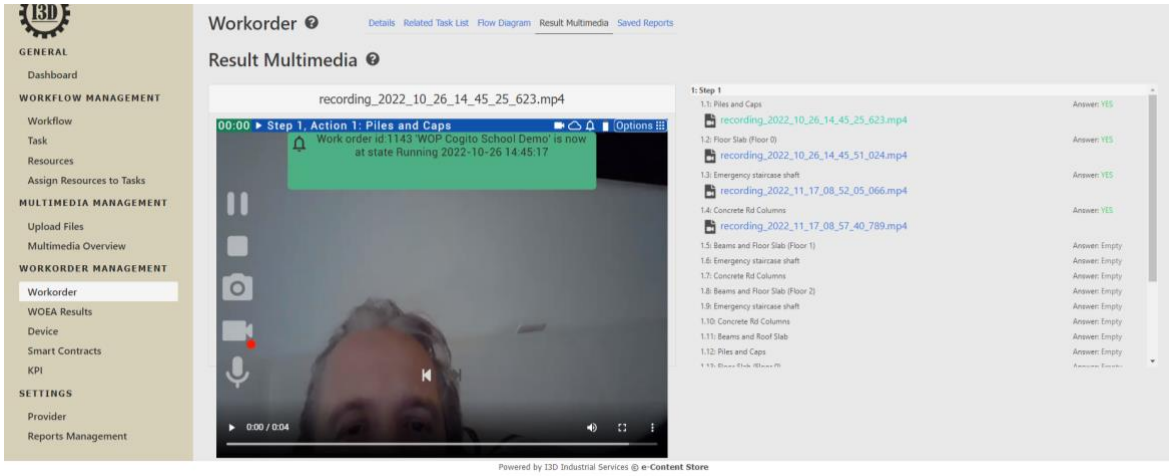
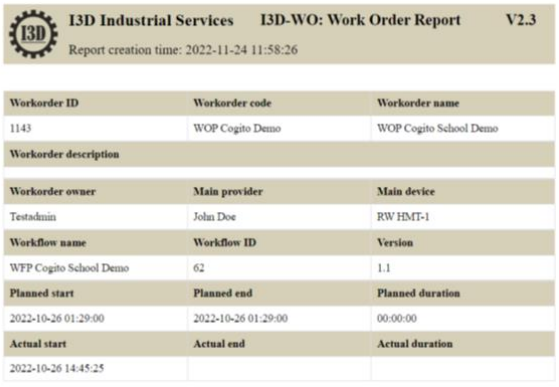


Figure 20 – Result Multimedia

Clicking on the "Print workorder report" button (Figure 18), the work order results report is generated and is opened in new browser tab. On the top part of report (Figure 21), information about chosen workorder is shown: Name, planned start, planned end, actual dates etc.



I3D Industrial Services I3D-WO: Work Order Report V2.3

Report creation time: 2022-11-24 11:58:26

Workorder ID	Workorder code	Workorder name
1143	WOP Cogito Demo	WOP Cogito School Demo
Workorder description		
Workorder owner	**Main provider**	**Main device**
Testadmin	John Doe	RW HMT-1
Workflow name	**Workflow ID**	**Version**
WFP Cogito School Demo	62	1.1
Planned start	**Planned end**	**Planned duration**
2022-10-26 01:29:00	2022-10-26 01:29:00	00:00:00
Actual start	**Actual end**	**Actual duration**
2022-10-26 14:45:25		

Figure 21 - Workorder: WOEA Report (Top)

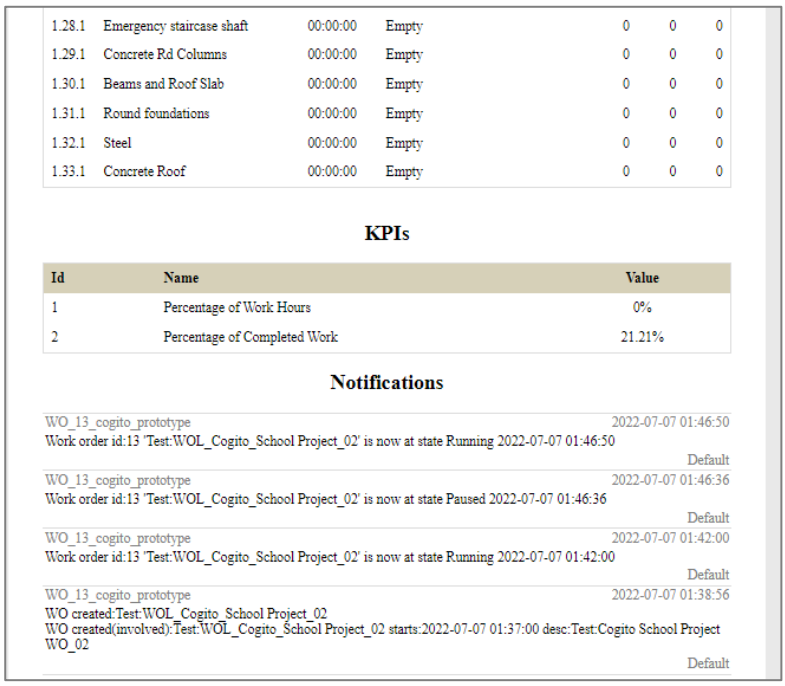
The middle part of WOEA report presents the results related to the selected work order (Figure 22). There are all Tasks, their duration, results texts and information about multimedia recorded.

Detailed report

Seq	Step name Action name	Time	Result	Results text	Value	Voice	Photo	Video
1	Step 1	00:02:33	4/0/20			0	0	4
1.1.1	Piles and Caps	00:00:04	YES		0	0	0	1
	Video 1							
1.2.1	Floor Slab (Floor 0)	00:00:14	YES		0	0	0	1
	Video 1							
1.3.1	Emergency staircase shaft	00:02:11	YES	Check done	0	0	0	1
	Video 1							
1.4.1	Concrete Rd Columns	00:00:04	YES		0	0	0	1
	Video 1							
1.5.1	Beams and Floor Slab (Floor 1)	00:00:00	Empty			0	0	0
1.6.1	Emergency staircase shaft	00:00:00	Empty			0	0	0
1.7.1	Concrete Rd Columns	00:00:00	Empty			0	0	0
1.8.1	Beams and Floor Slab (Floor 2)	00:00:00	Empty			0	0	0
1.9.1	Emergency staircase shaft	00:00:00	Empty			0	0	0
1.10.1	Concrete Rd Columns	00:00:00	Empty			0	0	0
1.11.1	Beams and Roof Slab	00:00:00	Empty			0	0	0
1.12.1	Piles and Caps	00:00:00	Empty			0	0	0
1.13.1	Floor Slab (Floor 0)	00:00:00	Empty			0	0	0

Figure 22 - Workflow: WOEA report (Middle)

On the bottom of the report, KPIs and the history of work order is located (Figure 23). The WODM currently supports two KPIs – Percentage of Work Hours and Percentage of Completed Work. They are automatically determined from the comparison between the planned time and the actual time of the execution, and the rate of the tasks that have been completed, respectively. The system is capable to accommodate KPIs defined by SLAM, but some of them are still being integrated and are under development. This will be tested during ICT integration phase in WP8 work package.



1.28.1	Emergency staircase shaft	00:00:00	Empty	0	0	0
1.29.1	Concrete Rd Columns	00:00:00	Empty	0	0	0
1.30.1	Beams and Roof Slab	00:00:00	Empty	0	0	0
1.31.1	Round foundations	00:00:00	Empty	0	0	0
1.32.1	Steel	00:00:00	Empty	0	0	0
1.33.1	Concrete Roof	00:00:00	Empty	0	0	0

KPIs

Id	Name	Value
1	Percentage of Work Hours	0%
2	Percentage of Completed Work	21.21%

Notifications

WO_13_cogito_prototype 2022-07-07 01:46:50
Work order id:13 'Test:WOL_Cogito_School Project_02' is now at state Running 2022-07-07 01:46:50
Default

WO_13_cogito_prototype 2022-07-07 01:46:36
Work order id:13 'Test:WOL_Cogito_School Project_02' is now at state Paused 2022-07-07 01:46:36
Default

WO_13_cogito_prototype 2022-07-07 01:42:00
Work order id:13 'Test:WOL_Cogito_School Project_02' is now at state Running 2022-07-07 01:42:00
Default

WO_13_cogito_prototype 2022-07-07 01:38:56
WO created:Test:WOL_Cogito_School Project_02
WO created(involved):Test:WOL_Cogito_School Project_02 starts:2022-07-07 01:37:00 desc:Test:Cogito School Project WO_02
Default

Figure 23 – Workorder: Results Report (bottom)

Clicking the "WOEA Results" on the left side menu, the results of all work orders are loaded (Figure 24). On that page, red coloured lines indicate that the corresponding work orders have actions that have been failed. Filters are also available to load only results of work orders based on their actual start and end time, the respective workflow, the assigned worker (provider), the status, and the result.

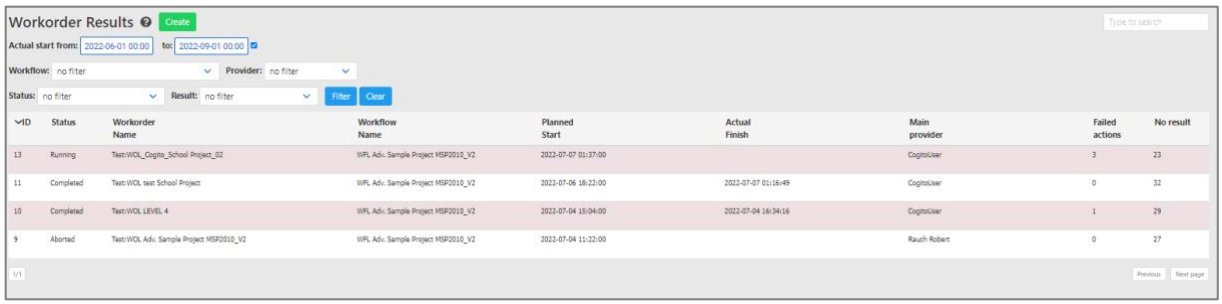


Figure 24 – Work orders results page

2.1.4 KPI definition

This section is included in "Workorder" section of UI (Figure 25) and it is prepared to accommodate KPI definition

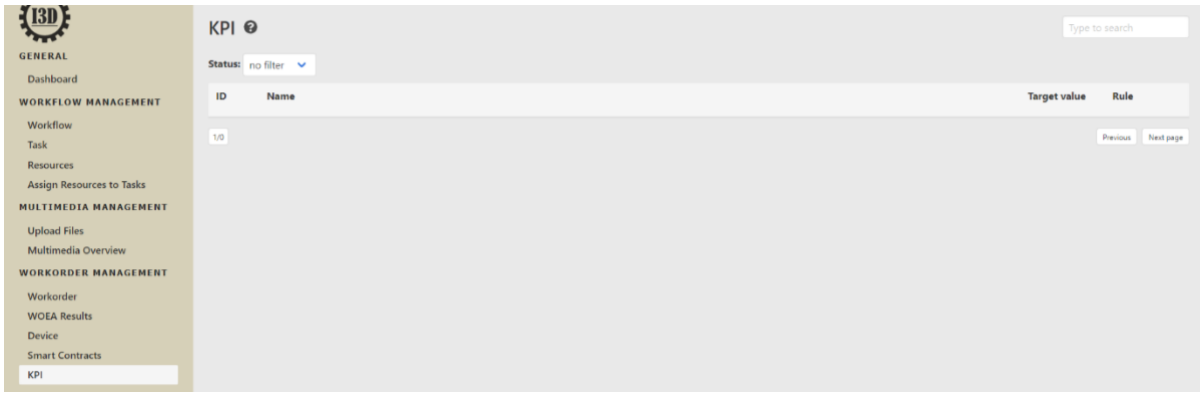


Figure 25 - KPI management

from according Use Cases UC1.1 and UC1.2. Currently we are supporting only two KPIs which are explained in WOEA report section. During the ICT integration phase these KPIs will be extended and tested.

2.1.5 SLA definition

Smart contract (or SLA – Service Level Agreement) are part of deliverable D6.2 – Blockchain & Smart Contracts on the Workflow Modelling. WODM UI accommodate functionalities (Figure 26) to assign SLA to workorder. More details are in D6.6. This functionality requires validation and testing during implementation phase

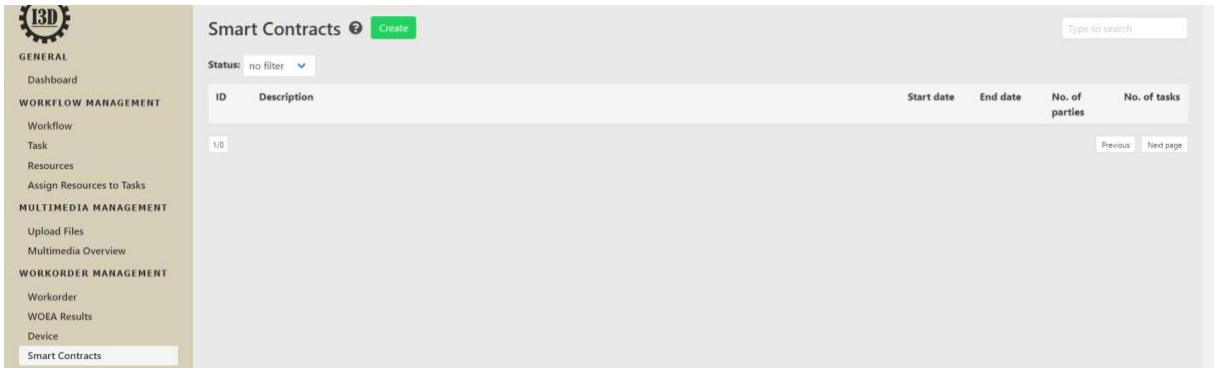


Figure 26 - SLA definition

2.2 Technology Stack and Implementation tools

WODM UI is web-based interface of WODM tool, using php programming language and Angular development platform.

2.3 API Documentation

The WODM UI is the frontend environment of the WODM backend, thus all the interactions with other COGITO applications are realised through the corresponding WODM backend components. We refer the interested reader to D6.6, where the individual interfaces of WODM with external applications are thoroughly presented.

2.4 Licensing

WODM is provided as a closed source component.

2.5 Installation Instructions

The WODM UI is web-based application runs on any web browser, thus installation or downloading of any component is not required. To access WODM UI and test the WODM's already implemented functionalities, please visit the following page: https://I3D.econtent.lu/i3d2/I3D-frontend/I3D-en-cogito/.

Demo user credentials are provided below:

1. credentials based on the WODM's internal user management; no access to COGITO projects data that are available through the DTP endpoints:
   - **Login**: info@novitechgroup.sk
   - **Password**: qB6USqBGJ8Wed4A
2. credentials based on the COGITO Identity Provider; access to the COGITO School project data that are available through the DTP endpoints:
   - **Login**: CogitoUser
   - **Password**: rdh486o38qw9sf4jz

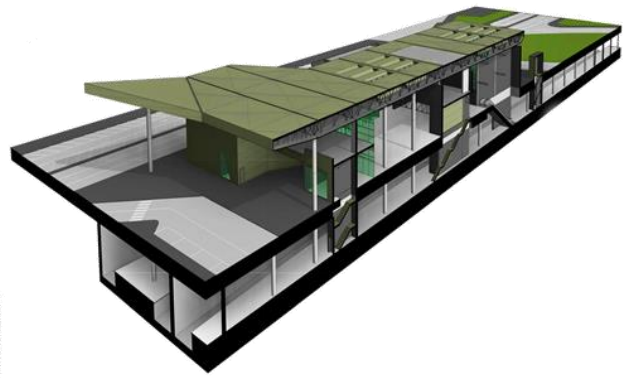
2.6 Development and integration status

The current version of WODM UI provides access to the already implemented functionalities of WODM, regarding workflow management and work order creation and monitoring. The WODM's integration with other components of the COGITO ecosystem has been tested based on manual data importing and exporting tests. Fully automatic communication will be validated during ICT integration in WP8 work package. WODM is integrated into COGITO ecosystem via Identity Provider in DTP.

The UI has been updated according to COGITO design and current status of Use cases UC1.1 and UC1.2. UI reflecting all changes done in WODM (backend) to be used for validation, implementation and testing. Obviously, any changes required in next phases of the project could be easily accommodated as WODM backend is supporting all functionalities required by stakeholders.

3 Conclusions

This demonstrator deliverable presents the current status of the WODM UI, the frontend solution for WODM, which plays a key role in the workflow and work order management. The component is an extended and repurposed version of an existing UI, which provides functionalities tailored to COGITO requirements that have been elicited from the use-cases UC1.1 and UC1.2 sequence diagrams. This version of UI is ready to support implementation and validation task within COGITO tools. The WODM UI is also ready to accommodate all necessary changes and updates which could occur during next phases of the project.



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