COGITO

CONSTRUCTION PHASE DIGITAL TWIN MODEL

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D6.9 – Workflow User Interface for Project Managers v1

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Version History

Version	Editors	Date	Comment
0.1	NT	01.04.2022	Initial version
0.2	NT	01.05.2022	ToC
0.3	NT	27.07.2022	First draft version
0.5	OLOD, CERTH	29.07.2022	First draft internal review
0.5	NT	09.08.2022	Comments partially addressed
0.6	Hypertech	10.08.2022	Final internal review
0.8	NT	17.08.2022	Additional comments addressed
0.9	NT, Hypertech, UEDIN	18.08.2022	Final version
1.0	NT, Hypertech	19.08.2022	Submission to the EC portal

Disclaimer

Executive Summary

The goal of this deliverable is to present the first 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 detailed overview of work order 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 first 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 "D6.5-Adaptive Workflow Management and Automation Tool v1", where the current status of the WODM has been described.

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List of Acronyms

Term	Description
COGITO	Construction Phase diGItal Twin mOdel
PM	Project manager
SM	Site manager
DTP	Digital Twin Platform
PMS	Process Modelling and Simulation
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 construction process, including overview of the statuses of the tasks. In the first version of the WODM UI, 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 will be delivered as an outcome of WP6. Full integration with the Digital Twin platform will take place in WP8.

1.2 Relation to other Tasks and Deliverables

This deliverable is closely related to T6.3 and its deliverable "D6.5-Adaptive Workflow Management and Automation tool v1". 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.

2 Workflow User Interface for Project Managers v1

The Work Order Definition and Monitoring User Interface (WODM UI) is a web-based UI that provides the end-user the possibility to visually experiment with the WODM backend functionalities that have been described in D6.5. 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, its prototype overview and the I3D toolkit terminology have been presented in D6.5. To avoid any plagiarism, this section emphasises on the WODM UI's usage walkthrough.

2.1 Usage Walkthrough

To access WODM UI, the user should first visit the WODM web page[1] and click on the "Ask for registration", if he/she has not already been registered (see Figure 1). WODM is enhanced with an internal identity and access management system to ensure that access to data is restricted to specific users with the appropriate permissions. For the registered user, unique credentials are generated and are used to login (see Figure 1). Full integration of WODM with the COGITO Identity Provider, developed as part of the DTP, will be delivered in their second version, planned to be released in M24 (October 2022).

For early demonstration of WODM functionalities, a generic COGITO user account has been created. Credentials for that account are provided in Section 2.6.

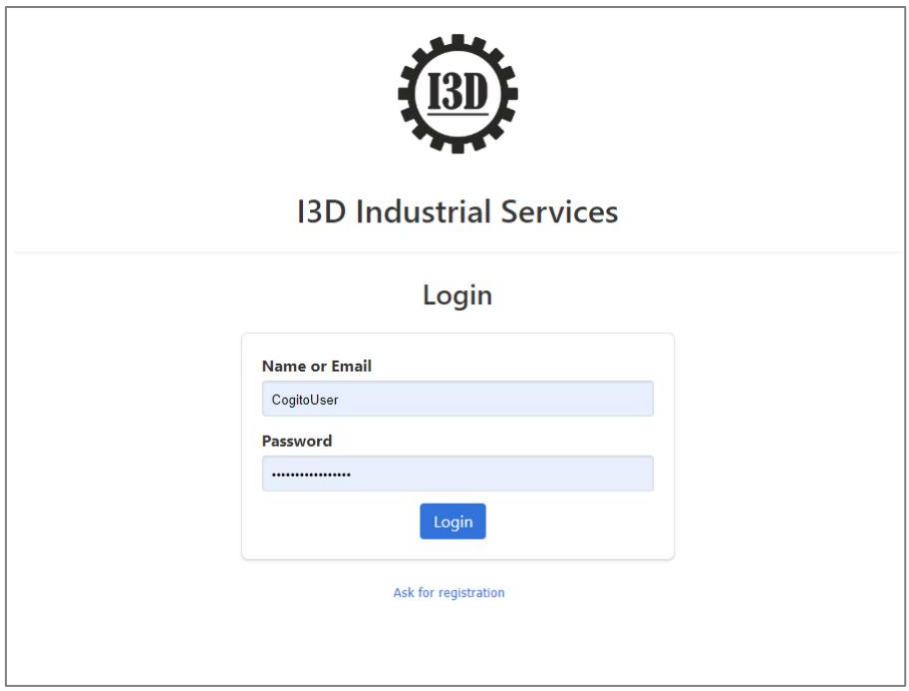


Figure 1 – Login page

After a successful login, the user selects a project from a list of running/current user's projects (Figure 2) accessible by him/her. In this version, the projects are stored in WODM backend. In the next version, the list of running projects assigned to the user will be retrieved from DTP.

To Navigate throughout the WODM UI, two projects have been created and assigned to the COGITO user (CogitoUser) account, the "Construction Prototype" and the "Vyvoj – Prostredie pre vyoj I3D" as illustrated in Figure 2.

[1] https://i3d.econtent.lu/i3d2/i3d-frontend/i3d-en-cogito/

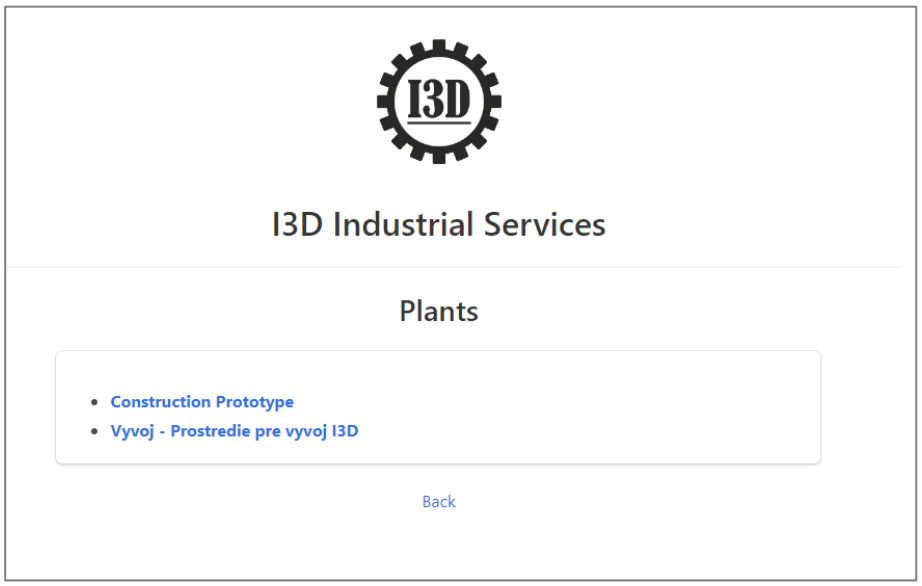


Figure 2 – Project list

Upon selection of a project, the main dashboard of the WODM UI for the specific project is shown (see Figure 3). 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 4).

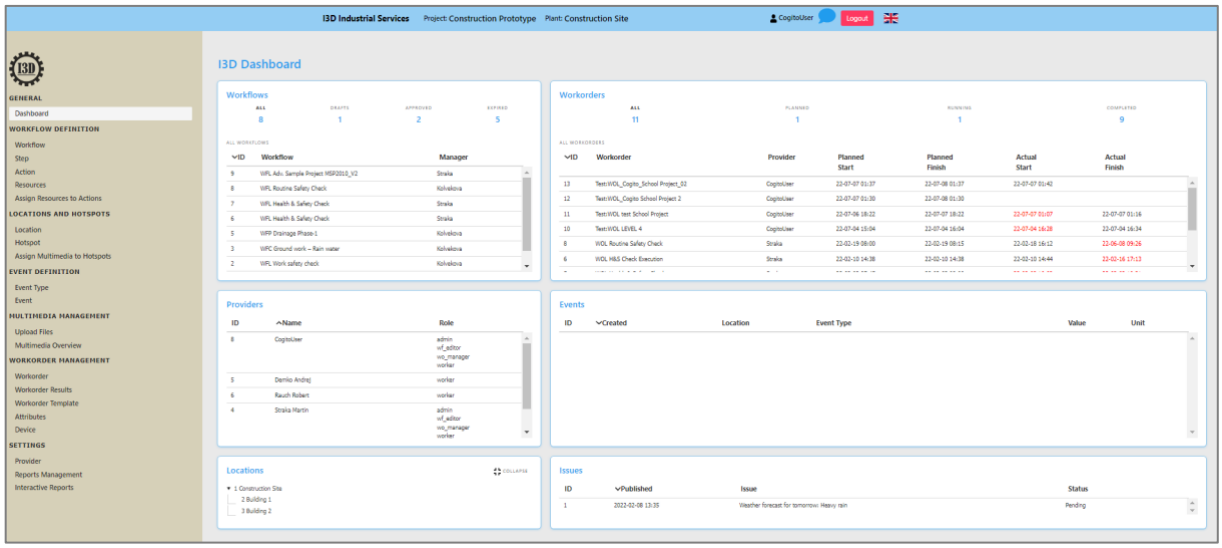


Figure 3 – Main page

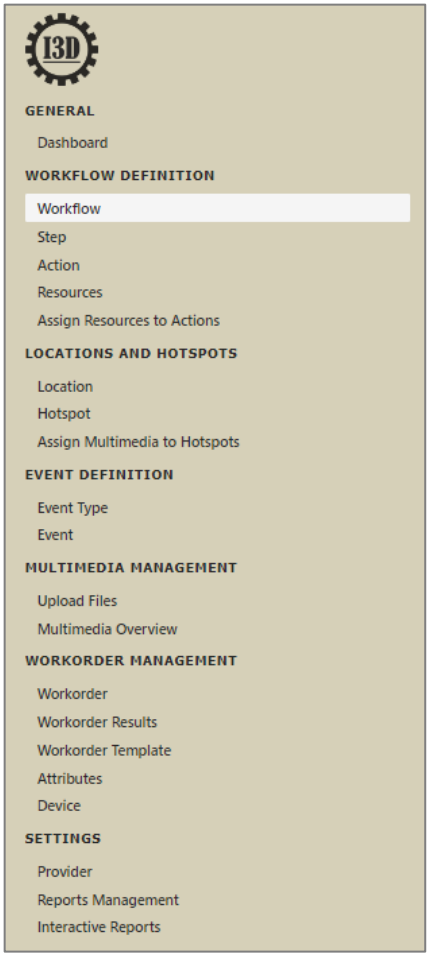


Figure 4 – WODM UI menu

2.1.1 Workflow Definition

Concerning the workflow definition process, clicking the "Workflow" tab, the workflow list is shown (see Figure 5). In alignment with the WODM's backend documentation (see D6.5), the main input for the workflow definition is the process model in BPMN format, designed by the PMS. Currently, an ETL service for importing BPMN files has been created[2]. To import the process model, on the WODM UI menu, the user clicks on "Workflow". On the loaded page, they select "Create" and then "BPMN File import" (see Figure 5).

Figure 5 – Workflows: BPMN import

[2] Since DTP acts as the central repository of COGITO, the involved partners agreed that the PMS-to-WODM interaction should be realised through DTP using already defined JSON structures. In the next version of the WODM, a similar ETL service will be implemented to automatically process JSONs of that structure.

When the BPMN is successfully imported, the workflows are shown in the workflow list (see Figure 6) and each workflow properties can be edited. 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".

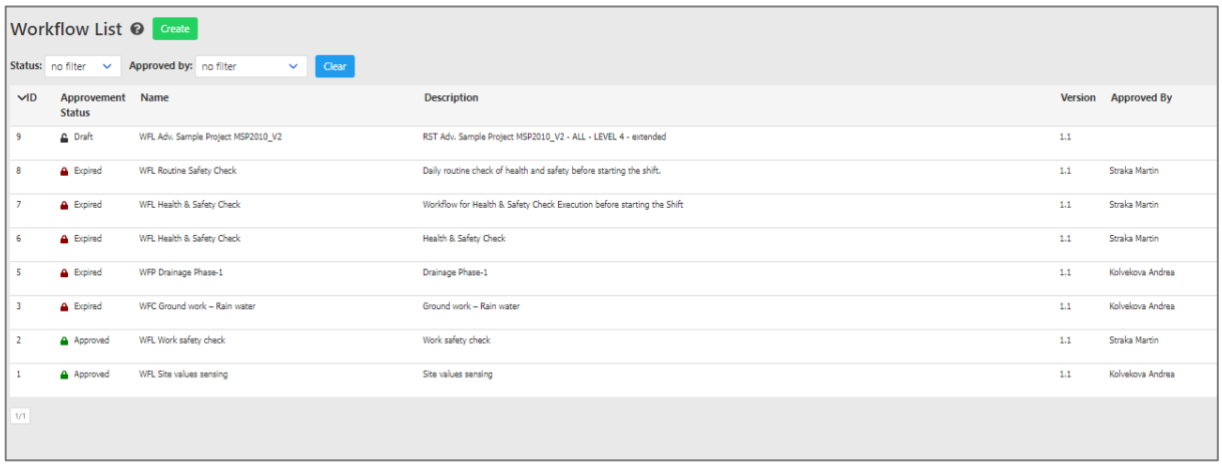


Figure 6 – Workflow list

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 clicks on the line of the corresponding workflow. Upon workflow selection, the page with its details is loaded (see Figure 7).

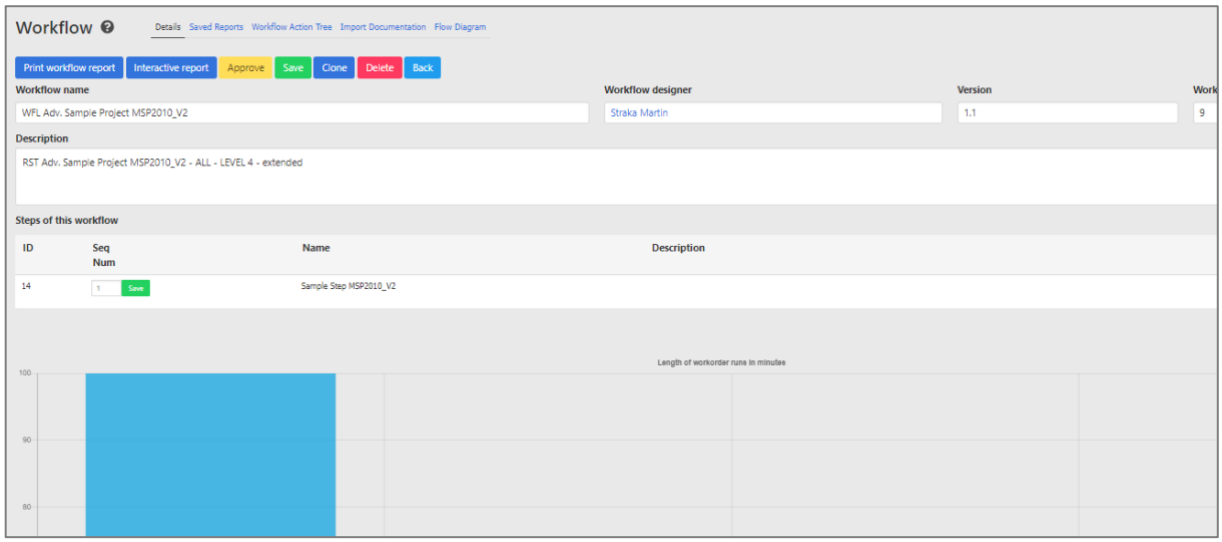


Figure 7 – Workflow: Details

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 action tree" the tree of Actions and Steps is shown (Figure 8). W prefixes stand for Workflows, S for Steps, and A for Actions. Every workflow has one or more Steps. Every step consists of one or more Actions (instructions). An action represents the exact work that must be done. For further information about the WODM's terminology and taxonomy, please refer to D6.5.

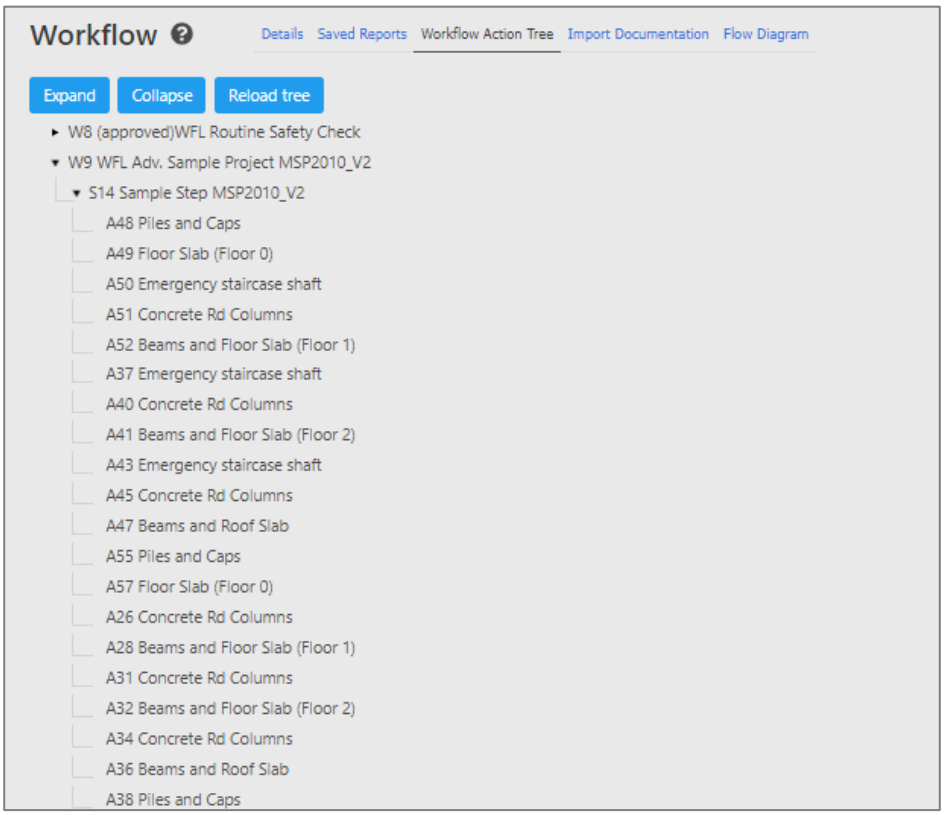


Figure 8 – Workflow: Workflow Action Tree

Selecting "Step" from left side menu, the step list is shown (Figure 9). To show steps related to a specific workflow, the user selects the workflow name from the "Workflow" drop down list.

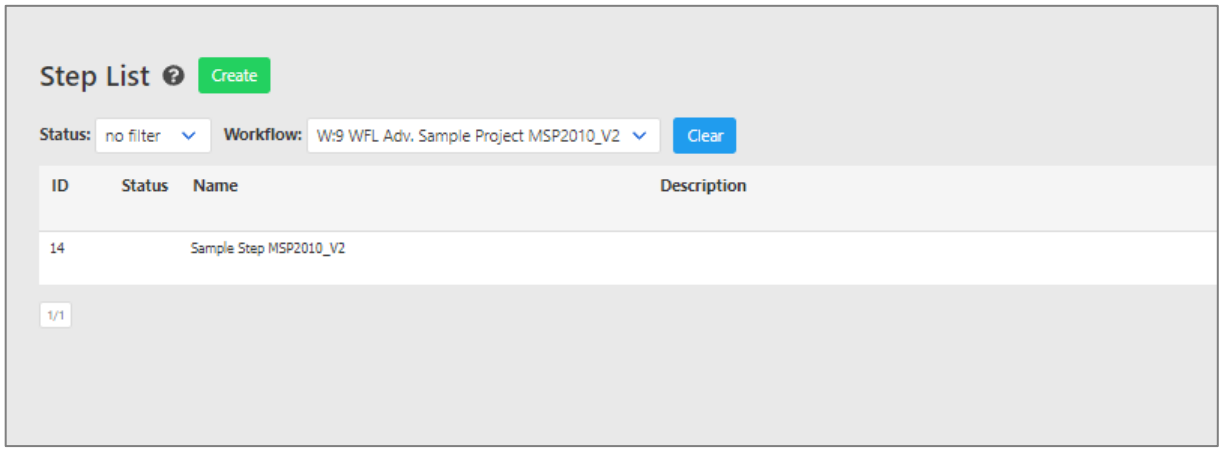


Figure 9 – Workflow: Step List

To access the details for a specific step, the user clicks on the line of the corresponding step. Upon step selection, the page with its details, called Step Item, is loaded (see Figure 10). In this view, the Step name, its description, and the relevant workflow are displayed. Furthermore, through this page, the user is informed about the list of actions that correspond to the selected step.

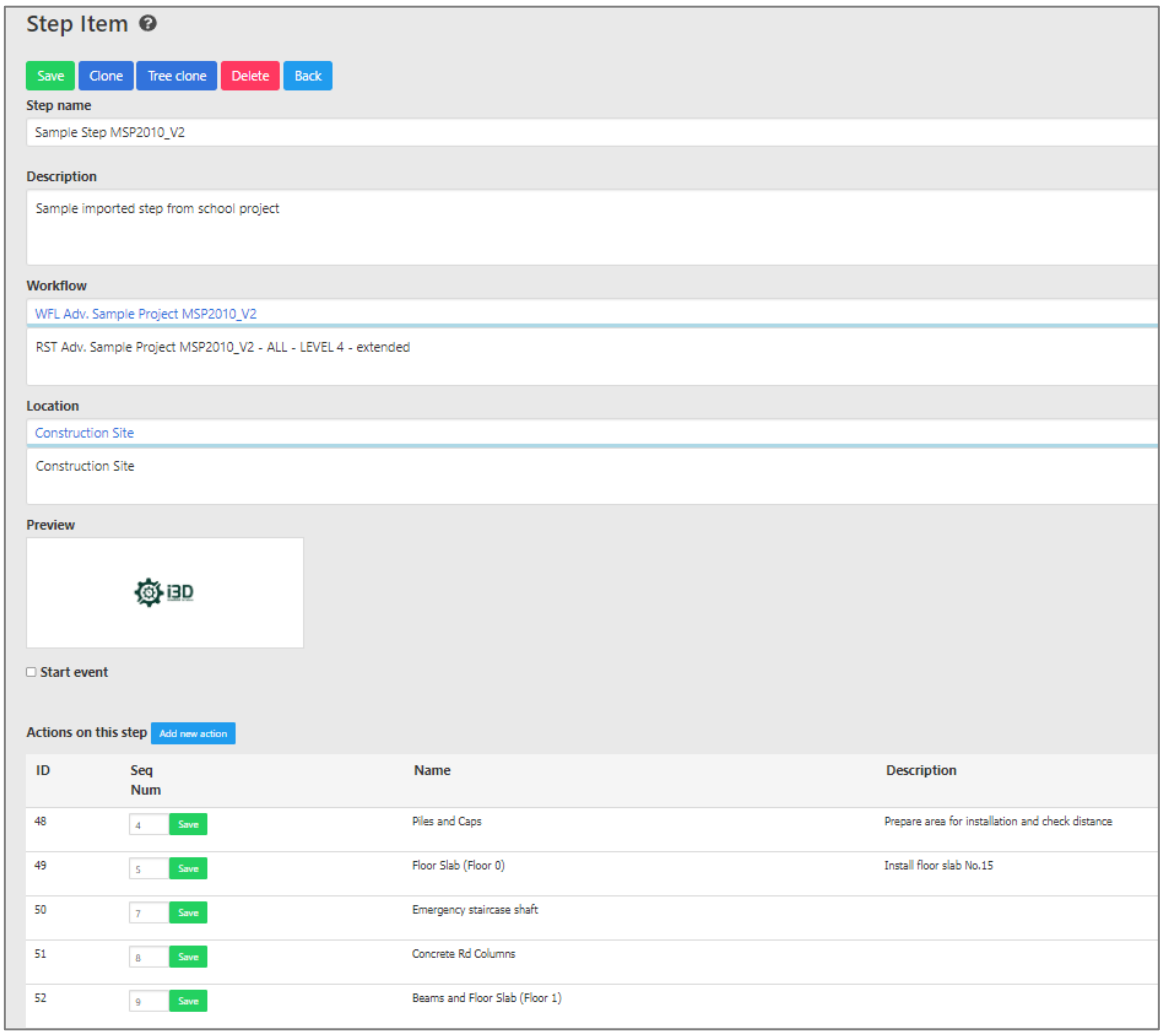


Figure 10 – Workflow: Step Item

Further information about a specific action can be accessed by clicking on the corresponding action at the bottom of the Step Item page (see Figure 10). Alternatively, the user can click the "Action" tab on the menu and select the action of interest from the Action List that is loaded (see Figure 11).

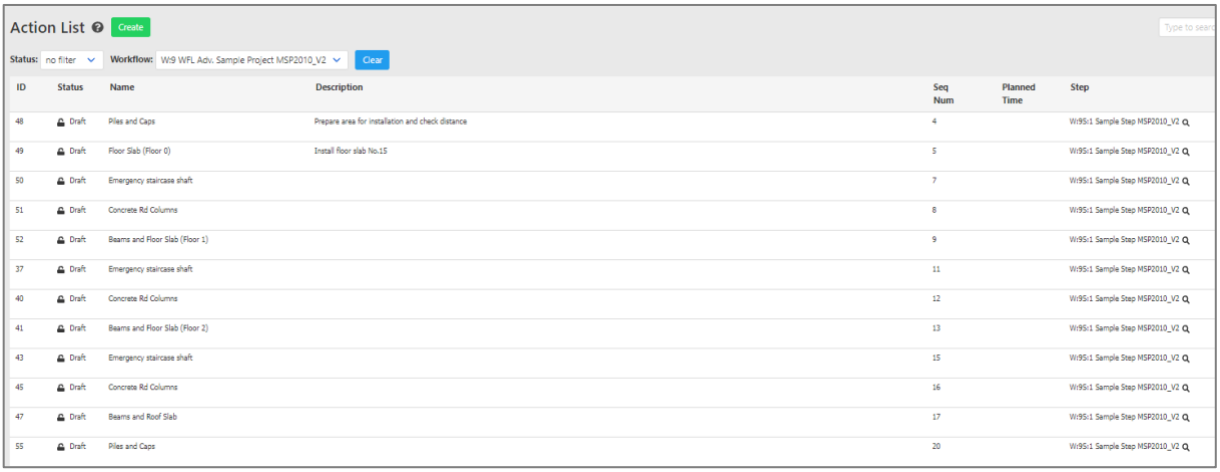


Figure 11 – Workflow: Action List

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 (see Figure 12).

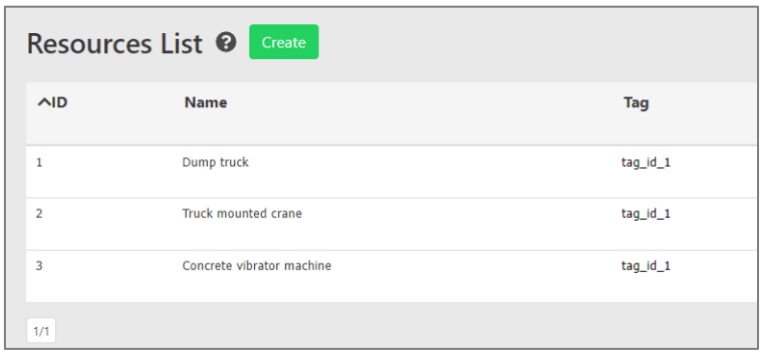


Figure 12 – Workflows: Resources List

Having checked and confirmed the lists of workflows, steps, actions and their relations, and the list of resources, the user can assign resources to actions by clicking the "Assign Resources to Actions" tab. This option allows the user to create links between resources and actions. The relationship between the two is N:M, meaning that you can assign multiple resources to each action, and each resource can be shared among multiple actions (see Figure 13).

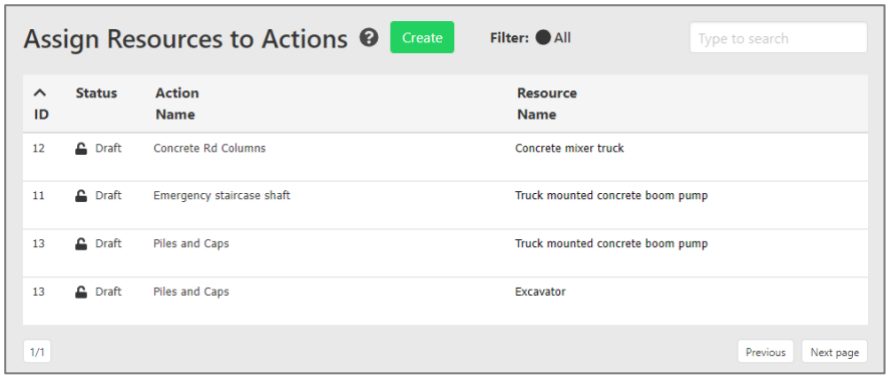


Figure 13 – Workflows: Assign Resources to Actions

2.1.2 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 14).

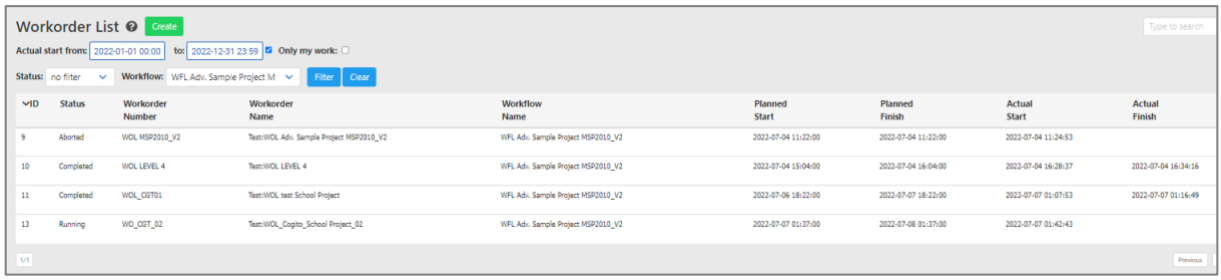


Figure 14 – Workorder: Workorder List

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, and the description of work order to be shown on worker's device. Through this page, the user can assign a specific worker for this work order (Main provider) and the device that the worker is going to use to report progress on that workorder (e.g., RW HMT-1).

Clicking the "Related Action 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 D6.7). 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”.

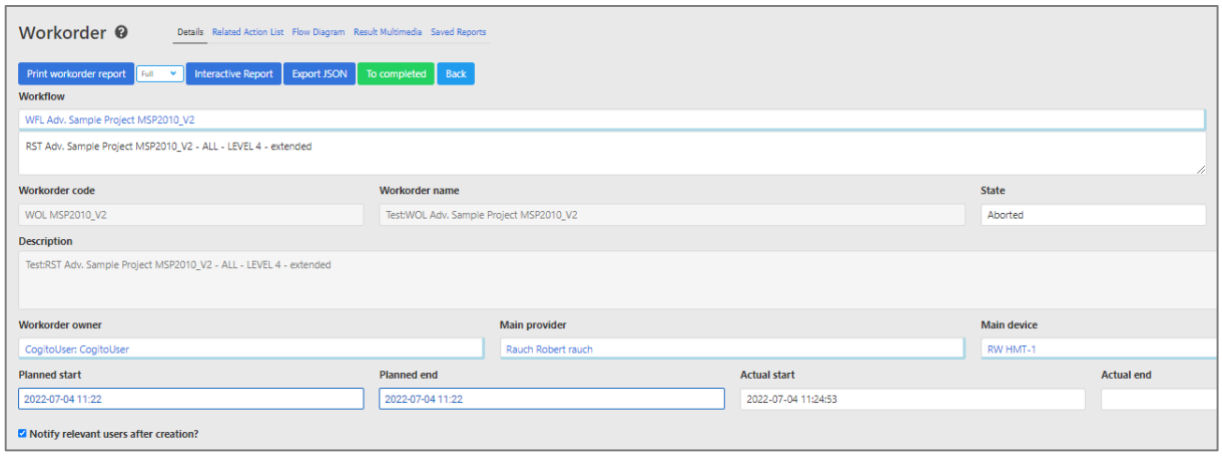


Figure 15 – Workorder: Details

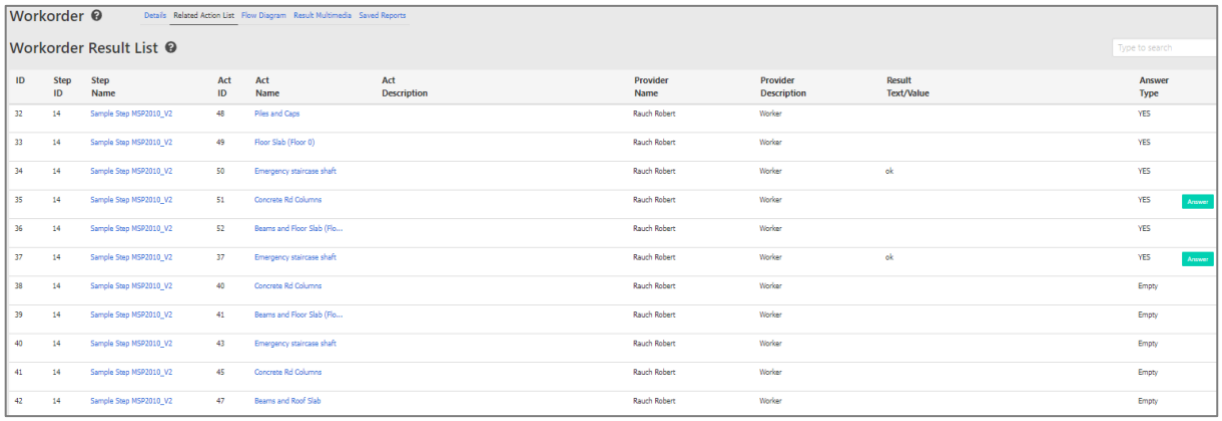


Figure 16 – Workorder: Related Action List

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 17).

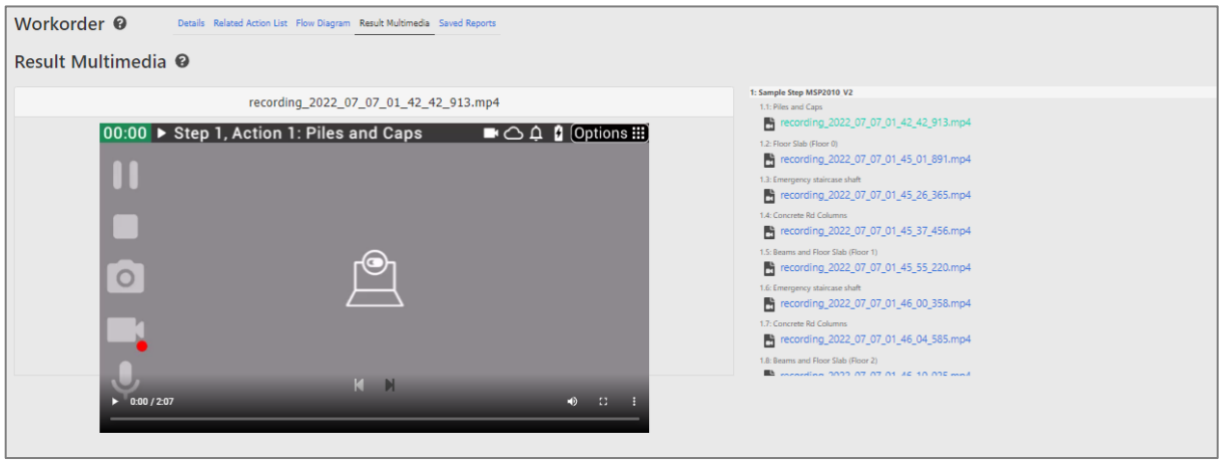


Figure 17 – Result Multimedia

Clicking on the "Print workorder report" button, the work order results report is generated and is opened in new browser tab (Figure 18). The report presents the results related to the selected work order. On the bottom of the report, KPIs and history of work order is located (Figure 19). 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.

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

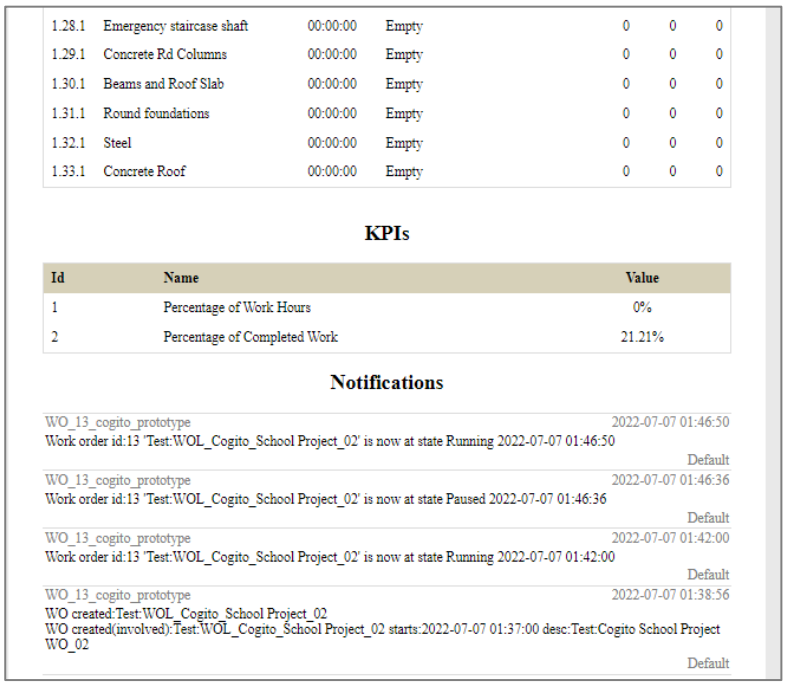
Report creation time: 2022-07-26 22:16:18

Workorder ID	Workorder code	Workorder name
13	WO_CGT_02	Test:WOL_Cogito_School Project_02
Workorder description		
Test:Cogito School Project WO_02		
Workorder owner	**Main provider**	**Main device**
CogitoUser	CogitoUser	RW HMT-1
Workflow name	**Workflow ID**	**Version**
WFL Adv. Sample Project MSP2010_V2	9	1.1
Planned start	**Planned end**	**Planned duration**
2022-07-07 01:37:00	2022-07-08 01:37:00	00:00:00
Actual start	**Actual end**	**Actual duration**
2022-07-07 01:42:43		

Detailed report

Seq	Step name Action name	Time	Result	Results text	Value	Voice	Photo	Video
1	**Sample Step MSP2010_V2**	**00:03:01**	**7/3/33**			**0**	**0**	**10**
1.1.1	Piles and Caps	00:02:07	YES	Done	0.120 m	0	0	1
	Video 1							
1.2.1	Floor Slab (Floor 0)	00:00:18	YES	Done	0	0	0	1
	Video 1							
1.3.1	Emergency staircase shaft	00:00:06	NO			0	0	1
	Video 1							
1.4.1	Concrete Rd Columns	00:00:13	PROBLEM	Missing cap		0	0	1
	Video 1							
1.5.1	Beams and Floor Slab (Floor 1)	00:00:03	YES		0	0	0	1
	Video 1							
1.6.1	Emergency staircase shaft	00:00:02	YES		0	0	0	1
	Video 1							
1.7.1	Concrete Rd Columns	00:00:04	YES		0	0	0	1

Figure 18 – Workorder: Results Report (top)



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 19 – Workorder: Results Report (bottom)

Clicking the "Workorder Results" on the left side menu, the results of all work orders are loaded (Figure 20). 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.

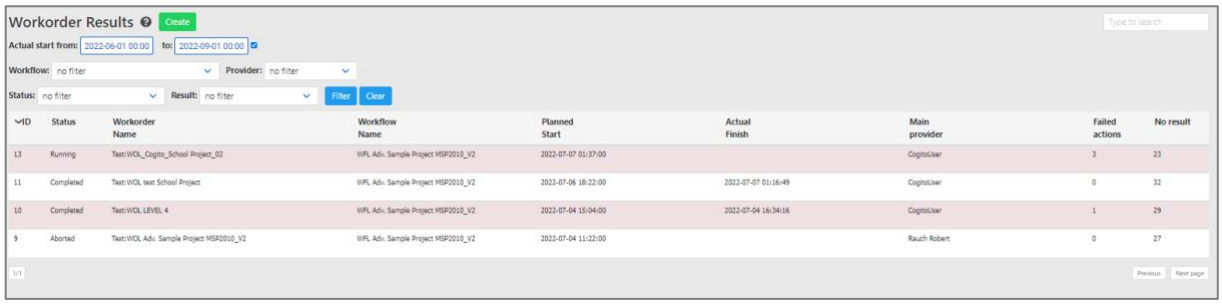


Figure 20 – Work orders results page

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 D6.5, 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:

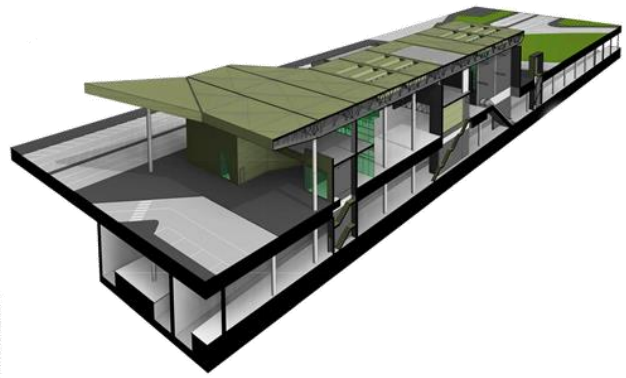
- **Name**: CogitoUser
- **Password**: rdh486o38qw9sf4jz

2.6 Development and integration status

The current version of WODM UI provides access to the already implemented functionalities of WODM related to workflow management and work order creation and monitoring. The WODM's integration with other components of the COGITO ecosystem has been partially tested based on manual data importing and exporting tests. In the next version, the automated data exchange with other tools will be implemented. For instance, WODM will interact with the identity provider of DTP to ensure secure access to data by authorised users, based on their roles, and authenticated clients. Furthermore, the ETL service to import workflows from DTP will be delivered. Finally, all the necessary REST communications with other COGITO tools will be implemented and tested. To accommodate all the aforementioned changes anticipated on the WODM backend, WODM UI will release accordingly new updates.

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. The second version of the WODM UI is expected to be released along with the corresponding deliverable "D6.10 – Workflow User Interface for Project Managers v1" in M24.



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