

ZDMP: Zero Defects Manufacturing Platform



WP4: Technical Challenge: Requirements, Specifications, and Standardization

D4.2: User Mock-ups - Vs: 1.0.0

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Contributing Partners: All WP9 and WP10 partners

Date: 2019-09

Dissemination: Public

Status: EU Approved

Abstract

The purpose of this document, D4.2 User Mock-ups, is to function as a reference for the technical partners of WPs 5, 6, 7 and 8 of the aspects and functionalities the zApps are expected to have for the ZDMP use-cases. This document describes the initial expectation of the mock-ups for each application from the users' perspective, extending and integrating with a graphical visualization the zApps proposed in D2.3, Industrial Scenarios and Use-Cases.

Grant Agreement:
825631



Document Status

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Internal Reviewer 1	Christian Melchiorre, SOFT
Internal Reviewer 2	Santiago Cáceres Elvira, ITI
Internal Reviewer 3	Stuart Campbell, ICE
Type	Deliverable
Work Package	WP4: Technical Challenge: Requirements, Specifications, and Standardization
ID	D4.2: User Mock-ups
Due Date	2019-06
Delivery Date	2019-09
Status	EU Approved

Project Partners:

For full details of partners go to www.zdmp.eu/partners



Executive Summary

The purpose of this document, D4.2 User Mock-ups, is to function as a reference for all the technical partners working in WPs 5, 6, 7 and 8 of the aspects and functionalities the zApps are expected to have for the ZDMP use-cases.

This document extends and integrates with a graphical visualization the zApps proposed in D2.3, Industrial Scenarios and Use-Cases.

This document describes the initial expectation of the mock-ups for each application from the users' perspective. The proposed zApps are thus enriched with a higher level of detail, defining in each screen the input & output information, the users' identities and permits, as well as the physical supports where the application will be used. Even if this work is performed very early in the project, the graphical interface requirements definition, the functionalities description, the coherence of the mock-ups with the actors, and roles verification have only been possible after a detailed drawing of the expected graphical interfaces of the zApps.

The availability is also extremely useful for the technical partner not only as a 'exact' reference but also to help understand how users will approach and use the zApps in practice.

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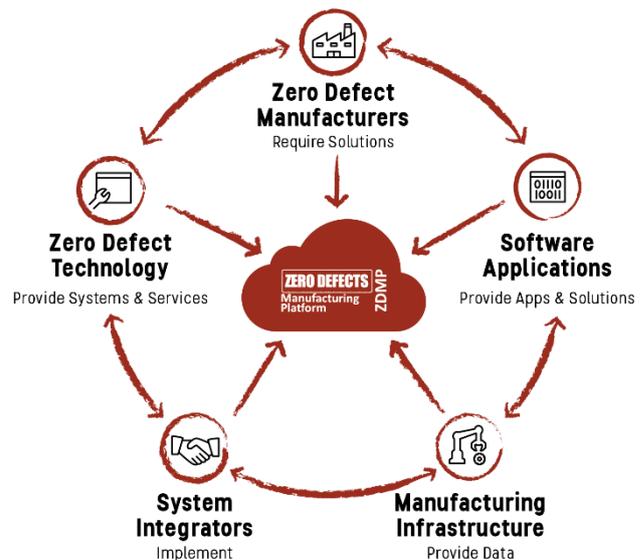
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0 Introduction

0.1 ZDMP Project Overview

ZDMP – Zero Defects Manufacturing Platform – is a project funded by the H2020 Framework Programme of the European Commission under Grant Agreement 825631 and conducted from January 2019 until December 2022. It engages 30 partners (Users, Technology Providers, Consultants and Research Institutes) from 11 countries with a total budget of circa 16.2M€. Further information can be found at www.zdmp.eu.

In the last five years, many industrial production entities in Europe have started strategic work towards a digital transformation into the fourth-industrial revolution termed Industry 4.0. Based on this new paradigm, companies must embrace a new technological infrastructure, which should be easy to implement for their business and easy to implement with other businesses across all their machines, equipment, and systems. The concept of zero-defects in the management of quality is one of the main benefits deriving from the implementation of Industry 4.0, both in the digitalisation of production processes and digitalisation of the product quality.



To remain competitive and keep its leading manufacturing position, European industry is required to produce high quality products at a low cost, in the most efficient way. Today, manufacturing industry is undergoing a substantial transformation due to the proliferation of new digital and ICT solutions, which are applied along the production process chain and are helping to make production more efficient, as in the case of smart factories. The goal of the ZDMP Project is to develop and establish a digital platform for connected smart factories, allowing to achieve excellence in manufacturing through zero-defect processes and zero-defect products.

ZDMP aims at providing such an extendable platform for supporting factories with a high interoperability level, to cope with the concept of connected factories to reach the goal of zero-defect production. In this context, ZDMP will allow end-users to connect their systems (ie shop-floor and Enterprise Resource Planning systems) to benefit from the features of the platform. These benefits include product and production quality assurance amongst others. For this, the platform provides the tools to allow following each step of production, using data acquisition to automatically determine the functioning of each step regarding the quality of the process and product. With this, it is possible to follow production order status and optimize the overall processes regarding time constraints and product quality, achieving the zero defects.

0.2 Deliverable Purpose and Scope

The purpose of this document, D4.2 User Mock-ups, is to specify the aspects and functionalities the zApps are expected to have for ZDMP use-cases. It describes the first version of the mock-ups for each application. The proposed zApps are here enriched with a higher level of detail, defining in each screen the input, output information, as well as the support where the application will be used.

Since this document extends and integrates the description of the zApps proposed in D2.3, Industrial Scenarios and Use-Cases, many references to the aforementioned deliverable are included. A summary of the most important tables and results of D2.3 is included in the first chapter.

Specifically, the DOA states the following regarding this Deliverable:

O4.2 To develop Mock-ups (by users)					
T4.2	User Mock-ups			FIDIA	M4-6
D4.2	User Mock-ups	R	PU	6	RD1
<p>This task will create graphical designs and early mock-ups of all ZDMP components and platform from a user-perspective. These mock-ups will provide a first clarification on how the components will look like and on how they may be used. Mock-ups do not necessarily need to define the final screen design but they will show the usability and the basic concepts allowing all team members of ZDMP to create a joint understanding and to verify how the practical usage will look like which is especially important considering the large number of users, sectors, and (for example) the interfaces with others in the ecosystem which ZDMP will have.</p>					

0.3 Target Audience

Whilst primarily aimed at the project partners, this public deliverable can be useful for the wider scientific and industrial community. This includes other publicly funded projects, which may be interested in collaboration activities.

0.4 Deliverable Context

This document relationship to other documents is as follows:

Primary Preceding documents:

- **D2.3** Industrial Scenarios and Use-Cases

Primary Dependant documents:

- **D4.1** Requirements
- **D4.3** Global Architecture Specification
- **D4.4** Functional Specification
- **D4.5** Technical Specification
- **D9.1** Traditional: Implementation Definition, Plan, KPI Validation/Measurement Criteria
- **D10.1** Extended: Implementation Definition, Plan, KPI Validation/Measurement Criteria

0.5 Document Structure

This deliverable is broken down into the following sections:

- **Section 1: Use-cases and zApps:** An introduction to this deliverable including an overview of the use-cases and zApps
- **Section 2: Mock-ups:** Mock-up design and functionalities description for all the zApps having a user interface
- **Section 3: Conclusion:** Summary of the deliverable results and the next steps
- **Annexes:**
 - **Annex A:** Document History
 - **Annex B:** References
 - **Annex C:** Mock-ups details

0.6 Document Status

This document is listed in the Description of Action as “public” since it provides general information about the goals and scope of ZDMP and can therefore be used by external parties in order to receive insight into the project activities.

0.7 Document Dependencies

This document has no preceding documents.

0.8 Glossary and Abbreviations

A definition of common terms related to ZDMP, as well as a list of abbreviations, is available at <http://www.zdmp.eu/glossary>.

0.9 External Annexes and Supporting Documents

- None

0.10 Reading Notes

- None

1 Use-cases and zApps

This chapter provides a summary of the description of the use-cases and the proposed zApps relevant to the mock-up description. This further definition of the functionalities required and the high level of detail of the preliminary graphical interface have resulted in some minor changes to the zApp table, with respect to the description included in D2.3.

1.1 Use-cases

ZDMP use-cases cover four sectors: Automotive, Machine Tools, Electronics, and Construction. The interactions between the different domains considered in the ZDMP use-cases are modelled in Figure 1. The two production lines considered in ZDMP are assembly and provision.

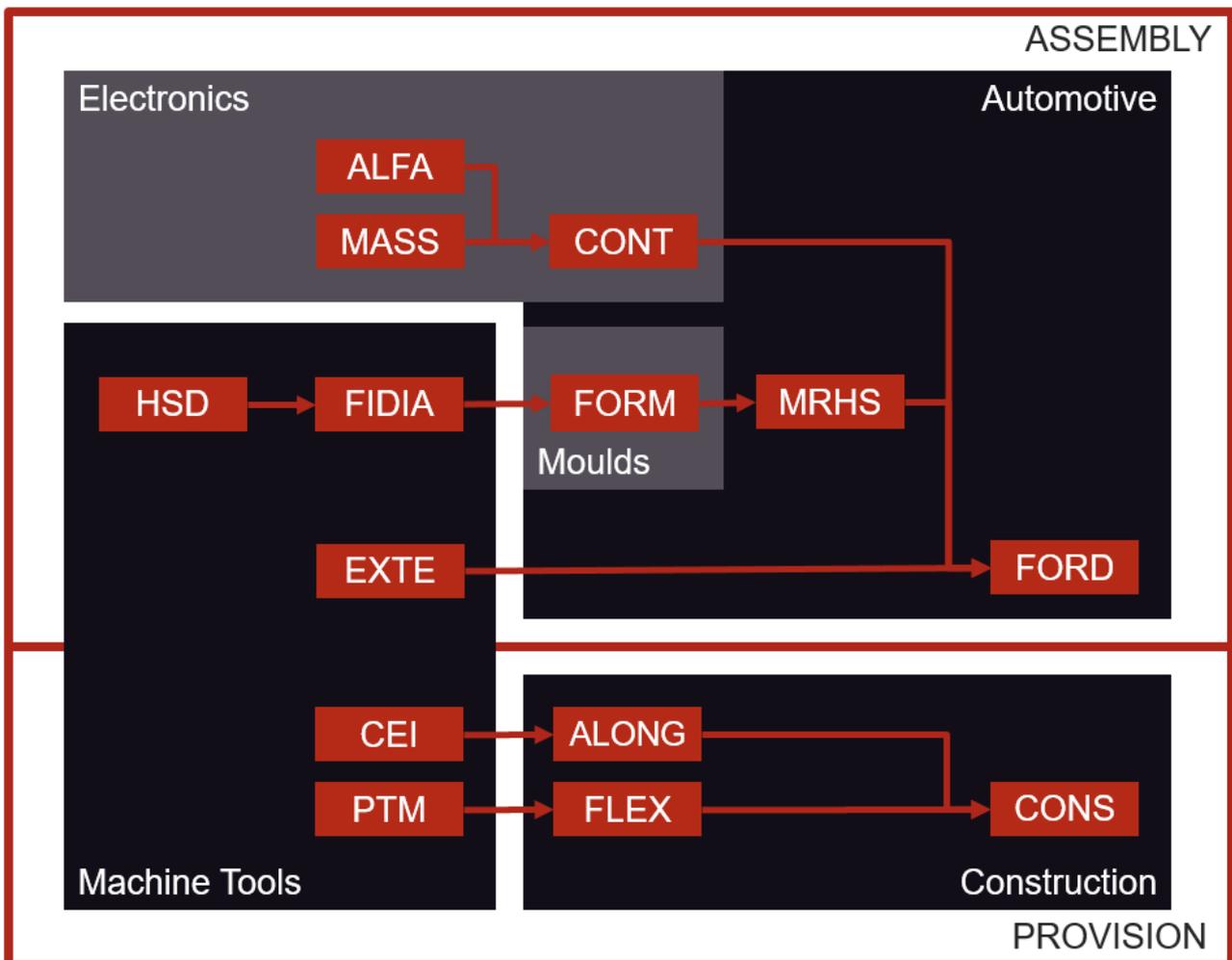


Figure 1: Manufacturing lines and supply chain of the actors participating in ZDMP

For each sector, a number of use-cases have been identified, in which ZDMP solutions would represent a step ahead with respect to the current use-case scenario (For further details, refer to D2.3). The table of Figure 2 (below) identifies a summary of the use cases that will be implemented in ZDMP.

	Sector	ID	Titles
Traditional	Automotive	UC1.1	Engine block manufacturing: Defects detection and prediction in aluminium injection operations
		UC1.2	Engine block manufacturing: Defects detection and prediction in machining operations
		UC1.3	Engine block manufacturing: Defects reduction by the optimization of the machining process
	Machine Tools	UC2.1	Moulds manufacturing: Process alert system for machine tool failure prevention
		UC2.2	Moulds manufacturing: Smart process parameter tuning
		UC2.3	Moulds manufacturing: in-line 3D modelling
Extended	Electronics	UC3.1	Electronic products manufacturing: Component inspection
		UC3.2	Assembly line: AI-supported optical defects detection
		UC3.3	Assembly line: monitoring and control system
	Construction	UC4.1	Steel tubes: production monitor
		UC4.2	Stone tiles: equipment wear detection
		UC4.3	Construction supply chain: quality control at construction site
		UC4.4	Construction supply chain: quality traceability

Figure 2: List of ZDMP Use Cases divided by sector

1.2 The zApps

Figure 3 provides a summary of the proposed zApps and a brief description of their purpose. Many zApp can be exploited by more than one use-case, therefore their IDs do not include a reference to a specific use-case. It is instead composed by a first digit, referring to the application sector, and an incremental number as the second digit. For example, zA1.3 is the third application proposed for the first application sector (Automotive). It will be exploited in use-cases 1.1, 1.2 and 1.3.

zApp name	ID	Description
zAnomalyDetector	zA1.1	The objective of zAnomalyDetector is to ingest real time data from multiple sources and elaborate a multivariate analysis to detect system anomalies. When the system detects such an anomaly, it generates notifications to the zAlarm to alert the operator or the shop floor manager.
zDigitalTwin	zA1.2	The objective of zDigitalTwin is to ingest real time data from multiple sources and elaborate a simulation of the observed system. The model can optimize the system parameters and produce recommendations on those to achieve specific objectives defined by the users.

zAlarm	zA1.3	The objective of zAlarm is to alert users in real-time in case of incidents or abnormal situations eg machine downtimes. Service technicians can receive notifications with related information (machine, location, type of error, required tools...) on their smart wearable.
zMachineMonitor	zA2.1	The objective of zMachineMonitor is to automatically gather and store both equipment and machining process data. It is also able to monitor the task to detect sudden or abrupt changes that can lead to a premature failure and that need to be taken care of quickly by the operator. When the system detects such an event, it generates notifications to alert the operator or the shop floor manager. This data is temporal series of values read by the machine numerical control.
zMachineAnalytics	zA2.2	The objective of zMachineAnalytics is to automatically detect equipment or process deviation from standard working conditions that can lead to near failure events using data analysis algorithms. It will work on data already stored in a database by the zMachineMonitor zApp to identify degradation trends of the machine or components.
zParameterMonitor	zA2.3	The objective of zParameterMonitor is to automatically gather and store all parameters data and operators' feedback. The objective and the functioning of this zApp is similar to zA2.1, but in this case it might need a much simpler UI.
zParameterAnalytics	zA2.4	The objective of zParameterAnalytics is, given a condition (eg type of machine, environmental variables, etc), to automatically detect which parameter combination provides the best results. It triggers the appropriate response to all new production requests and provides the machine operators a suggestion upon which parameters to use for their current situation.
z3DScannerDriver	zA2.5	The objective of z3DScannerDriver is just to make the upload of the cloud of points to the ZDMP platform more easy/automatic and then to trigger the conversion. This is an auxiliary application requiring the authorization of the operator, which should substitute the manual upload. If the format of the cloud of points generated by the scanner is proprietary or not suitable as input for the z3DGenerator, a format conversion or adaption should be considered within the z3DScannerDriver.
z3DGenerator	zA2.6	The objective of z3DGenerator is to clean the cloud of points, convert it in 3D format and, if needed, simplify it also in term of memory occupation. The output should be a 3D .stl file [RB04].
zXRAYMonitor	zA3.1	<p>The objective of zXRAYMonitor is to automatically start the correct inspection program from the library, depending on the sample under testing and to make the comparison of the XRAY/CT information and the sample drawing & specification. For each type of material / sample, a set of special characteristics in the XRAY/CT library will be generated, measured, and controlled with dedicated software.</p> <p>The application will generate for each measurement an output, which will be the input to the database of zA3.2, which will in turn store the measured values and defined parameters for each sample under testing.</p>
zXRAYAnalytics	zA3.2	<p>The objective of zXRAYAnalytics is to have a database of the inspected parts and the measurement results. This allows the comparison of new measured results for the specific part to the measured results from previous analyses and generates statistical information, a deviation overview, and trend line of measurements including graphical representation.</p> <p>The direct results will be a preventive approach for the analysed set of materials and to discover the defect or predict possible issues at the</p>

		component supplier before it occurred. In case of deviations, the application will send alerts in a mail format to the involved parties.
zFeedbackMFT	zA3.3	The objective of zFeedbackMFT application is to assure the interface with MFT (Manual Final Testing), collect images and operator optical inspection decision and leaked parts information. The collected information will be stored in a database and used by a Z3.4 application.
zArtificial IntelligenceMFT	zA3.4	The objective of zArtificial IntelligenceMFT is to apply the artificial intelligence algorithm for Manual Final Test and to inform the operator for optical inspection test results.
zFeedbackAFT	zA3.5	The objective of zFeedbackAFT application is to assure the interface with AFT (Automatic Final Testing), correlate the test image, test results, and quality of test results. The collected information will be stored in a database and used by zA3.6 application to improve the testing program.
zArtificial IntelligenceAFT	zA3.6	The objective of zArtificial IntelligenceAFT is to apply the artificial intelligence algorithms for AFT testing and to provide manual and automatic improvement of the testing program.
zDriver	zA3.7	The objective of zDriver application is to assure the interface with the equipment and the line database.
zLineData	zA3.8	The objective of zLineData is to store the received information from the driver in the database and perform the strategic KPI calculations.
zVisualManager	zA3.9	The objective of zVisualManager is to provide an easy access to a variety of line management zApps. It is a web application that displays data and graphs, gathering the information from other line applications (zA3.10-zA3.15).
zProductVersionControl	zA3.10	The objective of zProductVersionControl is to assure that the produced part has used the right material version and the right equipment program for the mentioned product serial number. Additionally, the application automates the changeover process to avoid the changeover time and quality risks.
zAutomaticCall	zA3.11	The objective of zAutomaticCall is to monitor the status of the equipment and when an equipment breakdown is expected, to automatically call the right phone number for the intervention. Additionally, it provides details about the equipment maintenance plan details, corrective intervention history, and a predictive view based on historical data.
zPowerManager	zA3.12	The objective of zPowerManager is to handle the power management actions to reduce the total energy consumption of the assembly line. For example, if the production lot is finished, the data from the production plan may allow putting the equipment into a power save mode until needed again.
zCycleTimeManager	zA3.13	The objective of zCycleTimeManager is to read the production checkin and checkout times and evaluate the production key performance indicators
zAutomaticMaterialOrdering	zA3.14	The objective of zAutomaticMaterialOrdering is to manage the current material stock and automatically request materials to the purchasing department.
zDataArchiveControl	zA3.15	The objective of zDataArchiveControl is to manage all the archiving data operations (archive, restore, clean database)
zSteelSheetWidthMonitor	zA4.1	The objective of zSteelSheetWidthMonitor is to automatically detect the width of a steel sheet to detect if the width of the sheet varies over time. In a situation that the width changes, the tube will be defective. When this problem is detected in time, tube waste is avoided.

zHorizontalWeldDetection	zA4.2	The objective of zHorizontalWeldDetection is to automatically detect the horizontal weld of the steel sheet. This welding is made to connect the different steel coils to each other for production to continue uninterrupted. By detecting this defective welding, the operator can be warned to remove the tube that will contain the weld as this tube will need to be scrapped.
zVerticalWeldMonitor	zA4.3	The objective of zVerticalWeldMonitor is to automatically detect the quality of the vertical weld of the steel sheet. In a situation where the vertical welding has a defect, it causes the final product to be defective. Thus, it is necessary to readjust the machine every time that this happens, and it is also necessary to warn the operator.
zShapeTubeMonitor	zA4.4	The objective of zShapeTubeMonitor is to automatically detect the conformity of the tube shape. It is necessary to detect if the shape of the tube is within the conformity, in case it is not necessary then to warn the operator to proceed with the reconfiguration of the machine.
zWiresMonitor	zA4.5	The objective of zWiresMonitor is to automatically detect broken cables or irregular movements of cutting cables and the alignment of the cable, in the first step of stone cutting. When a stone is being cut, the cables, can break or move irregularly, creating defects in the stone. To solve these problems, the zWiresMonitor intends to implement sensors capable to detect when a cable is broken or moving irregularly.
zThicknessMonitor	zA4.6	The objective of zThicknessMonitor is to automatically detect defects in the thickness of stone slabs. For correct polishing, the stone slabs need to be in a certain size range. To verify compliance, this zApp allows real-time analysis of the thickness of stone slabs.
zDetectDefects	zA4.7	The objective of zDetectDefects is to automatically assign sheets stone moulds to stone slabs.
zWornOutBladeDetection	zA4.8	The objective of zWornOutBladeDetection is to automatically detect worn blades during the stone slabs cutting.
zTilesConformity	zA4.9	The objective of zTilesConformity is to validate the conformity of the final product before it goes to packaging. This zApp is the last step in the stone cutting process and will act as a validator of stone cutting procedures.
zRemoteQC	zA4.10	The objective of zRemoteQC is to allow access to and easy archiving of documentary evidence of compliance regarding material including their specifications. This facilitates the documentation assessment and the detection of potential errors, even before the supplies leave the manufacturing facility.
zRescheduler	zA4.11	The objective of zRescheduler is to allow a quick adjustment of a works schedule in case of delays in supplies, thus reducing productivity losses that normally would occur due to the supervisor taking time from other activities to adjust the schedule.
zMaterialTracker	zA4.12	The objective of zMaterialTracker is to allow the recording of the use of a specific material at a specific location, and based on that, to allow access to all the documentation related to that specific material. This could be construction records, quality control records, shipment records, or production control records.
zMaterialID	zA4.13	The objective of zMaterialID is to create an identification system capable of creating a unique identifier for different materials and corresponding quality control information. Through this identifier the materials will be traceable throughout the production process

Figure 3: Summary of the proposed zApps and their objectives

The non-technological features of the zApps relevant to the mock-up’s definition are summarized in Figure 4, which also contains information on the mock-up availability. If a

zApp has no user interface or a simple setting page, it has no mock-up. Its functionalities are described in the sections of the zApps they interact with. This figure lists the preferences of the users regarding some key features:

- **Type:** This parameter identifies whether the zApp is thought to be a self-standing zero-defects application (APP) or a component to support or enable a zero-defect application (COMP)
- **Priority:** This entry describes the level of priority the users give to the zApp. The priority can be both the expression of an interest (eg the company is highly interested in commercializing or using this type of solution) or also a logical priority (eg the zApp is a basis for other applications or components that cannot work without it). It is expressed in High (H), Medium (M) or Low (L)
- **UI:** This parameter stands for User Interface and identifies the necessity for the zApp to include a graphical interface. It is expressed as yes (Y), no (N) or maybe (M), in case this necessity has not yet been fully identified
- **Custom:** This parameter describes the degree of customization of the zApp. In other words, a zApp with low customization (L) could be used by other users and applied to other companies with zero or minor changes. zApp’s with medium (M) customization require few modifications for being extended to other users, whilst a zApp with high (H) customization is built for the specific machine, line, or company. In the case of the latter it implies that although the concept is applicable in other cases, adapting the zApp itself would require some major effort.

zApp name	ID	Mock-up section	Type (App, Comp)	Priority (H, M, L)	UI (Y, N, M)	Custom (H, M, L)
zAnomalyDetector	zA1.1	✓	APP	H	Y	L
zDigitalTwin	zA1.2	✓	APP	M	Y	M
zAlarm	zA1.3	✓	APP	H	Y	L
zMachineMonitor	zA2.1	✓	APP	H	Y	H
zMachineAnalytics	zA2.2	zA2.1	COMP	H	M	L
zParameterMonitor	zA2.3	✓	APP	L	Y	H
zParameterAnalytics	zA2.4	zA2.3	COMP	L	M	M
z3DScannerDriver	zA2.5	zA2.6	COMP	L	M	H
z3DGenerator	zA2.6	✓	APP	H	Y	L
zXRAYMonitor	zA3.1	✓	APP	H	Y	L
zXRAYAnalytics	zA3.2	✓	APP	H	Y	M
zFeedbackMFT	zA3.3	✓	APP	H	Y	H
zArtificialIntelligenceMFT	zA3.4	zA3.3	COMP	H	M	M
zFeedbackAFT	zA3.5	✓	APP	H	Y	H
zArtificialIntelligenceAFT	zA3.6	zA3.5	COMP	H	M	M
zDriver	zA3.7	✓	COMP	H	N	H

zLineData	zA3.8	✓	COMP	H	M	L
zVisualManager	zA3.9	✓	COMP	H	Y	L
zProductVersionControl	zA3.10	zA3.9	APP	M	M	L
zAutomaticCall	zA3.11	zA3.9	APP	M	M	L
zPowerManager	zA3.12	zA3.9	APP	M	M	M
zCycleTimeManager	zA3.13	zA3.9	APP	M	M	M
zAutomaticMaterialOrdering	zA3.14	zA3.9	APP	M	M	L
zDataArchiveControl	zA3.15	zA3.9	APP	M	M	M
zSteelSheetWidthMonitor	zA4.1	✓	COMP	M	N	L
zHorizontalWeldDetection	zA4.2	✓	COMP	M	N	L
zVerticalWeldMonitor	zA4.3	✓	COMP	M	N	H
zShapeTubeMonitor	zA4.4	✓	COMP	H	Y	M
zWiresMonitor	zA4.5	✓	COMP	L	N	H
zThicknessMonitor	zA4.6	✓	COMP	L	N	L
zDetectDefects	zA4.7	✓	COMP	H	Y	H
zWornOutBladeDectection	zA4.8	✓	COMP	M	N	L
zTilesConformity	zA4.9	✓	COMP	H	Y	H
zRemoteQC	zA4.10	✓	APP	M	Y	L
zRescheduler	zA4.11	✓	APP	M	Y	H
zMaterialTracker	zA4.12	✓	APP	M	Y	M
zMaterialID	zA4.13	✓	COMP	H	M	H

Figure 4: Summary of non-technological features of the zApps

Across all these zApps, those with the lower degree of customization are expected to be the easiest to apply in other scenarios outside the ZDMP project. As stated before, all the zApps described are the answer to a Zero-Defect problem of the manufacturing sector they refer to, therefore all of them have a high potential impact on many types of applications. Some of them are however easier to “export”, because they are more general in their applicability to other companies or domains.

2 Mock-ups

This section includes the early mock-ups of the zApps with a user interface. The applications that do not need a UI are mentioned in the sections of the zApps they exchange data with.

The level of detail of the mock-up descriptions can vary greatly depending on the zApp. Some applications, such as zA1.1 zAnomalyDetector and zA2.3 zParameterMonitor, have a relatively simple user interface to collect data and show results although the analytics and the technologies behind those results are complex. The challenges and the functioning of these applications are described from the technical perspective in the development work packages. On the contrary, applications such as zA4.10 zRemoteQC and zA4.11 zRescheduler have more richness and naturally more complex user interfaces. For example, they may require customization upon the different actors of the value chain that need different access rights to share only a part of the data with each other.

2.1 zA1.1 zAnomalyDetector

The objective of zAnomalyDetector is to ingest real time data from multiple sources to detect system anomalies. In order to do so the application have two main functionalities: creating a new model and opening the anomaly detector (Figure 5).

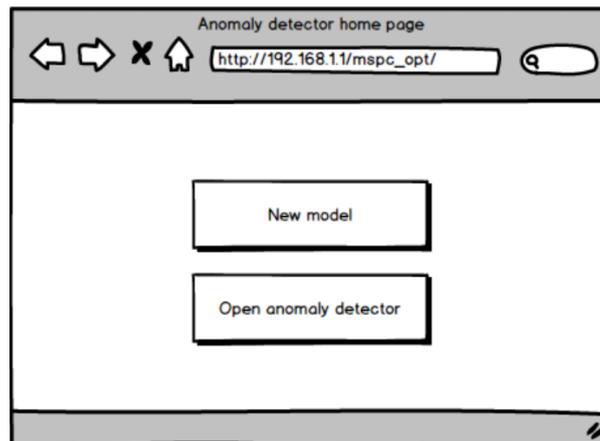


Figure 5: zAnomalyDetector home page

The first function allows the creation of a new model by selecting the desired variables (Figure 6). The button “Create” starts the fitting process of a model using historical data of the selected variables. The new model is then saved in the repository with the name specified by the user.

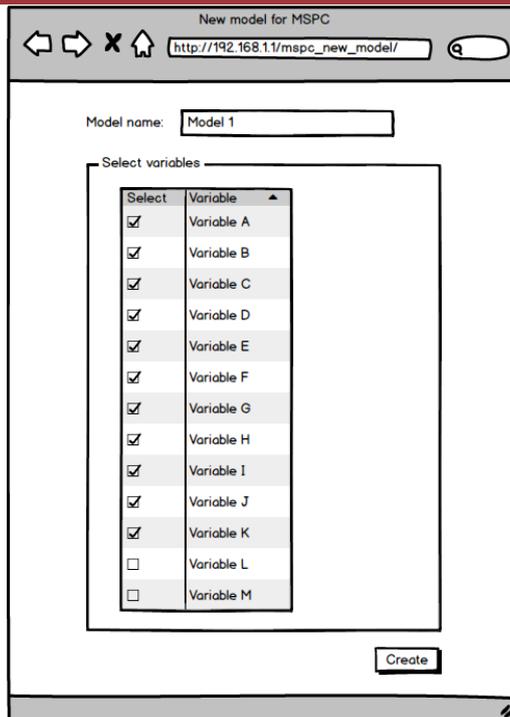


Figure 6: zAnomalyDetector new model page

The second button in Figure 5 opens the anomaly detector monitor (Figure 7). This tool allows the comparison of the real time data to a model with the help of the graphical representation of specific parameters. Once a model is selected in the combo box, two charts show the parameters variation with their corresponding contribution plots. When an observation exceeds the upper control limit, an alarm is triggered. The contribution plots show which variables contribute the most to an anomaly situation.

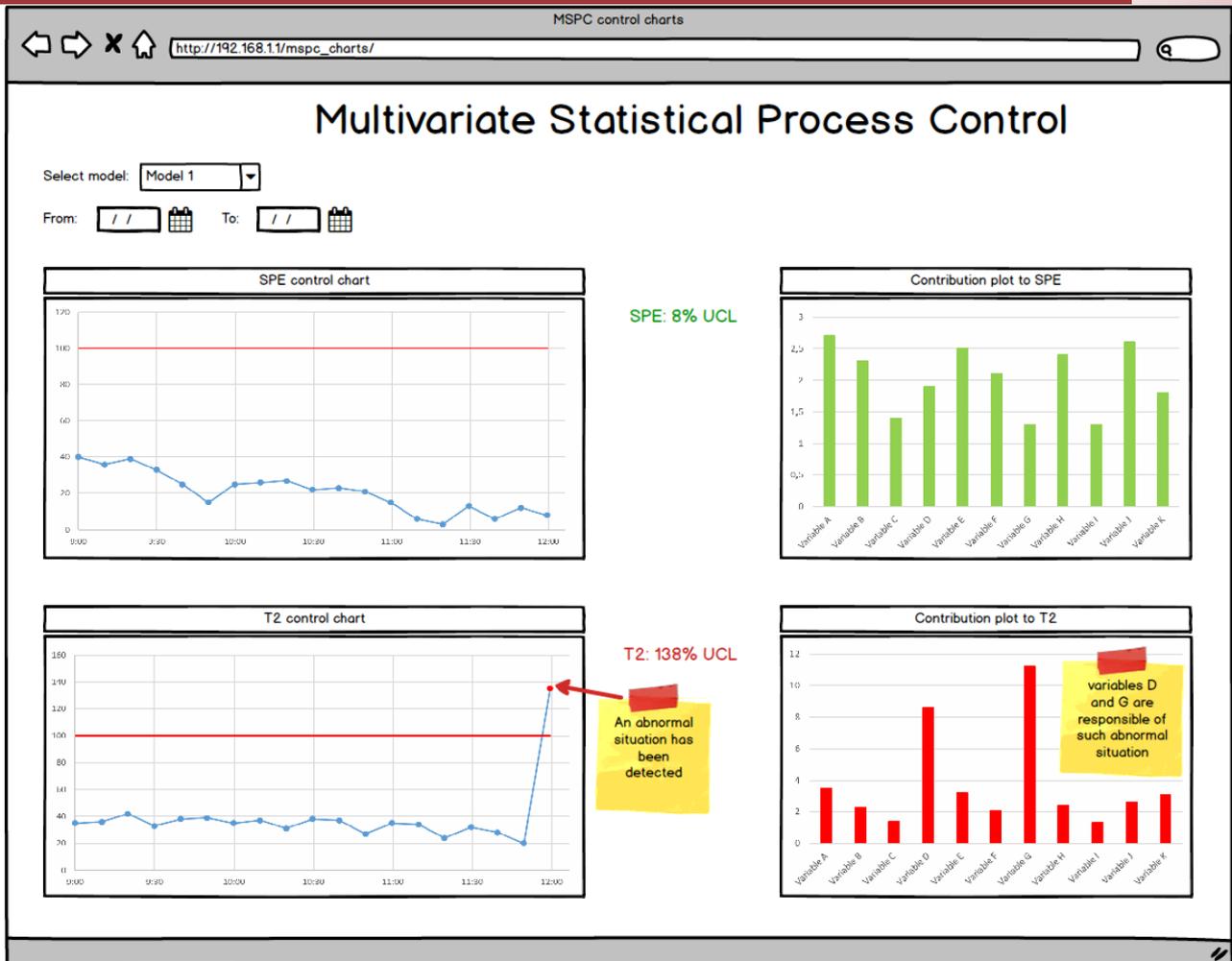


Figure 7: zAnomalyDetector monitoring page

By clicking on a bar in the contribution charts, a time series of the variable is plotted (Figure 8) in order to isolate the evolution of such variable during a selected timeframe.

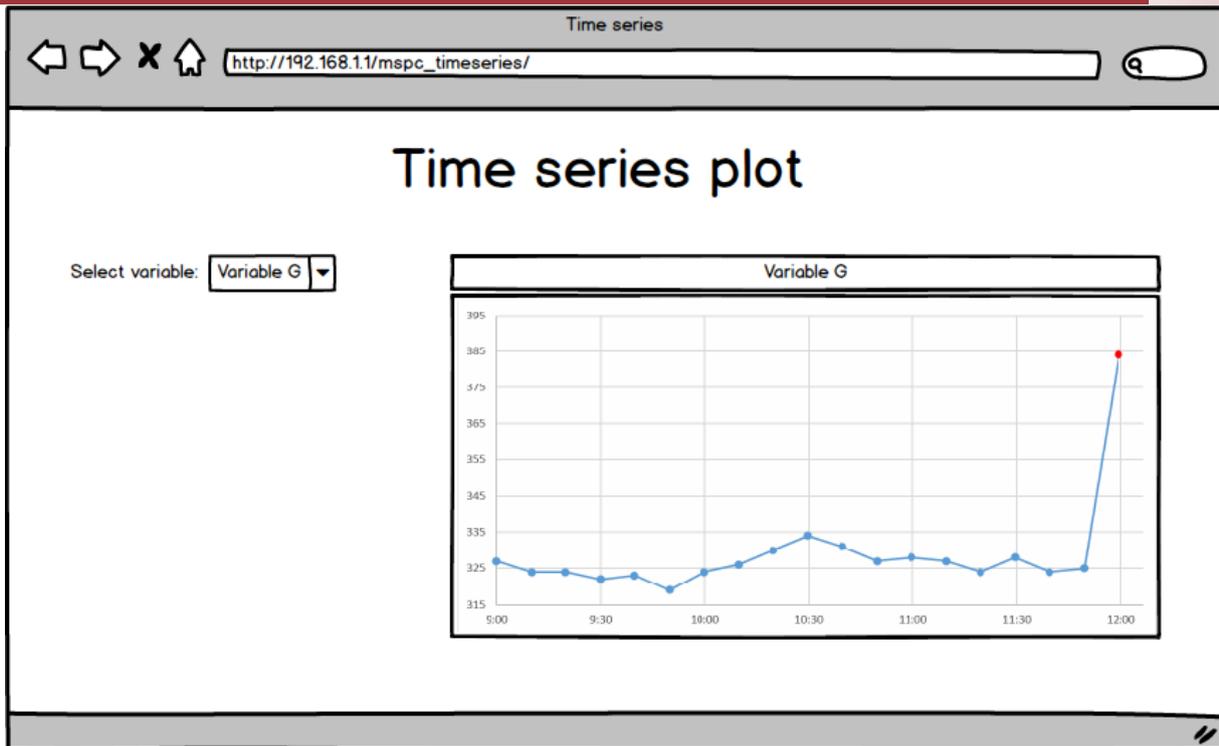


Figure 8: zAnomalyDetector time series plot page

2.2 zA1.2 zDigitalTwin

This zApp ingests real time data from multiple sources and elaborates a simulation of the system. The simulated model can be exploited to optimize the system parameters and produce recommendations towards specific objectives defined by the users.

The application has three main functionalities: Creating a new model, optimizing the parameters, and monitoring (Figure 9).

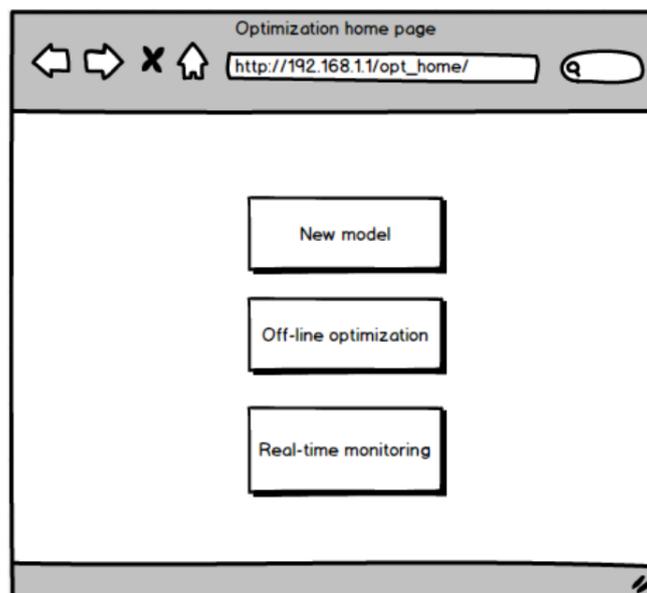


Figure 9: zDigitalTwin home page

The first function allows the creation of a new model by selecting the response variable (“objective variable”) and the predictor variables (“decision variables”) to be used in the model (Figure 10). The button “Create” starts the fitting process of a model using historical data of the selected variables. The new model is then saved in the repository with the name specified by the user.

Select	Variable
<input type="checkbox"/>	Variable 1
<input checked="" type="checkbox"/>	Variable 2
<input type="checkbox"/>	Variable 3
<input checked="" type="checkbox"/>	Variable 4
<input type="checkbox"/>	Variable 5
<input checked="" type="checkbox"/>	Variable 6
<input type="checkbox"/>	Variable 7
<input checked="" type="checkbox"/>	Variable 8
<input type="checkbox"/>	Variable 9
<input checked="" type="checkbox"/>	Variable 10

Figure 10: zDigitalTwin new model page

The second button in Figure 9 opens a configuration panel, where the user can choose the model to optimize, the criteria for the optimization (minimization or maximization), and the (optional) constraints applied to the decision variables (Figure 11).

Optimization configuration

http://192.168.1.1/opt_config/

Select model: Model 1

Objective: Variable 1

Optimization criteria

Minimize Maximize

Constraints

Variable	Min	Max
Variable 2	50	70
Variable 4		
Variable 6	40	
Variable 8		100
Variable 10		

Optimize

Figure 11: zDigitalTwin optimization configurator page

When the user clicks the “Optimize” button, the optimization procedure starts: A feasible solution can be found or not. If no feasible solution is found an error message is shown (Figure 12).

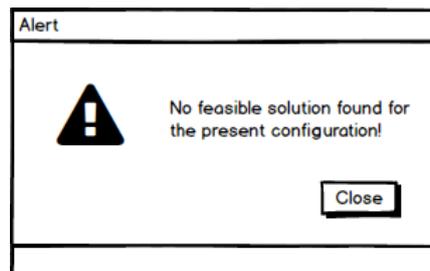


Figure 12: zDigitalTwin optimization configurator. No solution found with current settings.

If a feasible solution is found, the value of the objective variable and the values of the decision variables that lead to that solution are displayed (Figure 13).

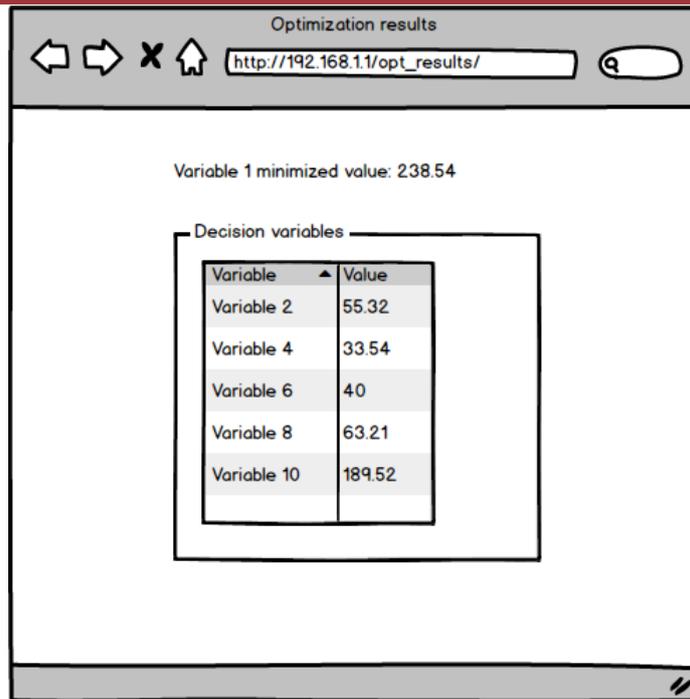


Figure 13: zDigitalTwin optimization configurator. Solution found.

The third button in Figure 9 opens a real-time monitoring dashboard. The user can select the sensors to monitor. Then, for each sensor, the application shows the observed value of that sensor and two predicted (simulated) values (each one for different time windows). On the right, user can change process parameters to simulate different scenarios and check the effect on the simulated sensors (Figure 14).

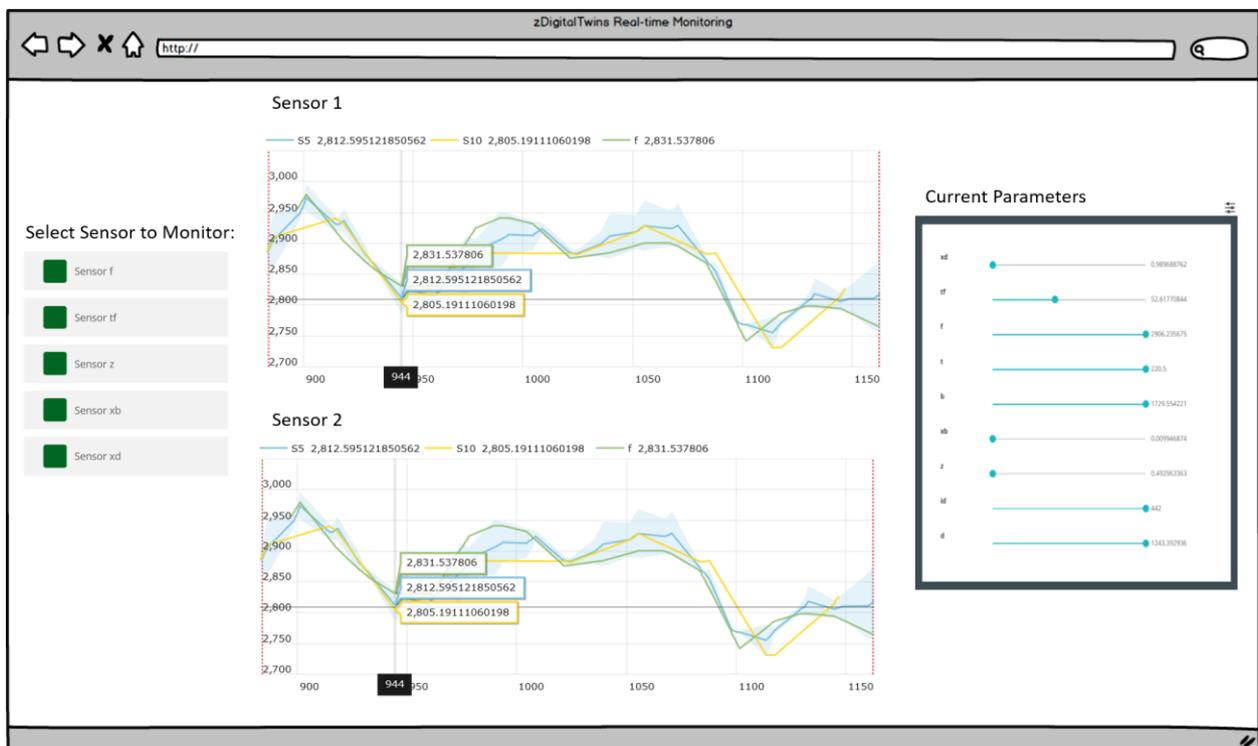


Figure 14: zDigitalTwin real-time monitor page

2.3 zA1.3 zAlarm

zAlarm enables users to receive alerts about any relevant event about the machines including on a wearable. Due to the reduced screen format and functionalities of the wearable, the user interface needs to be simple.

Considering a watch format (Figure 15), the application has four “pages”. One to inform the user a new alert must be attended to with buttons to confirm or reject the alert. Three further pages contain information on whether the alert has been correctly accepted, rejected, or assigned to someone else before the user responded.

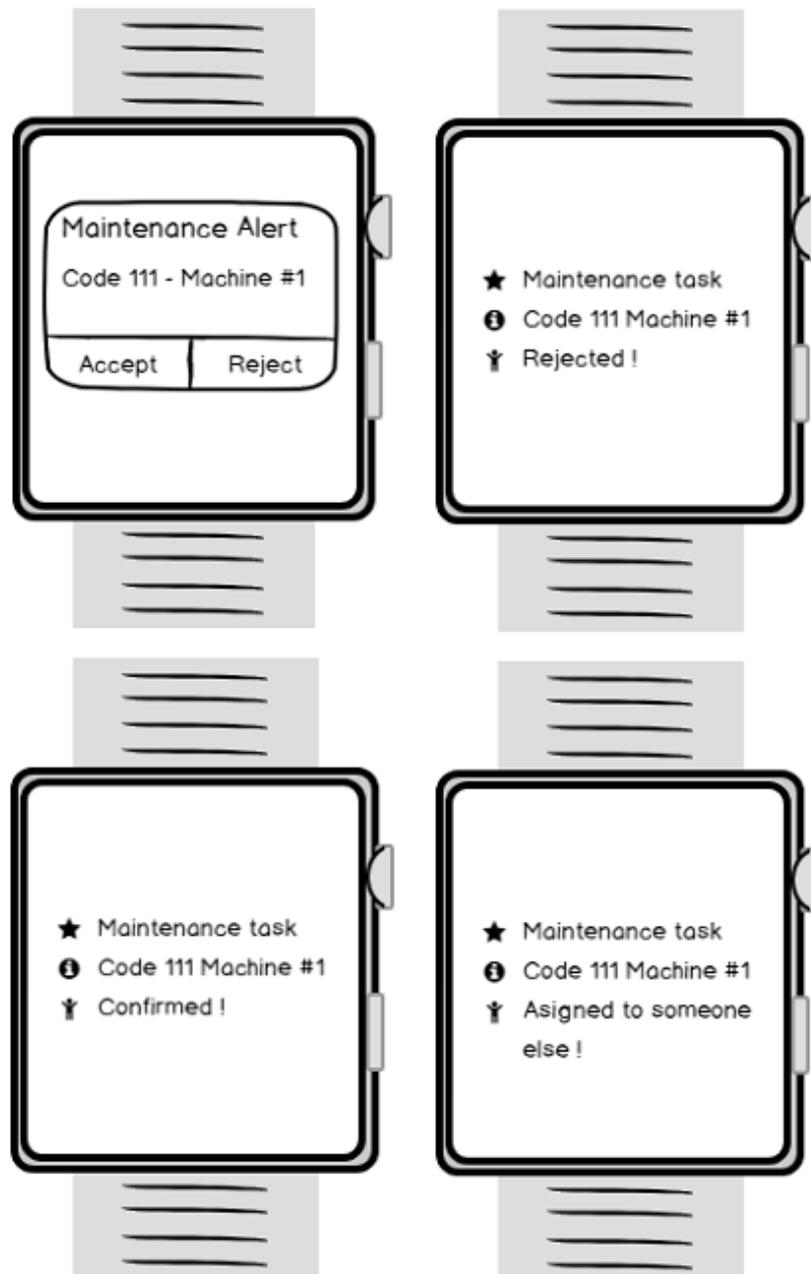


Figure 15: zAlarm main functionalities

2.4 zA2.1 zMachineMonitor

The objective of the zMachineMonitor is to visualize, search, filter, and plot the variables of any machine collected in a database. When coupled with the zMachineAnalytics, that detects deviations from standard working conditions and future degradations, it visualizes the results of the data analysis performed in cloud.

zMachineMonitor is composed by five main applications, one in each tab of the single application.

The physical variables page (Figure 16) allows searching and filtering in the time series database. The search box allows entering regular expressions to isolate the time interval and the variables registered in it. Each variable in the interval is a time series that can be opened and read in numbers or sent to a plotter.

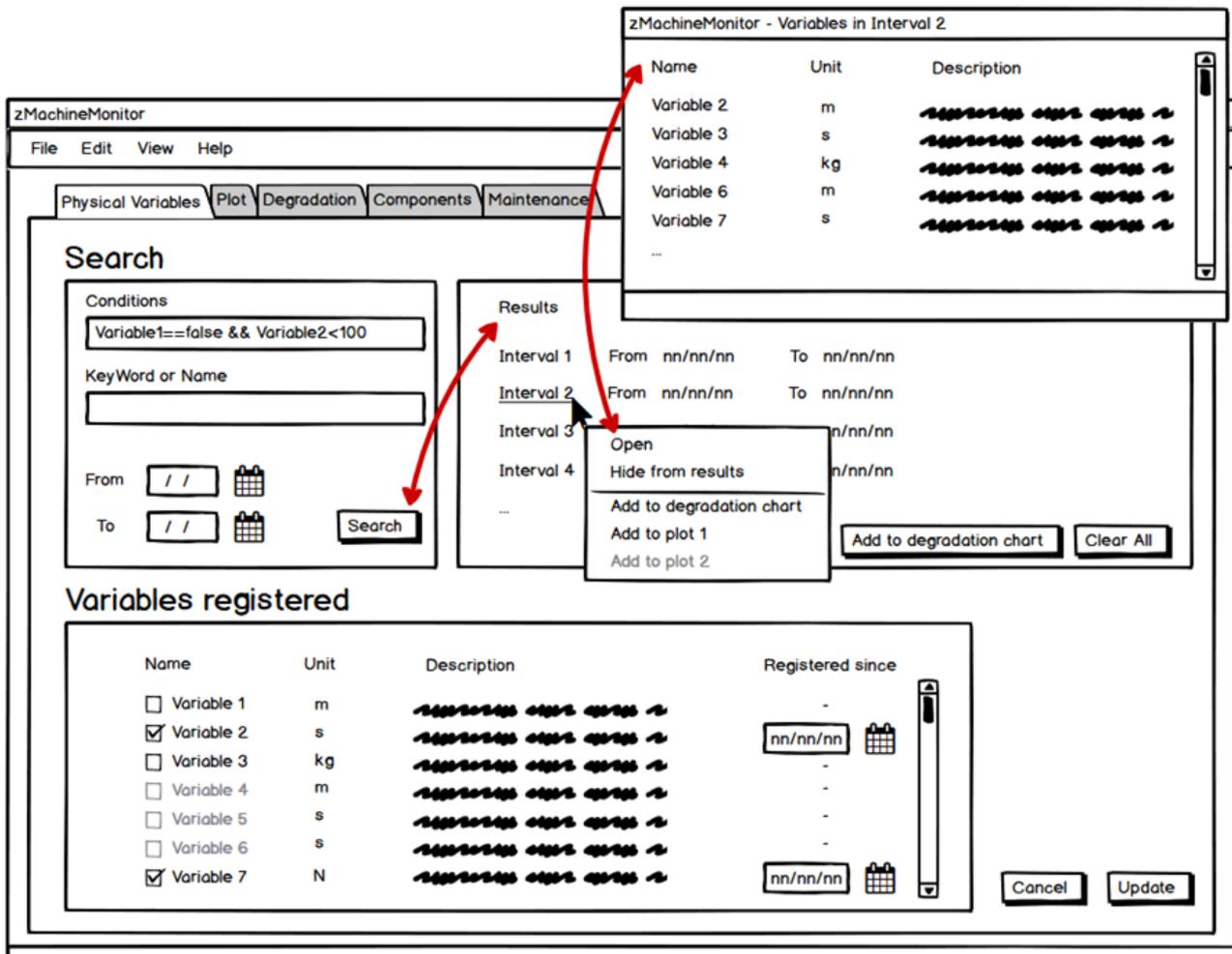


Figure 16: zMachineMonitor physical variables page

The plot page (Figure 17) allows visualisation of one or more variables in the same period.

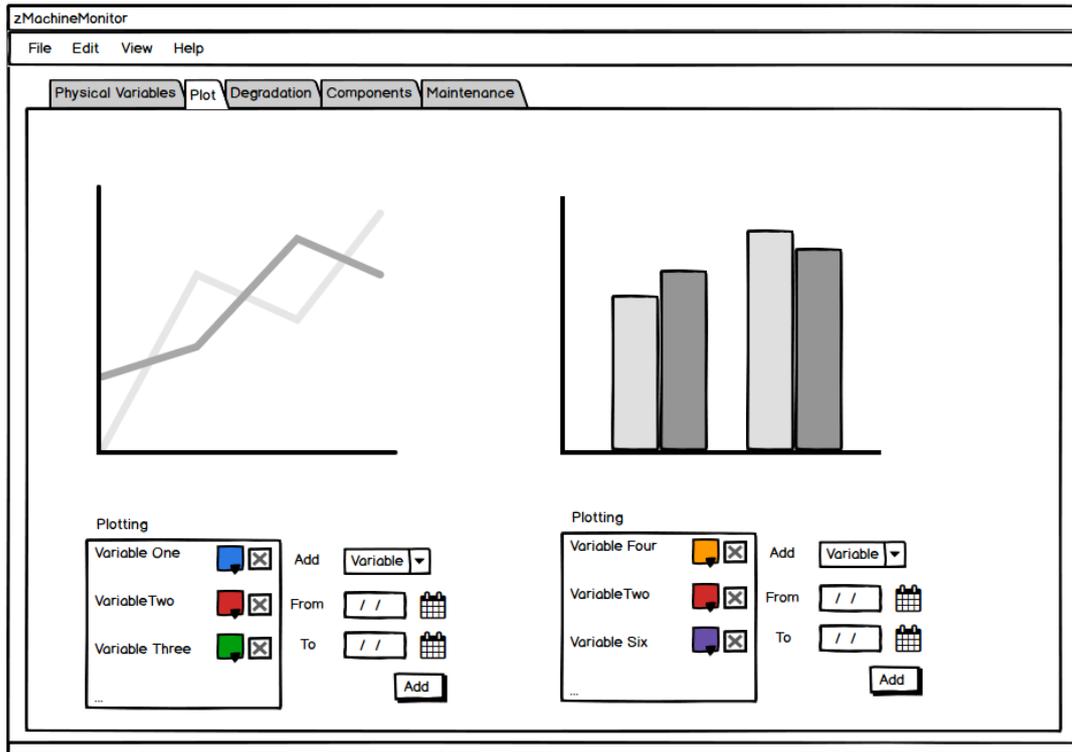


Figure 17: zMachineMonitor plot page

The degradation monitor page (Figure 18) allows the visualisation of the same variable in different time frames. This is useful to visualize the degradation of specific components.

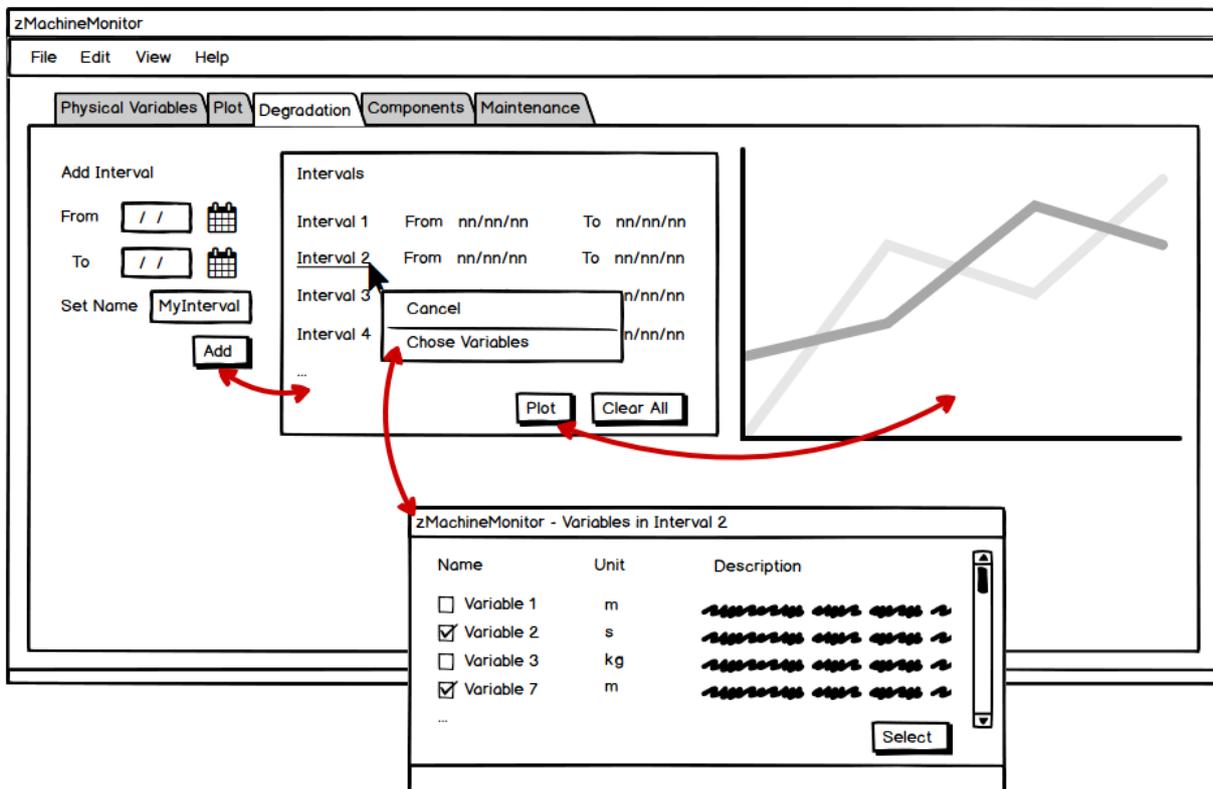


Figure 18: zMachineMonitor degradation monitor page

The components page (Figure 19) allows the visualisation of the usage time of each component. In case the component ages differently depending on other conditions. An effective usage time can be calculated as a function of the usage time. The result, is calculated, stored in the database, and is shown in the component page.

For each component, several actions are possible: to read the information, provide alerts, and to modify them.

System	Usage Time (h)	Effective Time (h)	Info	Alert	Manage
Bearings	NNN	NNNN			
Electronic Drives	NNN	NNNN			
Engine X	NNN	NNNN			
Monitoring System	NN	NN			
Lubricants	-	-			
Refrigerating System	NNN	NNNN			

Figure 19: zMachineMonitor components page

The maintenance page (Figure 20) includes a planner for maintenance interventions and shows the faults and interventions suggested by the zMachineAnalytics.

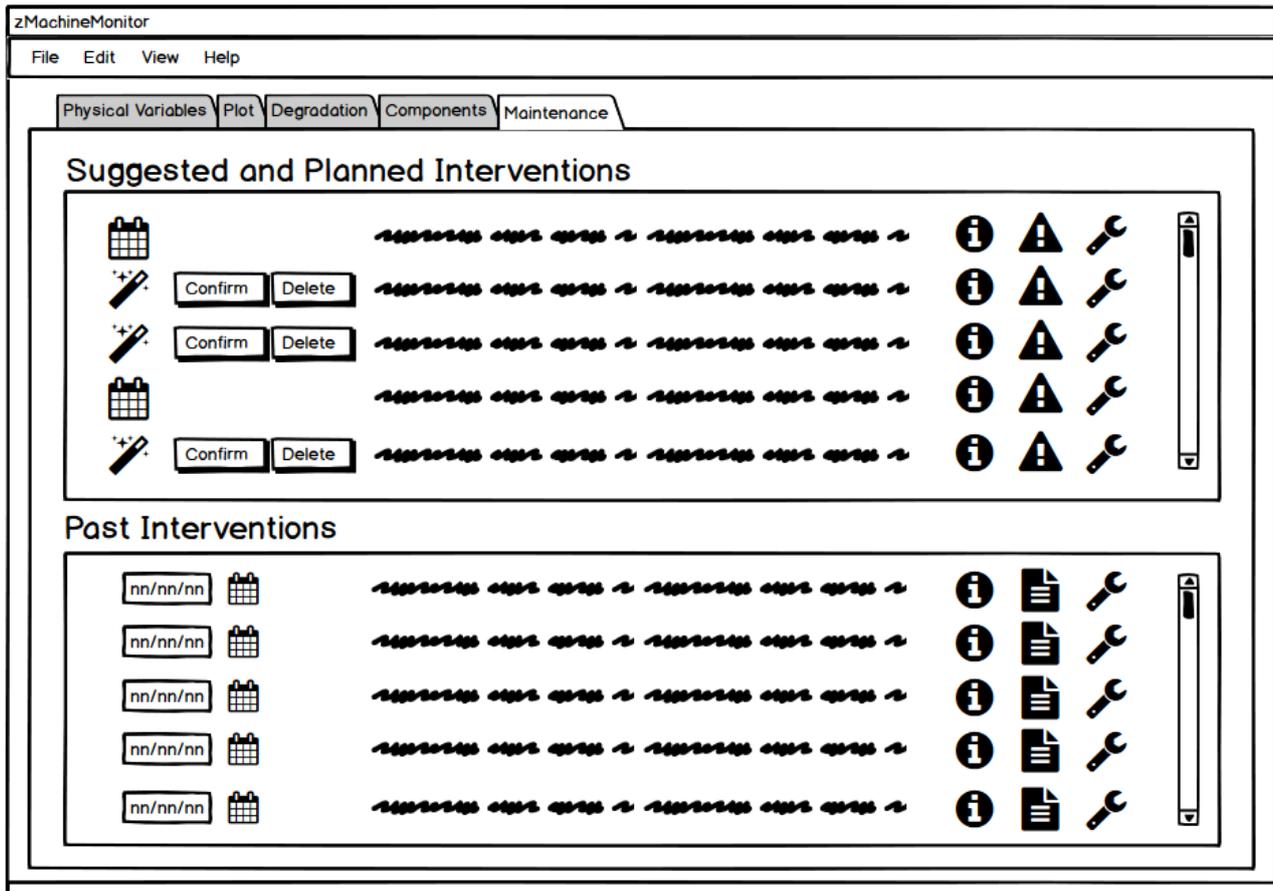


Figure 20: zMachineMonitor maintenance page

2.5 zA2.3 zParameterMonitor

The objective of zParameterMonitor is to find the best parameters set for a specific task based on the quality of previous results.

This application registers general manufacturing conditions, machine parameters, and quality results. Whenever a similar task needs to be performed under similar conditions, the zApp proposes the most similar/higher quality situation and shows the parameters used.

A page (Figure 21) is entirely dedicated to the phase before a new manufacturing operation starts. When the workpiece is placed and the machine is ready to execute, the operator accesses this page. Having as an input the current manufacturing conditions and machine characteristics, the application searches the most similar cases in its database. Then it sorts the list by results quality, suggesting possible changes, based on the zParameterAnalytics results. The operator decides whether to apply the suggested changes to the parameters.

The “Auto Correction” button skips the list of similar cases, showing directly to the operator the best fitting result. The “Quality Advice” button allows the operator to navigate the list and see the different results.

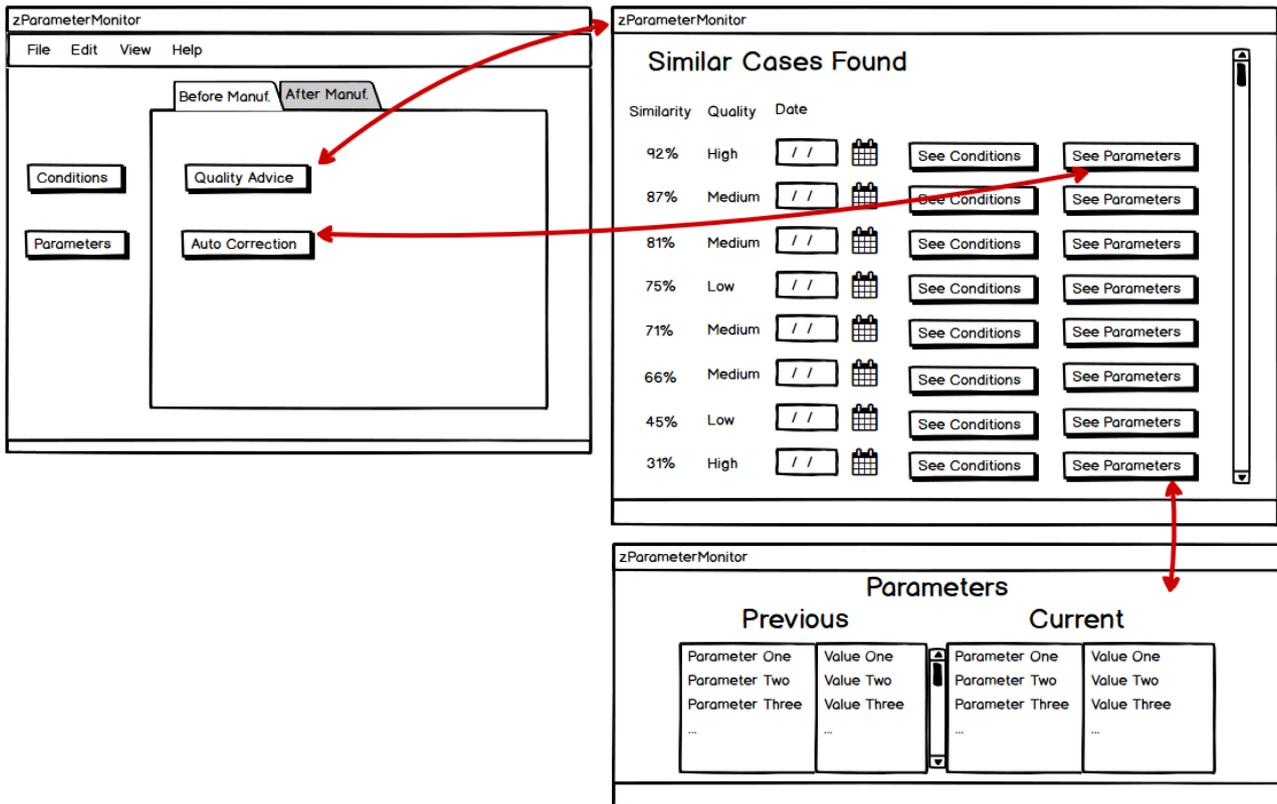


Figure 21: zParameterMonitor before manufacturing page

After the manufacturing operation has finished, the application registers the newly obtained data in the cloud, to enrich the database. A page (Figure 22) is dedicated to the end of the manufacturing operations. At this stage, it automatically gathers the set of conditions, the set of parameters, and ask to the operator a feedback on the quality manufactured component. All this information is saved and stored in ZDMP database.

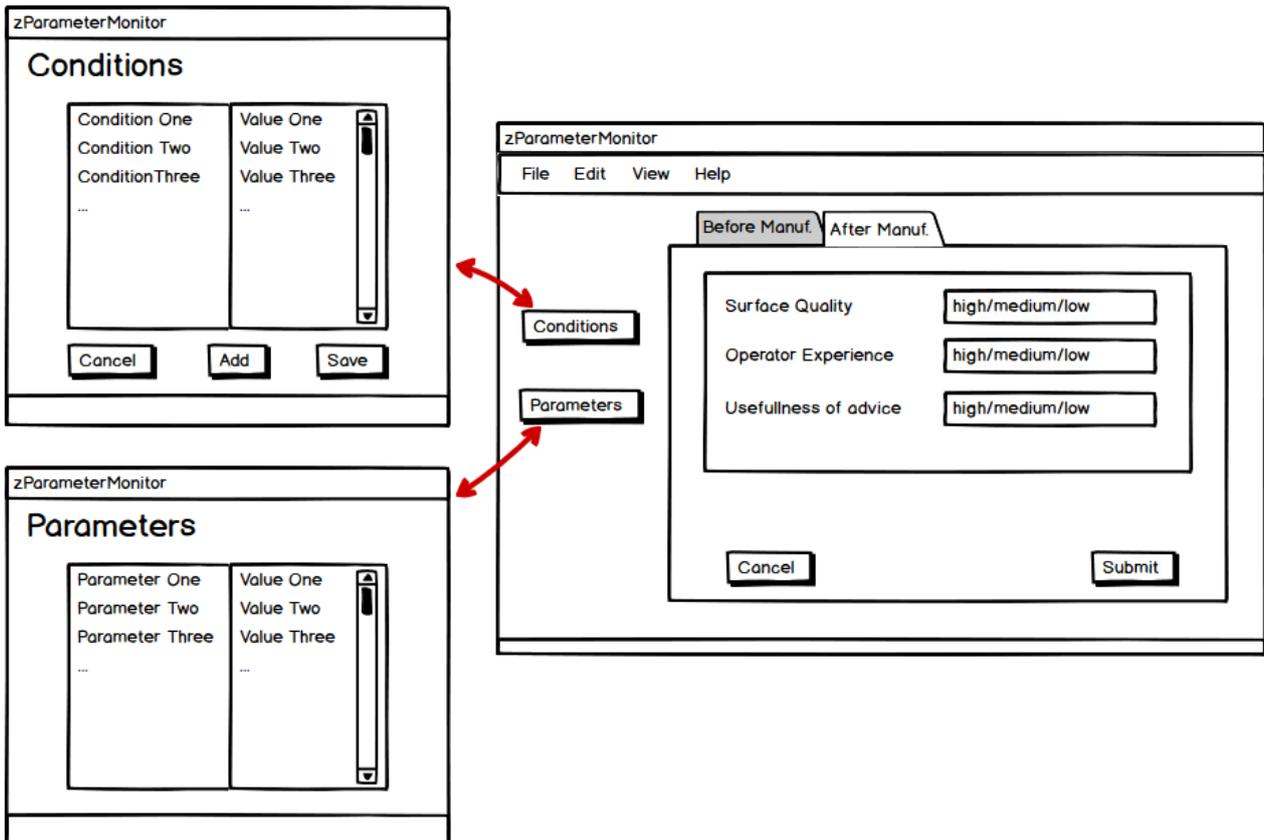


Figure 22: zParameterMonitor after manufacturing page

2.6 zA2.6 z3DGenerator

The objective of z3DGenerator is to generate a file in a model format from a collection of points. This collection, or cloud of points, is gathered with a scanner. It is then uploaded in ZDMP database, where the z3DGenerator runs. This zApp cleans the cloud of points, converts it in 3D format and, if needed, simplifies it also in term of memory occupation. The output is a 3D .stl file.

Figure 23 shows the main page of z3DGenerator. It includes two lists: the first, on the left, includes all the original files in the cloud of points format, the second, on the right, lists the converted files saved. A new source file can be uploaded by selecting it in the local folder a give it a name.

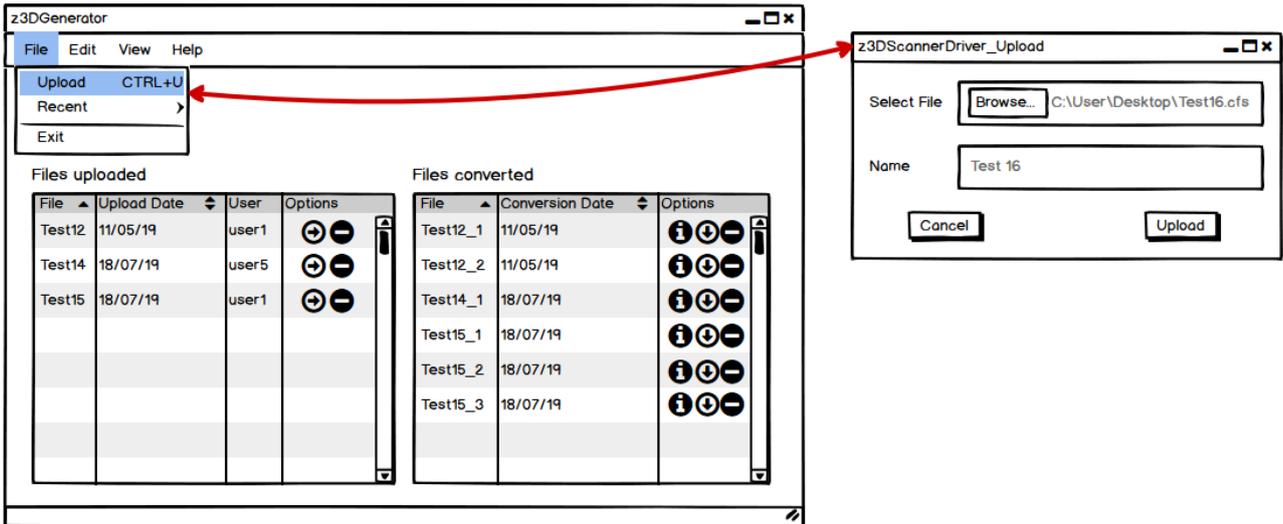


Figure 23: z3DGenerator main page and upload new source file

Each item in the “Files uploaded” list has two options: convert and delete. When the convert button is pressed, a configuration window is opened (Figure 24) to allow selecting the desired conversion parameters. Once converted, a new entry appears in the list on the right. Each source file can be converted several times, to allow the users to try different settings configuration.

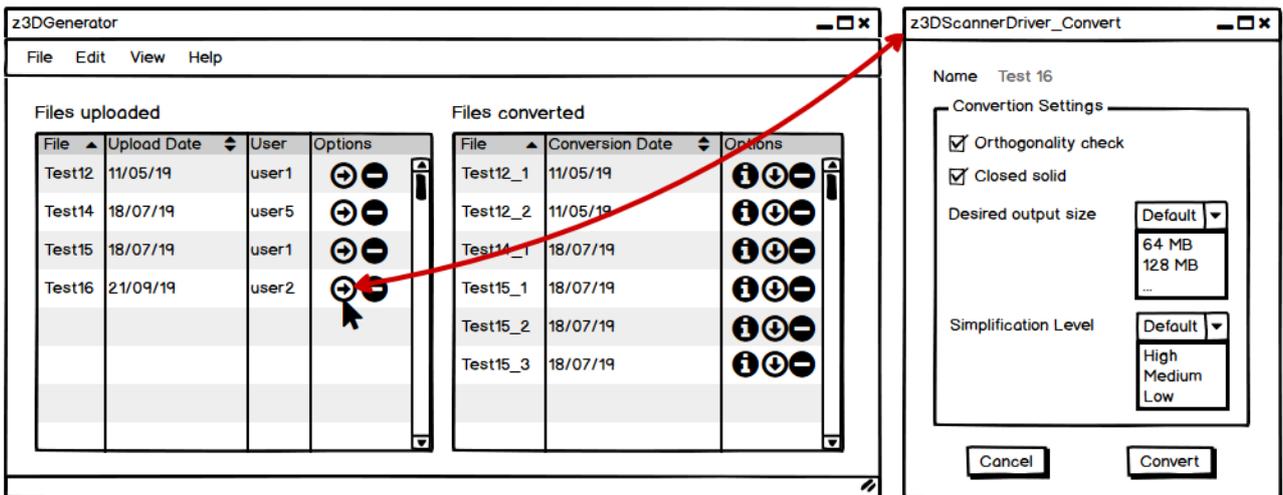


Figure 24: z3DGenerator conversion window

Each item in the “Files converted” list has three options: see information, download, and delete. When the info button is pressed a window is opened (Figure 25) providing information on the applied settings and on the conversion results.

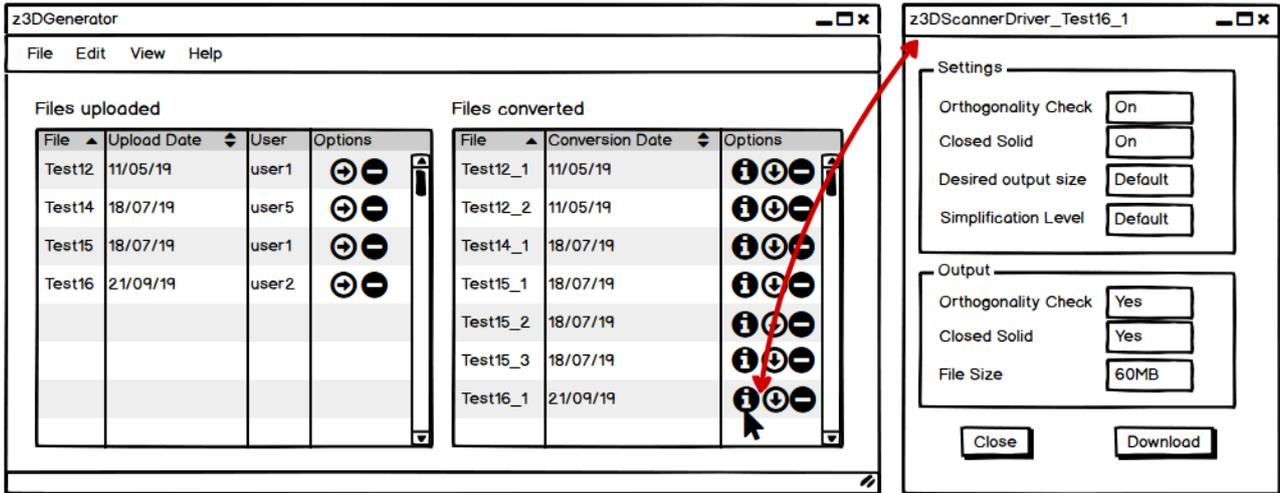


Figure 25: z3DGenerator information window

In addition to z3DGenerator, a driver can be installed locally. The objective of zApp2.5 z3DScannerDriver is to be automatically upload the source file in the z3DGenerator and start the conversion every time a new scan is made by the operator. The only purpose of its graphical interface (Figure 26) is to ask for the explicit confirmation of the operator before uploading the file and start the conversion. The same graphical interface can include an area with the settings for the conversion, which, if unfilled, has default values.

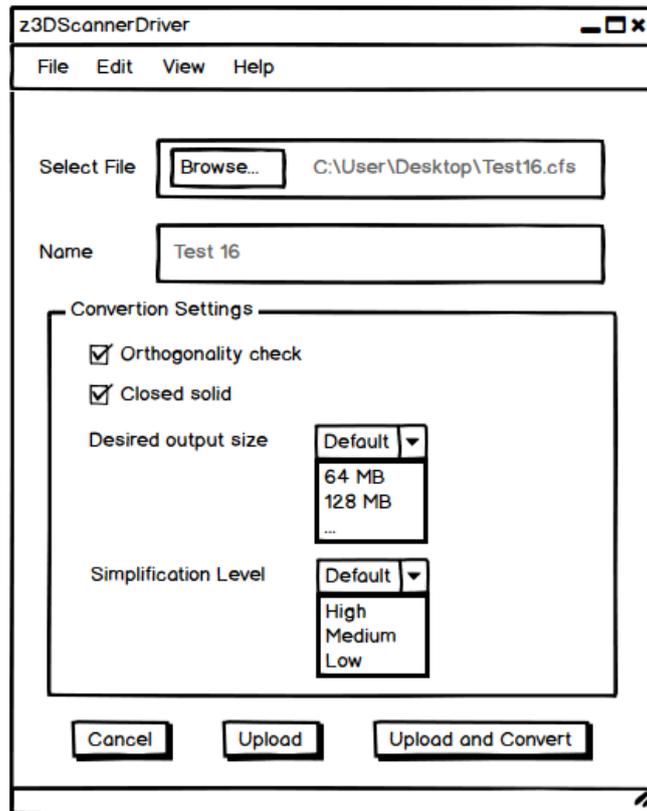


Figure 26: z3DScannerDriver

2.7 zA3.1, zA3.2 X-ray equipment

The two zApps zXRAYMonitor and zXRAYAnalytics both refer to x-ray measurements. In this section they are presented as two collections of functionalities part of a same graphical interface, since from the user perspective of using the two applications on the same computer this is the ideal scenario. Another scenario could involve, for example, the use of the analytical tool from a computer that has no control on an x-ray machine, therefore only using zA3.2 in an isolated form.

The objective of zXRAYMonitor is to automatically start the correct inspection program from the library, depending on the sample under testing and to make the comparison of the XRAY/CT information and the sample drawing & specification. For each type of material / sample, a set of special characteristics in the XRAY/CT library will be generated, measured, and controlled with the dedicated software.

The objective of zA3.2 zXRAYAnalytics is to compare new measurement results to results from previous analysis and to generate statistical analysis and the deviation overview, trend line of measurements, including graphical representations.

The zXRAYMonitor interface allows users to access all the features of the XRAY/CT applications. Figure 27 shows the menus available in the home page of the zApp. These functions allow the viewing of the results, to run new analysis, and configure the parameters for the x-ray acquisition, for the analysis and for the reconstruction processes.

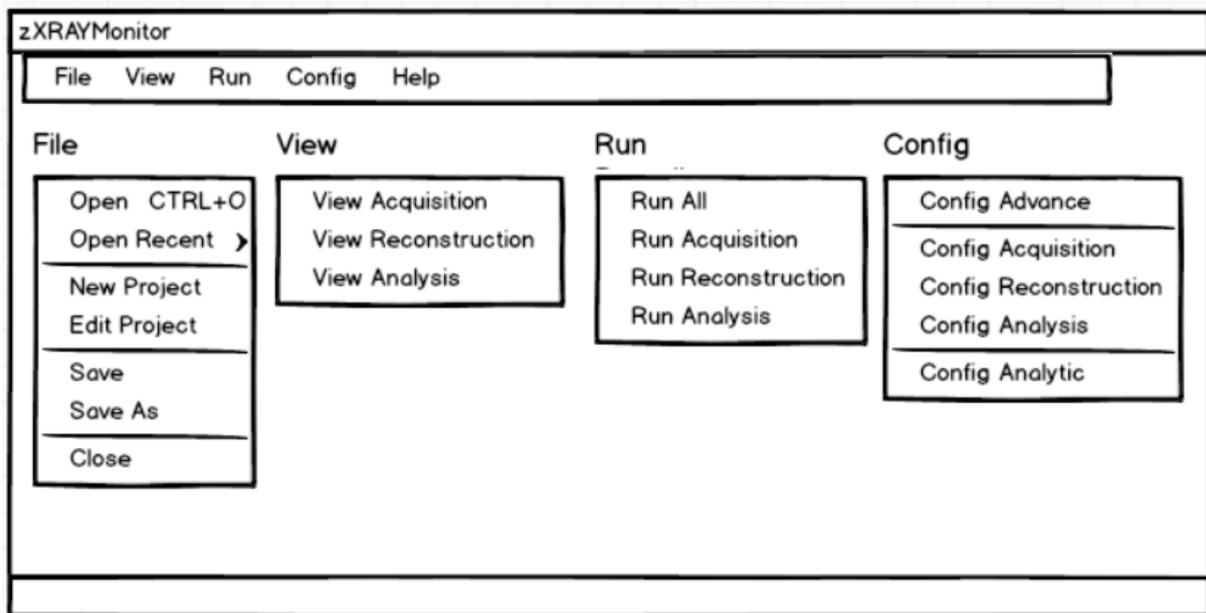


Figure 27: zXRAYMonitor home page and menus

“New project” opens a page (Figure 28) allowing the configuration of the XRAY acquisition, its reconstruction, analysis, and analytic interface. The user should specify only the material serial number (scan or setup manually), whilst for the rest of the configuration parameters the default values can be used.

zXRAYMonitor_New_Project

Working directory:

Path_Project\ Save Cancel

Config zXRAYMonitor

Scan/setup serial number Config_Acquisition

Config_Reconstruction Config_VGStudio_Analysis

Config zXRAYAnalytics

Config_Analytics_input Config_Analytics_output

Figure 28: zXRAYMonitor new project

“Configuration advance” opens a page (Figure 29) to specify the program used for acquisition, reconstruction, analysis, and analytics. The default value from for the path and program names do not need to be change for the standard installation packages.

zXRAYMonitor_Advance

XRAY acquisition program

Path_default\aqisition_program.exe

XRAY reconstruction program

Path_default\reconstruction_program.exe

XRAY analysis program

Path_default\analysis_program.exe

XRAY analytic program

Path_default\analytic_program.exe

Save Cancel

Figure 29: zXRAYMonitor configuration advance page

The “View” menu allows opening interfaces (Figure 30) to display the list of the measurements and make a comparison with threshold values. The input measurement report is an HTML file that includes the test name, results values, thresholds, and pass or fail information.

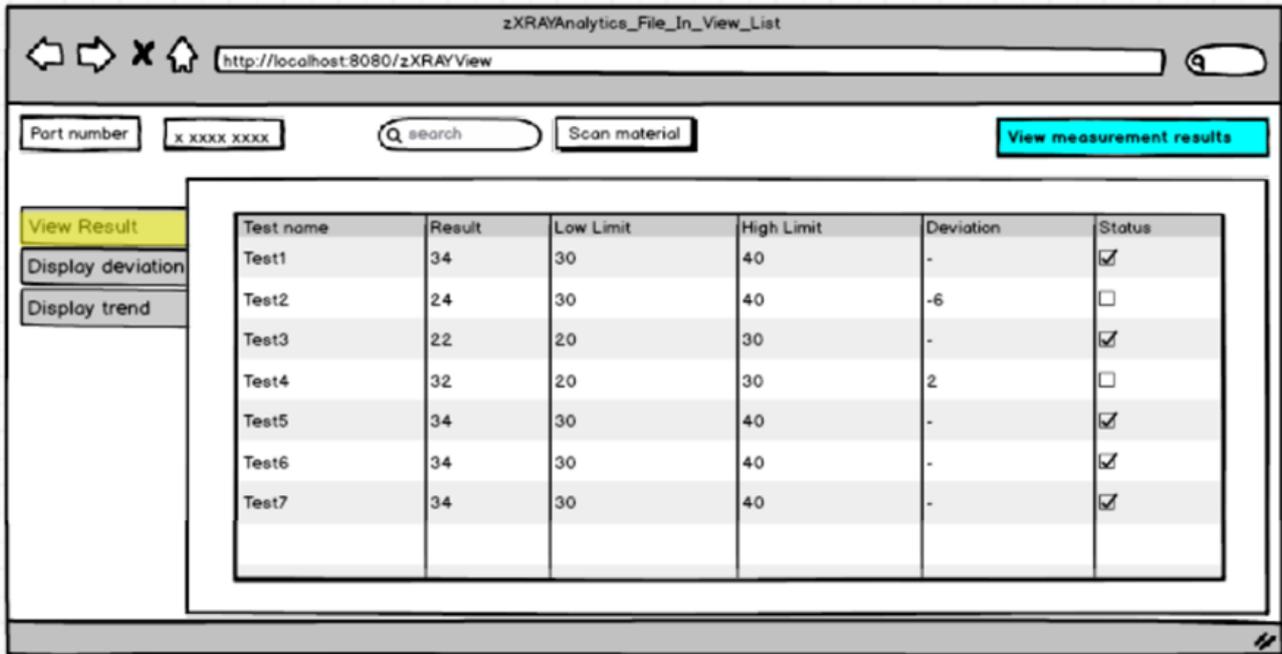


Figure 30: zXRAYAnalytics view results page

In the same page, the “display deviation” button opens an interface (Figure 31) to display the measurements results in a graphical format. The low limit and high limit will be indicated for each measurement in the graphic format.



Figure 31: zXRAYAnalytics display deviation page

On the same page, the “display trend” button opens an interface to display the current measurement results comparing them with previous measurements. The interface

provides the possibility to have a view of the last week measurement, last months or years.

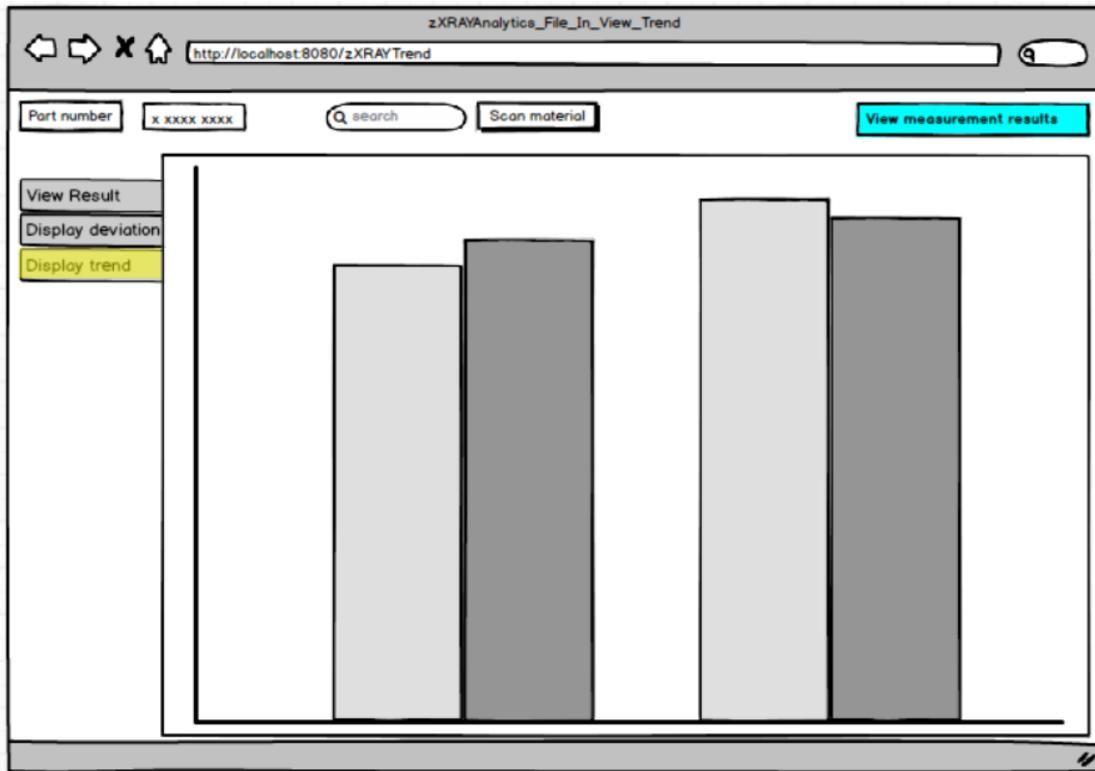


Figure 32: zXRAYAnalytics display trend page

2.8 zA3.3 zFeedbackMFT

The two zApps zFeedbackMFT and zArtificialIntelligenceMFT both refer to MFT measurements. zA3.3 has a user interface; it ensures the interface with MFT, collects images and operator optical inspection decisions as well as and leaked parts information. The collected information is then stored in a database and used by zA3.4. zA3.3. It can also show results from the artificial intelligence analysis.

The zFeedbackMFT interface allows users to access all the features of the MFT applications. Figure 33 shows the menus available in the home page of the zApp. These functions allow viewing of the results, running new analysis, and configuring the parameters for the MFT acquisition and the AI analysis of the zArtificialIntelligenceMFT.

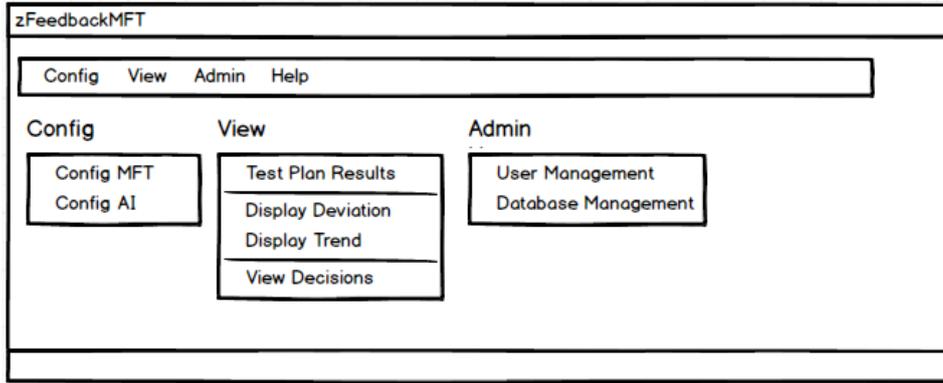


Figure 33: zFeedbackMFT home page and menus

“Configure MFT” opens a page (Figure 34) for the configuration of the Manual Final test specifying the storage location for the picture, camera location, and database configuration.

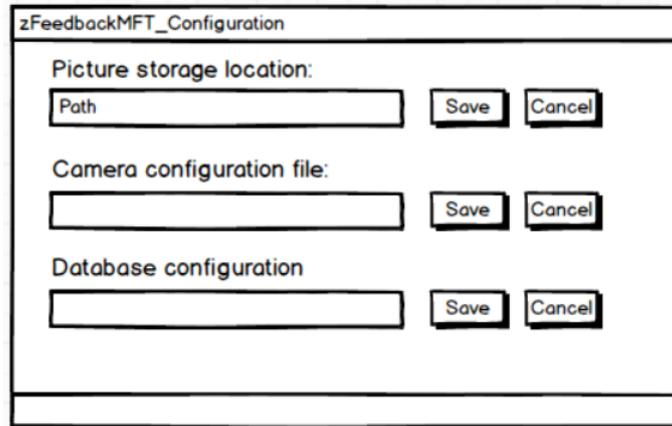


Figure 34: zFeedbackMFT configure MFT

“Configuration AI” opens a page (Figure 35) to permit the configuration of the Artificial Intelligence algorithms. All possible entries and parameters for this page will be agreed with the partners developing zArtificialIntelligenceMFT after the developments of the AI algorithms and relative ZDMP building blocks, depending on the actual implementation.

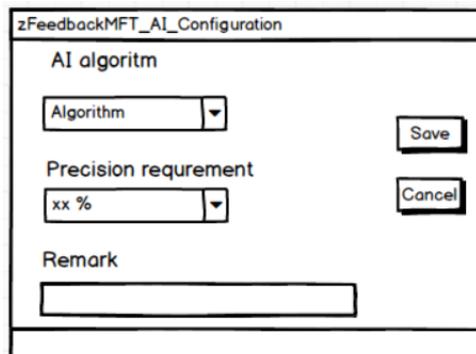


Figure 35: zFeedbackMFT configuration AI

The “View” menu allows to open interfaces (Figure 36) to display the test results of a specific serial number and allows easy access to the error details (pictures, operator decision details, test number). The “scan material” button allows to scan or specify

manually a unit under test serial number. The scan matrix code has usually 13 characters and the software should accept maximum 32 characters.

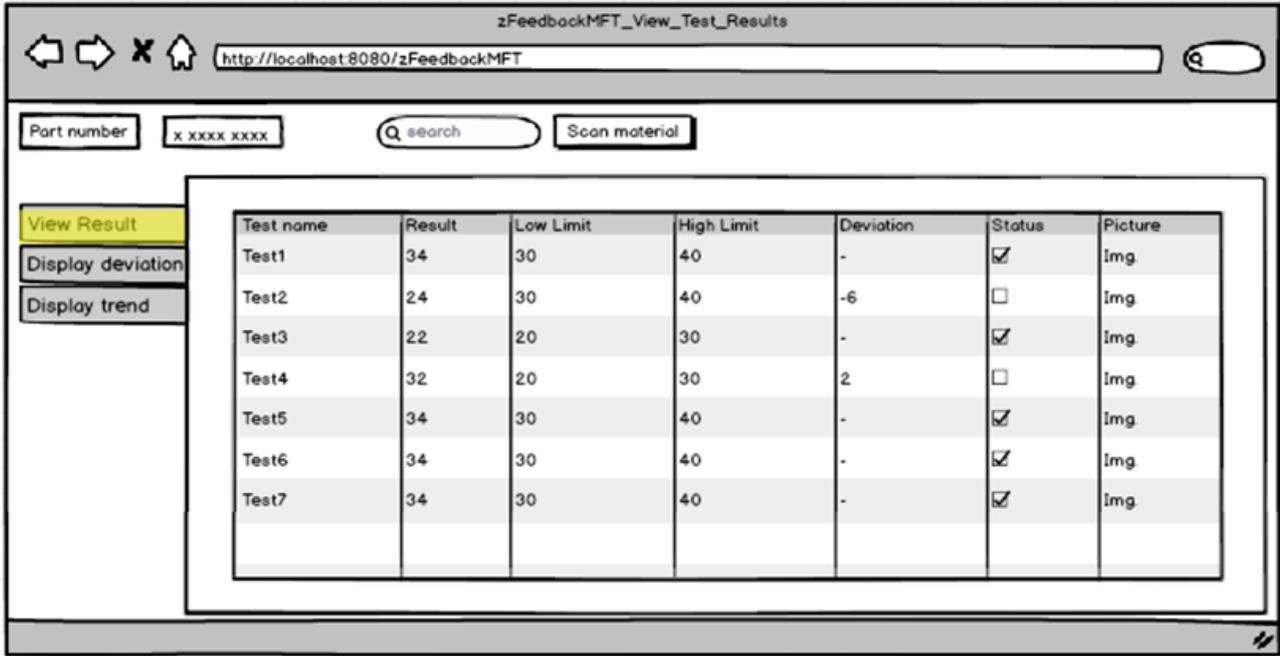


Figure 36: zFeedbackMFT view results page

In the same page, the “display deviation” button opens an interface (Figure 37) to display all the measurements results of the specified serial number in the graphical view. The low limit and high limit will be indicated for each measurement in the graphic format and the link to the pictures is available. If the part was tested more times all the measurement results will be indicated and group on specific test.



Figure 37: zFeedbackMFT display deviation page

On the same page, the “display trend” button opens an interface (Figure 38) to display the current measurement results comparing them with previous last measurements. The interface provides the possibility to have a view of the last week measurement, last months or years.

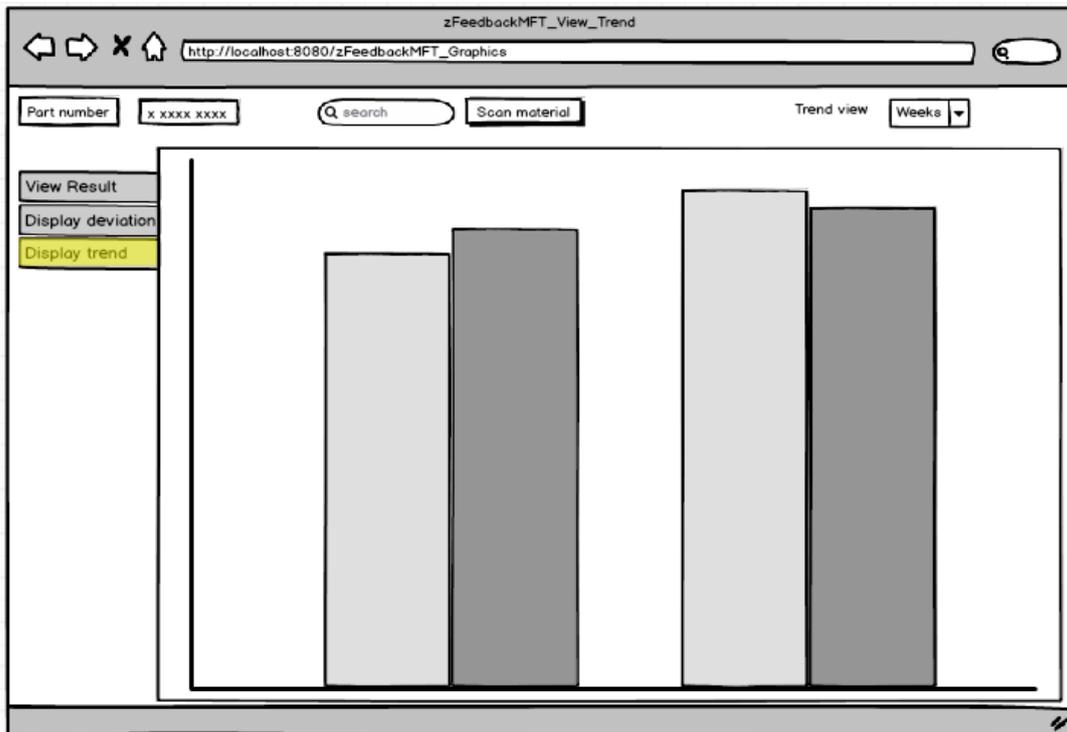


Figure 38: zFeedbackMFT display trend page

The “view decisions” button opens an interface (Figure 39) to display information regarding the test results and decisions made on the specific serial number for the relevant station from process flow.

Station	Date	Hour	Result	Details & errors
AFT	2019.08.01	12:00	Fail	Picture_SN_xx
AFT	2019.08.01	14:03	Pass	Picture_SN_xx
Analysis	2019.08.01	13:00	Pass	Display in limit
MFT	2019.08.01	14:04	Pass	Picture_SN_xx
OMFT	2019.08.01	14:04	Pass	Operator MFT decision
Customer	2019.10.01	12:00	Fail	Picture_SN_xx

Figure 39: zFeedbackMFT view decisions page

The “error information” page (Figure 40) allows the operator to provide more information about the product defect and the area. The selection of the area is performed with a mouse and the operator can select the defect type from the list. The interface is displayed at the Operator Manual Final Test station.

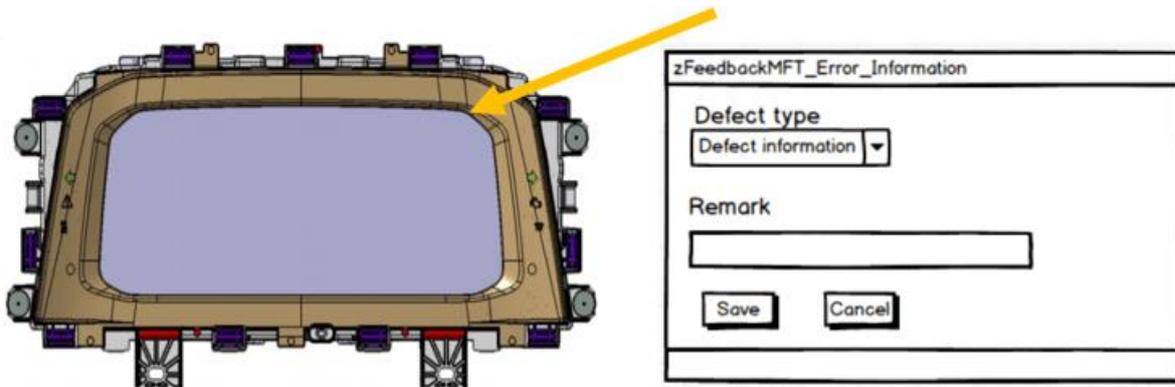


Figure 40: zFeedbackMFT error information page

2.9 zA3.5 zFeedbackAFT

The two zApps zFeedbackAFT and zArtificialIntelligenceAFT both refer to AFT measurements. zA3.5 has a user interface; it ensures the interface with AFT, collects images and operator optical inspection decisions, as well as leaked parts information. The collected information is then stored in a database and used by zA3.6. zA3.5. It can also show results from the artificial intelligence analysis.

The zFeedbackAFT interface allows users to access all the features of the AFT applications. Figure 41 shows the menus available in the home page of the zApp. These functions allow viewing of the results, running new analysis, and configuring the parameters for the AFT acquisition and the AI analysis of the zArtificialIntelligenceAFT.

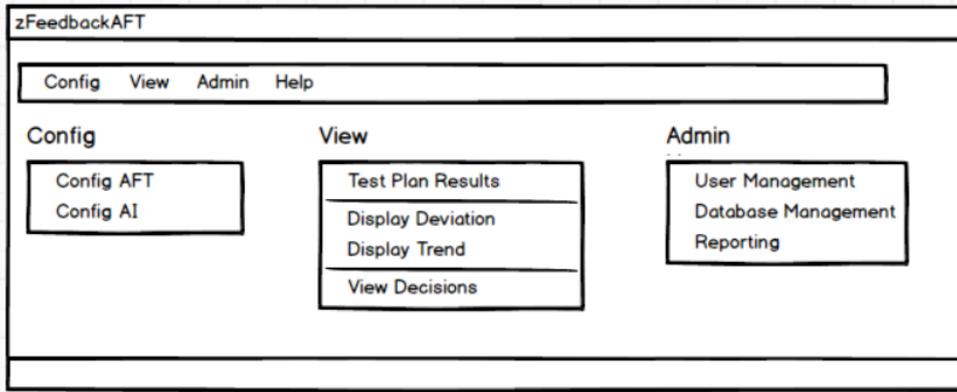


Figure 41: zFeedbackAFT home page and menus

All zFeedbackAFT functions, with the sole exception of the error information page, mirrors the zA3.3 zFeedbackMFT structure. Its mock-up is therefore similar, including pages for AFT configuration, AI configuration, view results, display the deviation, display the trends, and view the decisions.

zFeedbackAFT also includes a reporting interface (Figure 42) to allow the administrator to setup the reporting system for the specified user (email address).

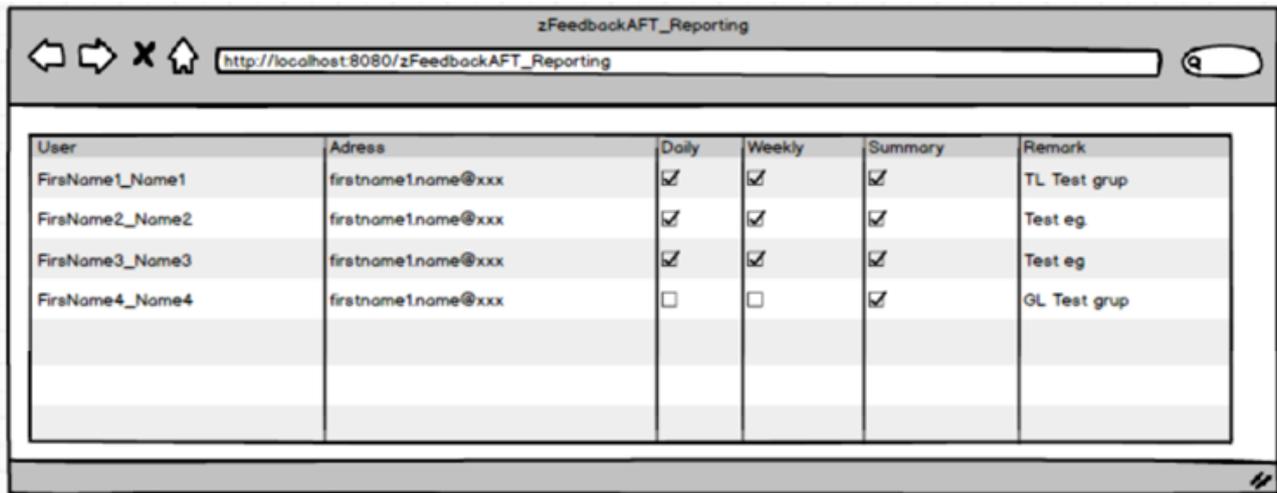


Figure 42: zFeedbackAFT reporting page

2.10 zA3.7 zDriver

The objective of zDriver is to act as an interface between the equipment and the line server database. Communication is assured based on client server protocol on a predefined set of parameters with an extensible data table.

The application (Figure 43) monitors the information exchange, stored as messages, which can also be filtered for compact views. The application can be configured to support both local and network equipment.

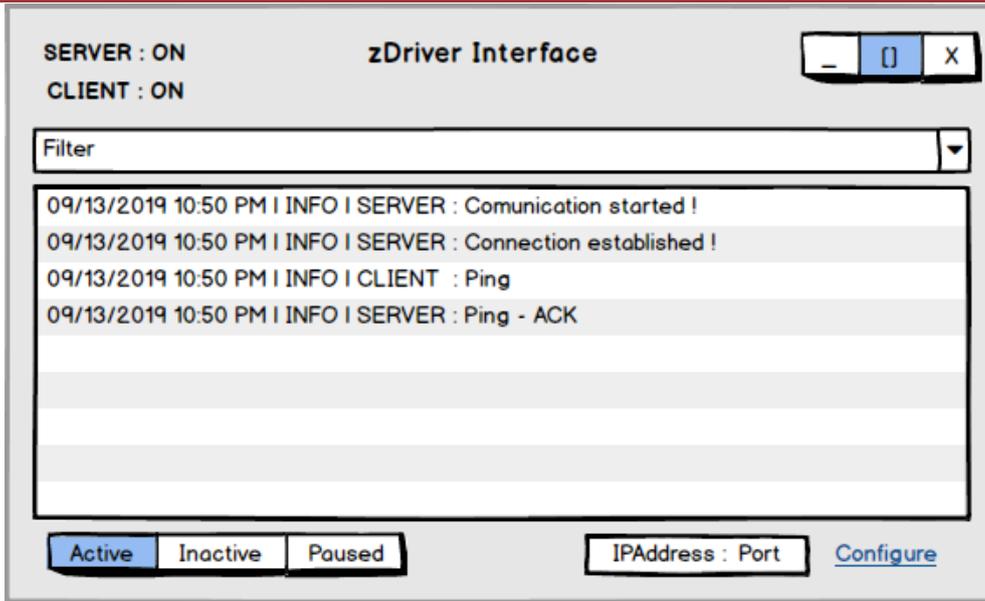


Figure 43: zDriver interface

2.11 zA3.8 zLineData

zLineData stores data received from zDriver and perform KPI calculations. It displays useful information about each transaction (Figure 44), as well as warning or errors notifications.

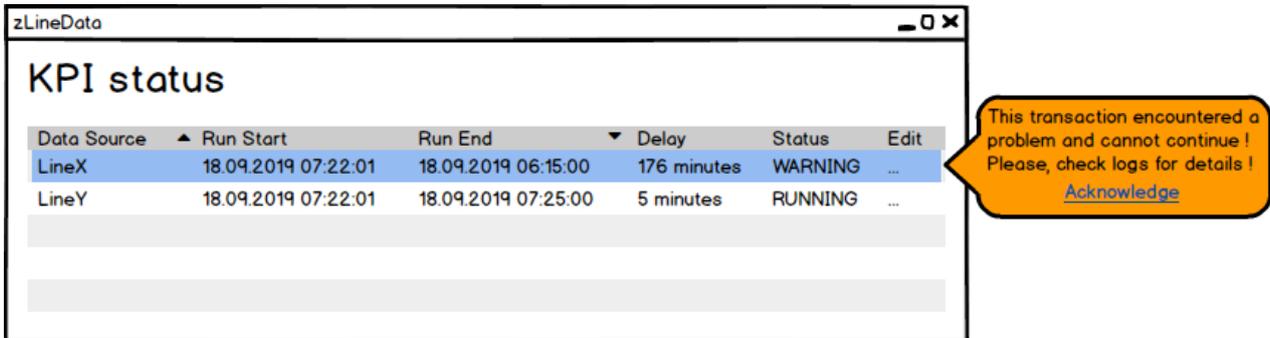


Figure 44: zLineData status page

Setting up KPIs for a line, requires defining a list of events, fired up when new data is coming from xDriver. The User can setup (Figure 45) a delay threshold value for warning popups, as well as logging errors if any.

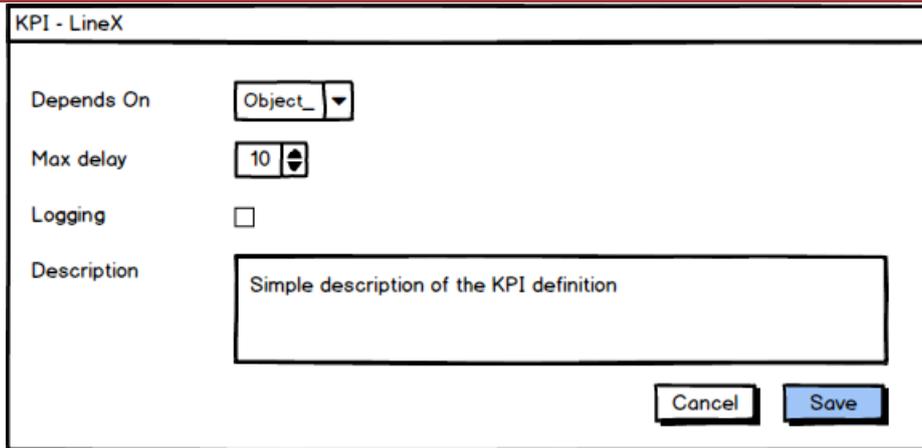


Figure 45: zLineData KPI page

2.12 zA3.9 zVisualManager and docking zApps

zVisualManager is a web application that allows the visualization of data, information and results coming from a variety of zApps for the assembly line monitoring. It allows a unique access point to all these different applications, that can be docked in different pages on the zVisualManager.

zA3.10 zProductVersionControl allows a user to make setup/change all in one transaction. The user selects the right material and the application maps all the requirements for given product. Results are shown in the zVisualizationManager.



Figure 46: zProductVersionControl

zA3.11 zAutomaticCall allows to configure availability time of support personnel. It shows a view (Figure 47) in which user can read previously stored configurations.

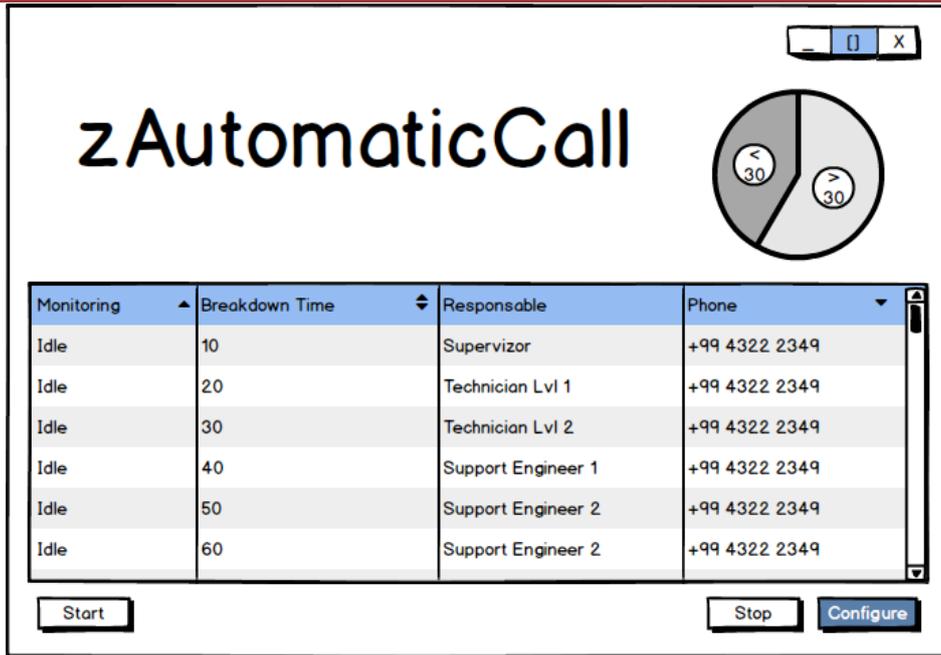


Figure 47: zAutomaticCall

zA3.12 zPowerManager monitors line’s activity in order to optimize the power delivery for each piece of equipment. If the production is finished, the power delivery is reduced.

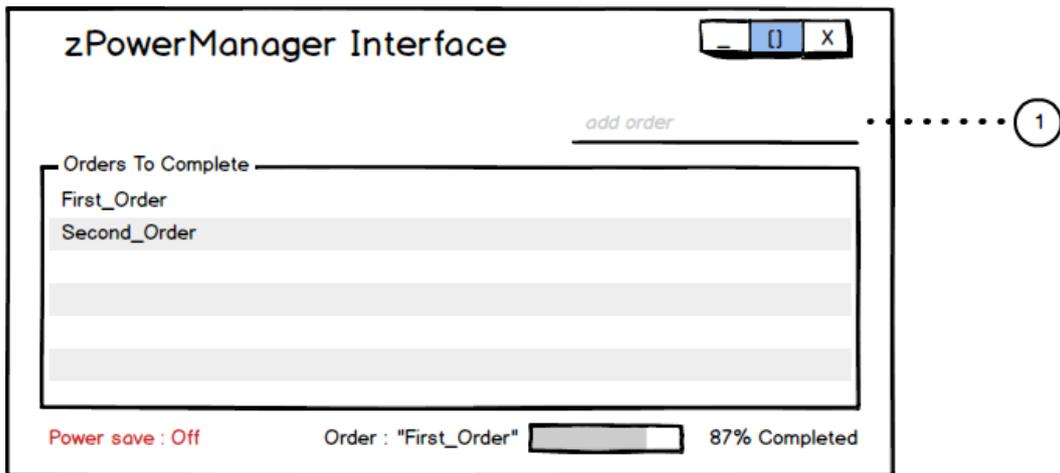


Figure 48: zPowerManager

The user can add a production order to the queue by filling in a field (1, in the picture) with the order name. When an order is finished, it is removed from the list. If the list is empty, it means that the production is finished, and power delivery can enter a power saving mode.

zA3.13 zCycleTimeManager measures and stores the current cycle times and translates data to production KPIs (OEE). It allows setting new nominal values for a cycle on a specific line or for all lines. It also evaluates the OEE based on current values, showing the simulation as a chart view based on time (Figure 49).

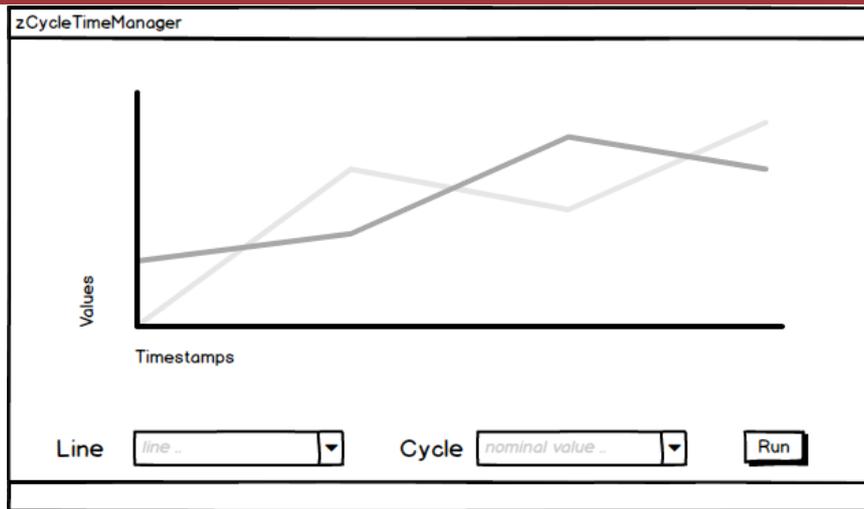


Figure 49: zCycleTimeManager

zA3.14 zAutomaticMaterialOrdering maintains the status of materials on-line and, based on production needs, makes a request for needed materials from logistics. The application evaluates materials based on Product definitions stored in database at setup/change (Figure 50).

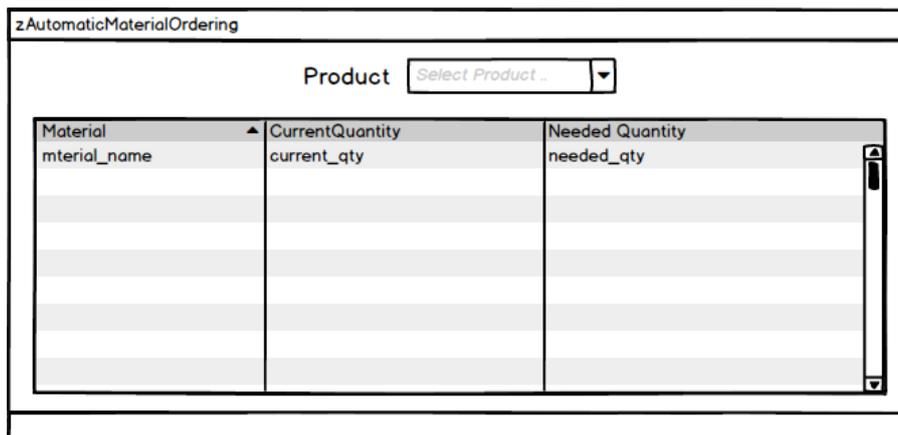


Figure 50: zAutomaticMaterialOrdering

zA3.15 zDataArchiveControl is a tool used for archiving, restoring, cleaning the database. The interface is used to configure agents to run as services to perform above operations. In the configuration window (Figure 51) a user can select an activity to run as a service. Activity options are: Archive, restore, and clean. Also, a datetime must be set to define when the service must run selected activity.

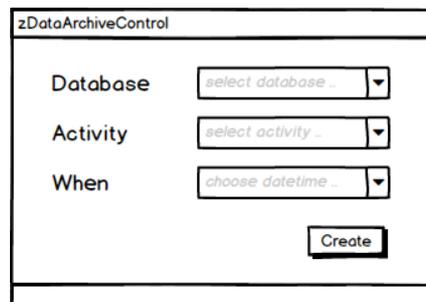


Figure 51: zDataArchiveControl

2.13 zA4.1, zA4.2, zA4.3, zA4.4 Steel Tubes

The Steel Tube Use Case described in Deliverable D2.3 identified four zApps. However, their mock-ups are presented in a single solution. As illustrated in Figure 52, three types of users have been identified: Operator, Project manager, and the Administrator. They each have different permissions and thus a login is necessary.

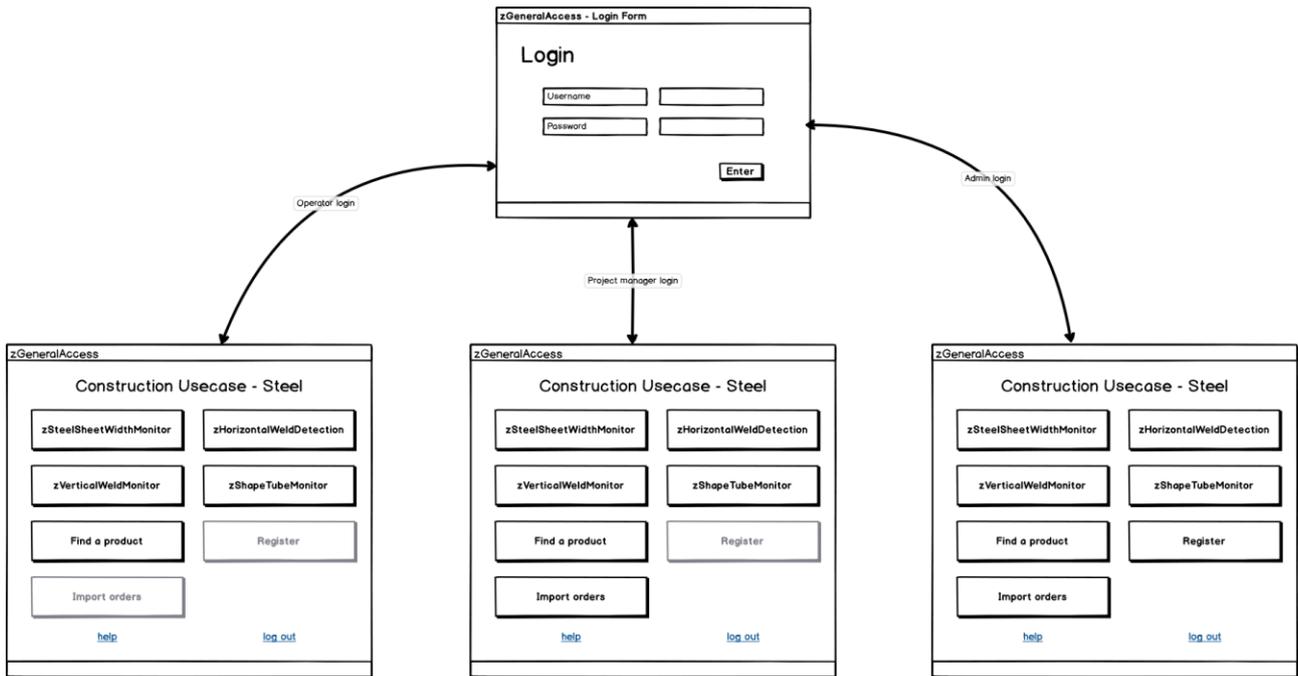


Figure 52: Login Menu

After the user logs in, the Main Menu of Figure 53 appears. This menu is the connection with the different zApps.

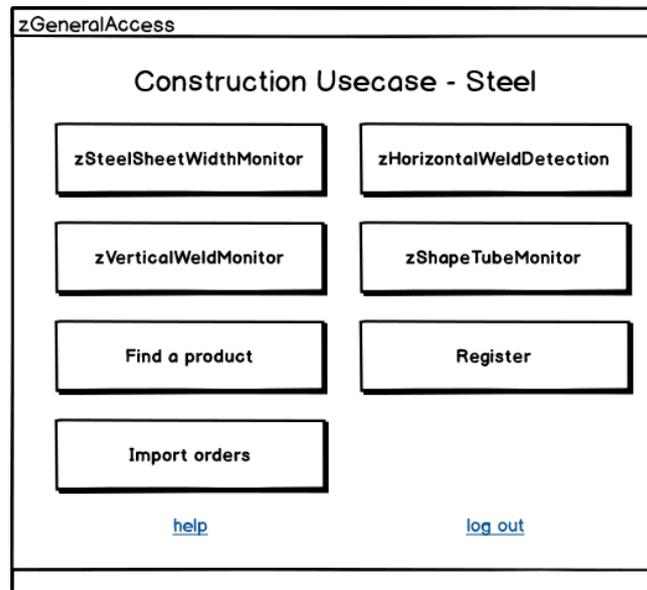


Figure 53: Main Menu.

In Figure 54, the Register Menu is illustrated. In this menu, the Administrator and the Process Manager have permissions to access it, giving the possibility to create new users, by defining name, company, type of user, and password.

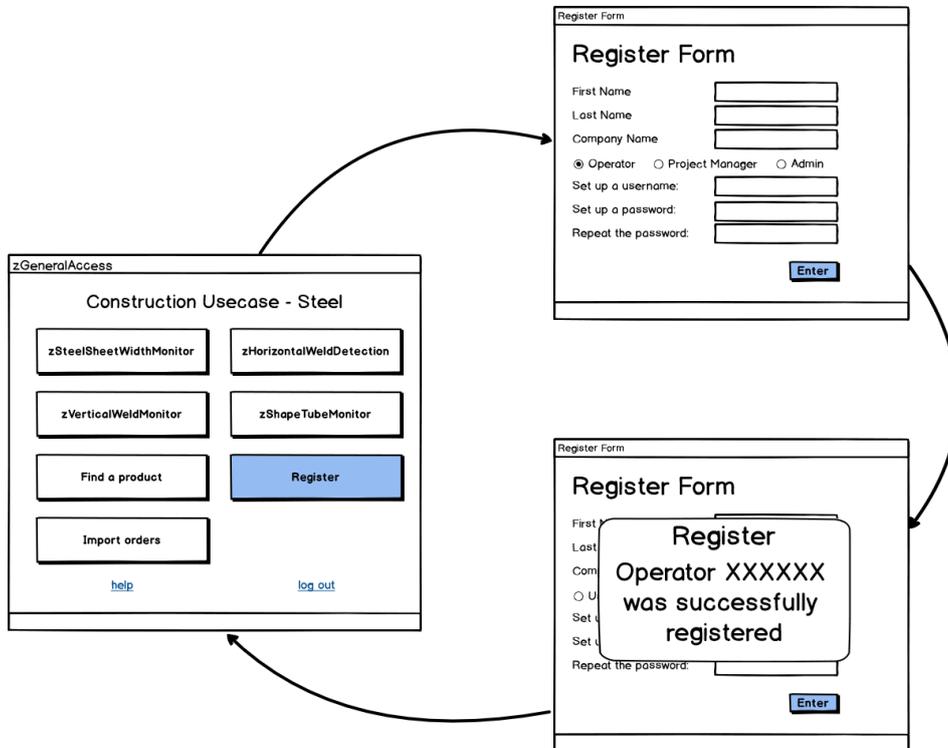


Figure 54: Registration Menu

In Figure 55 the 'Import Orders' is illustrated, only the Administrator has permission to access it. Every week, the Administrator will access it to upload the production orders into the ZDMP platform. This will allow the ZDMP platform to know the production schedule, the products being produced, material used, etc, to be used in the zero-defects monitoring in the different zApps.

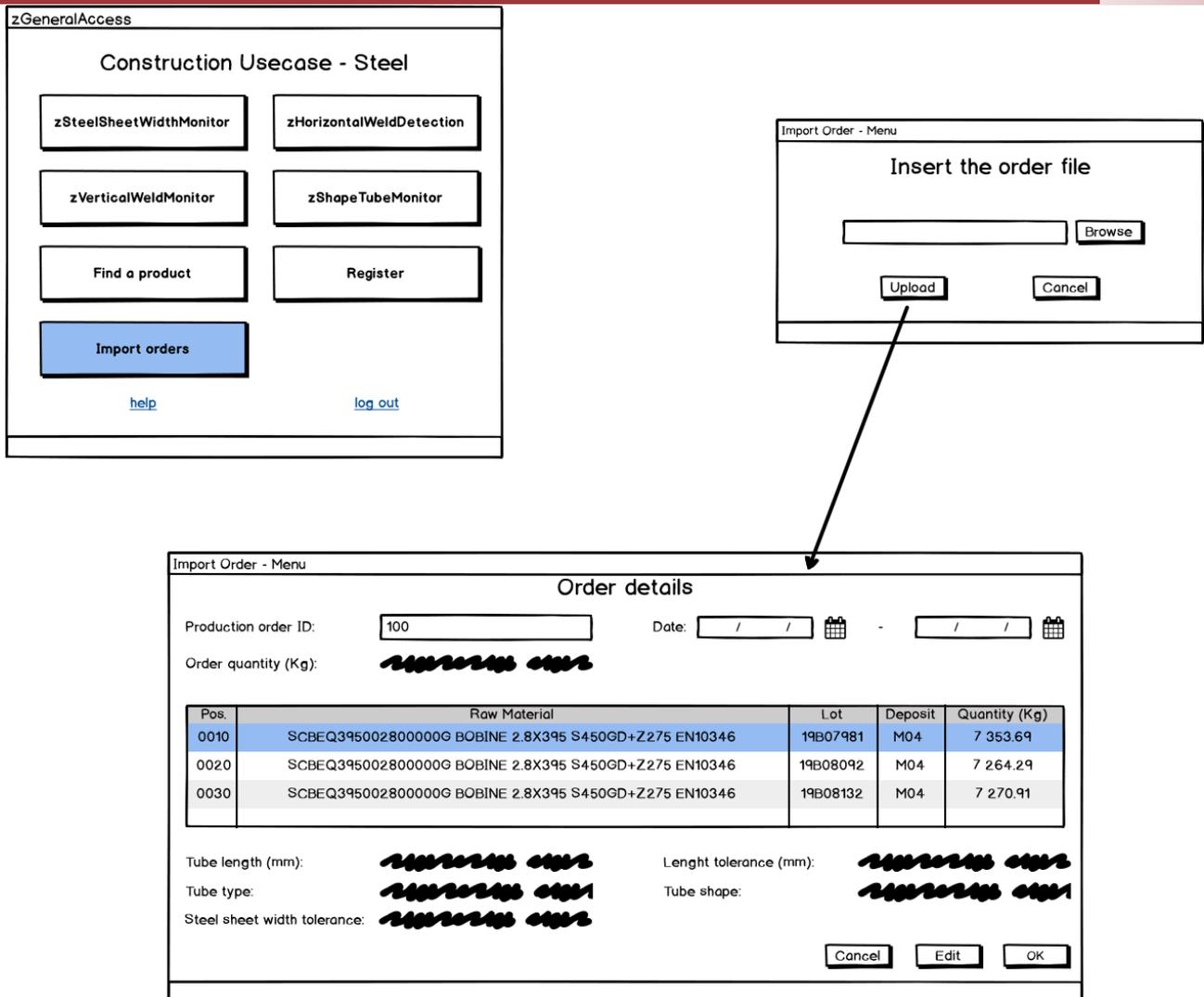


Figure 55: Import Orders.

The next menu is illustrated in Figure 56, representing the 'Find a Product', with all the users having permission to access it. This is the historical information of the zApp. It allows all users to find all the orders, products, material produced.

In Figure 57, the zSteelSheetWidthMonitor App is illustrated. In this app, the intention is to monitor the width of the steel sheet and to identify if this exceeds the parameters set by the operator. All users have permission to access this application.

This app starts by asking to the operator what is the actual production order? Then the operator needs to set the width parameters. After the operator defines these parameters, the monitoring begins, and the app shows in real-time the width being measured. In a situation in which the system detects that values that exceed the setup, the system warns the operator with an alarm.

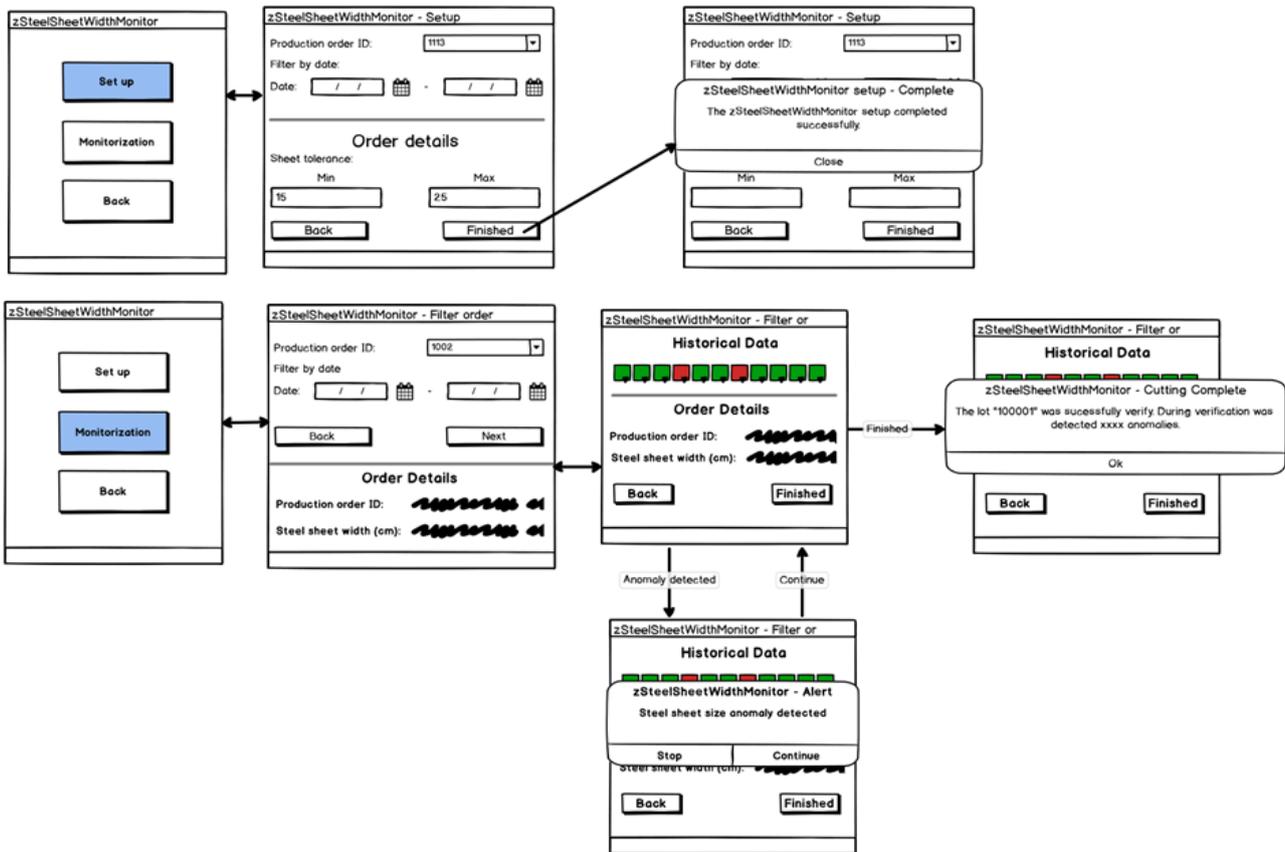


Figure 57: zSteelSheetWidthMonitor.

In Figure 58, the zHorizontalWeldDetection App is illustrated. All the users have permission to access it. Its objective is to detect the horizontal weld used to join two steel plate coils. This app begins by asking the operator what is the actual production order? After the monitoring starts, and the app shows in real-time the detection of the horizontal weld. Whenever horizontal welding is identified, the system warns the operator with an alarm.

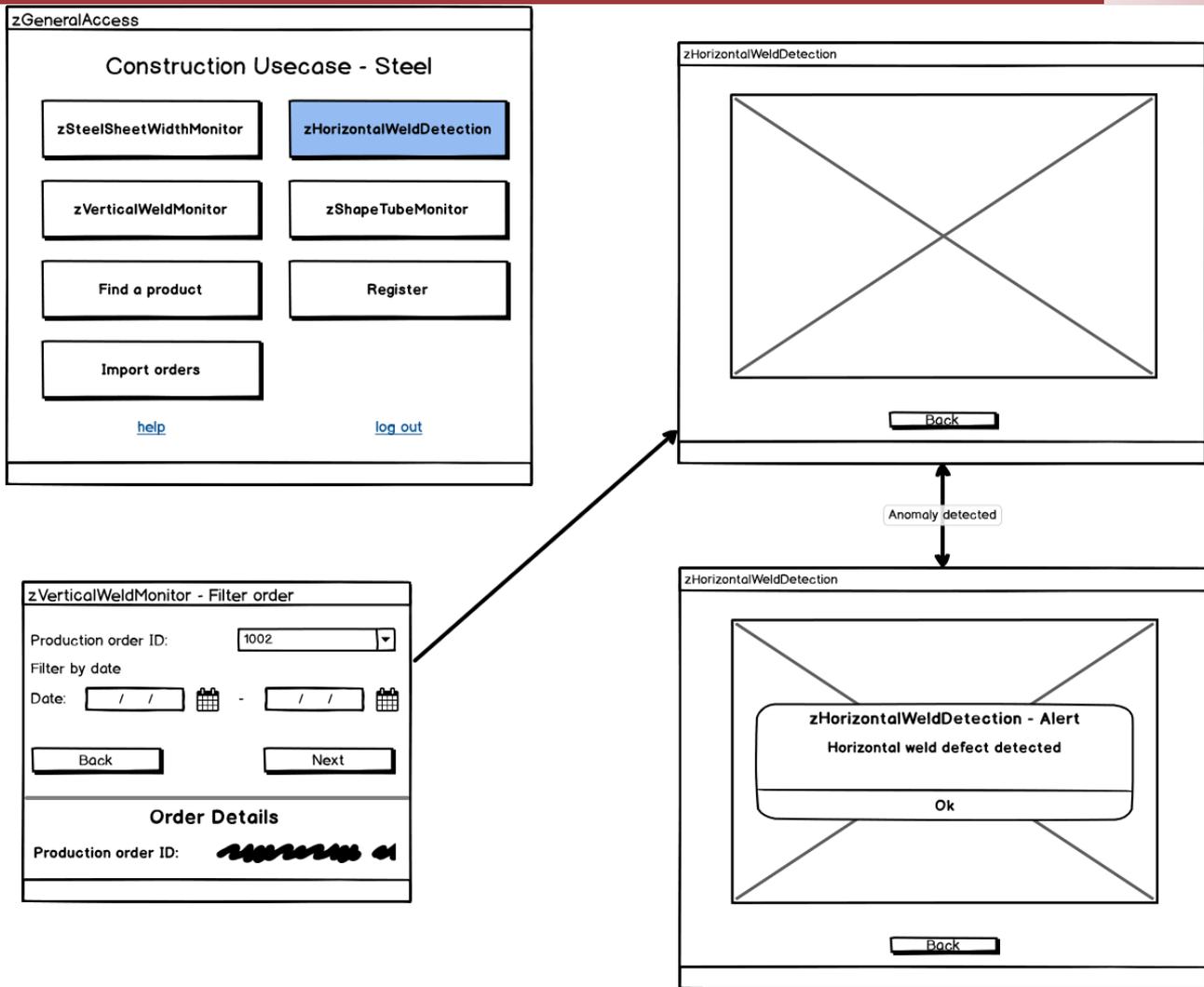


Figure 58: zHorizontalWeldDetection.

In Figure 59, the zVerticalWeldMonitor App is illustrated. All users have permission to access it. In this app, the intention is to monitor the vertical weld of the steel tube to identify if the width exceeds the parameters set by the operator. This app starts by asking to the operator what is the actual production order? After this, the monitoring starts. The app will show in real-time a graph showing the variations occurring in the formation of the steel tube. Sometimes the steel tips are not aligned, when this occurs, the app warns the user with an alarm, and the operator based on their experience decides what to do (stop the machine or allow it to continue).

For material quality compliance, operators must perform drift expansion and flattening tests throughout production and add to the app the tests results. In the case the operator does not update these tests, the app will ask the operator to perform them since they are mandatory.

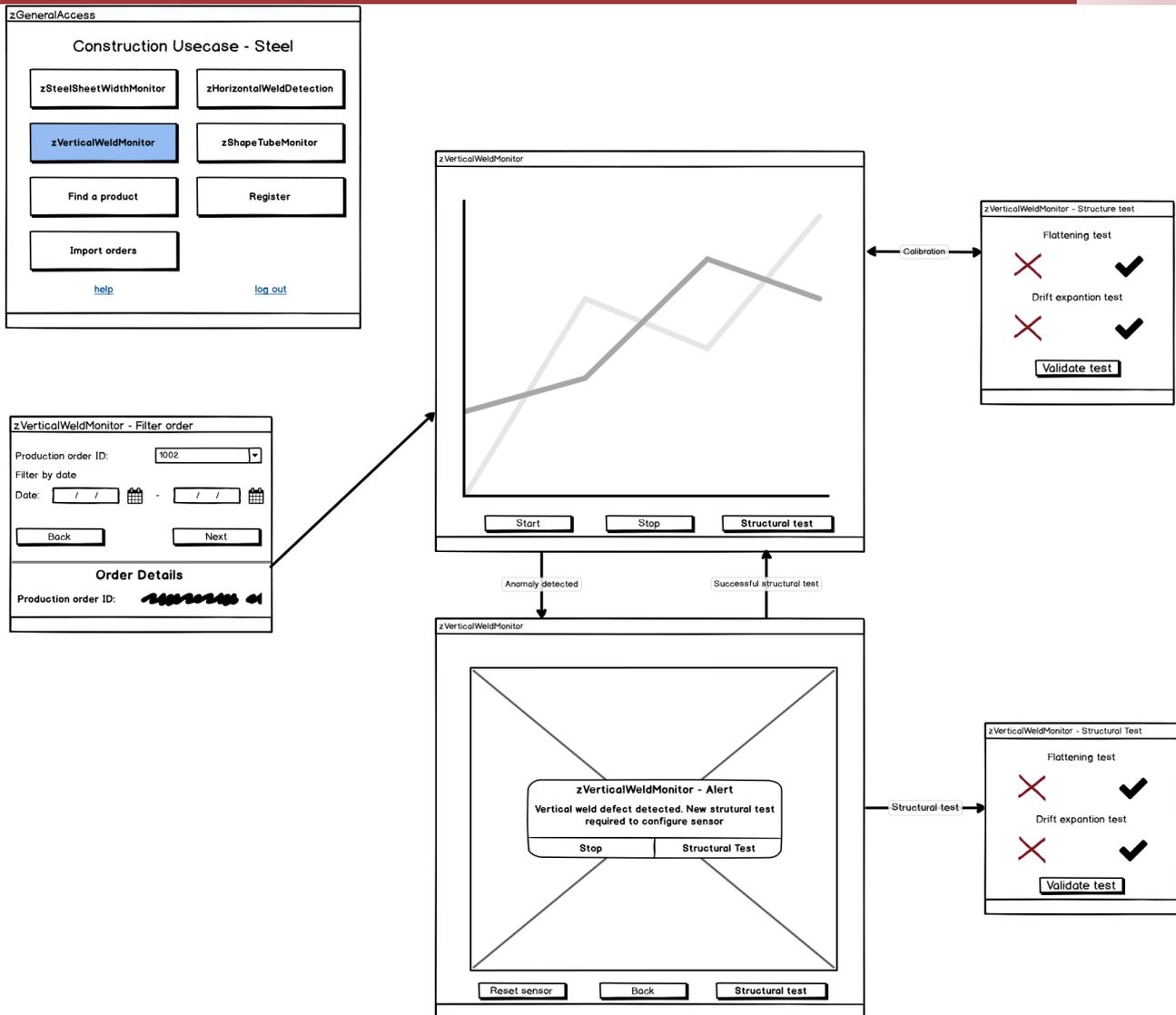


Figure 59: zVerticalWeldMonitor.

In Figure 60, the zVerticalWeldMonitor app is illustrated. All users have permission to access it. This app aims to monitor the shape of the steel tube to identify if the shape of the steel tube is in conformity with the defined standards. This app starts by asking to the operator what it is the actual production order. After this, the monitoring starts, and the app will show in real-time the steel tube production conditions and will compare the shape with a CAD file to identify if the dimensions are correct. If it identifies that the shape is not correct, it warns the user with an alarm. The operator then rejects the steel tube and will re-setup to the machine to adjust it.

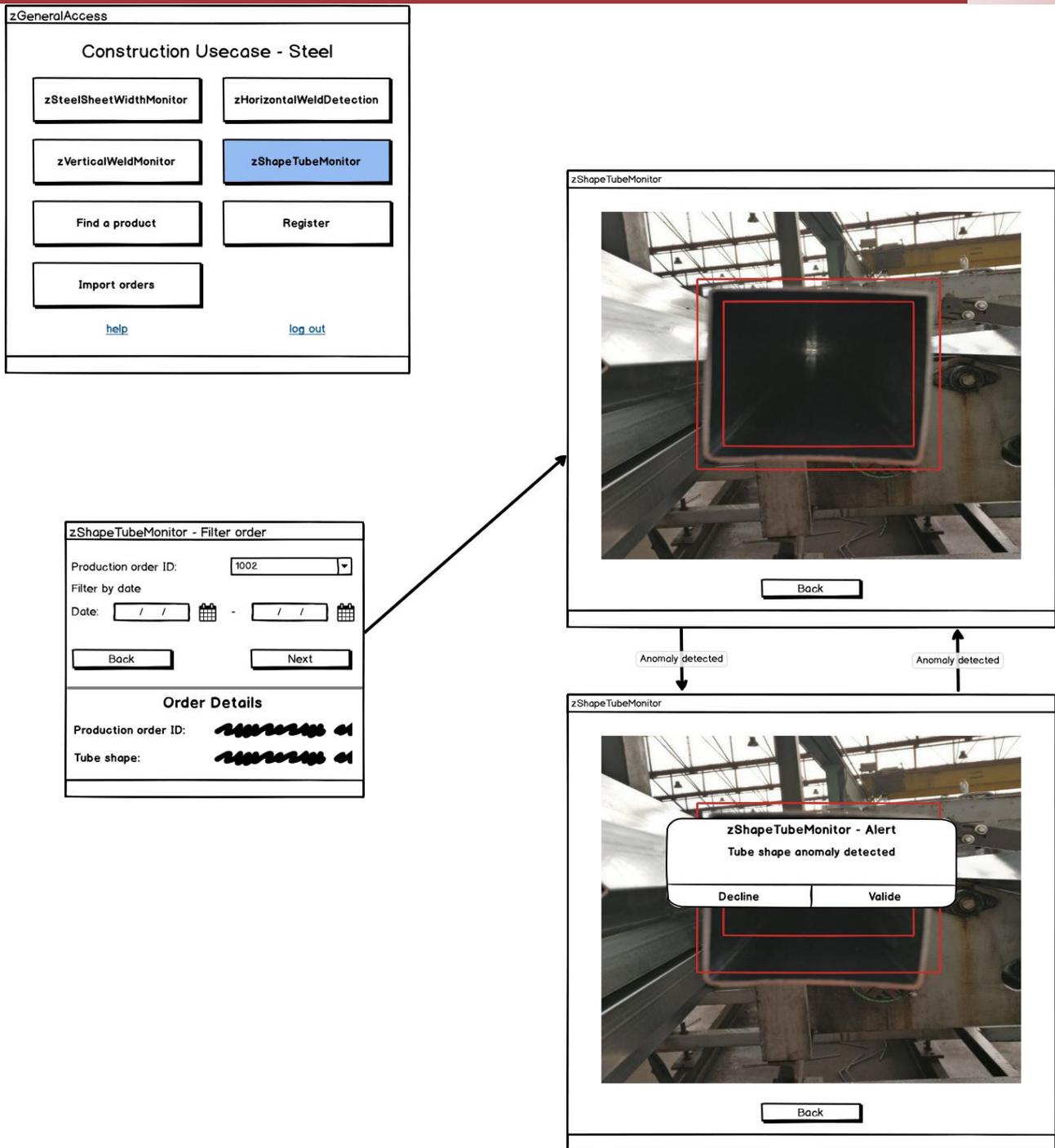


Figure 60: zShapeTubeMonitor

2.14 zA4.5, zA4.6, zA4.7, zA4.8, zA4.9 Stone Tiles

The Stone Tiles Use Case have three different types of users: Operator, Project Manager, and the Administrator, as illustrated in Figure 61. The main difference between them are permissions.

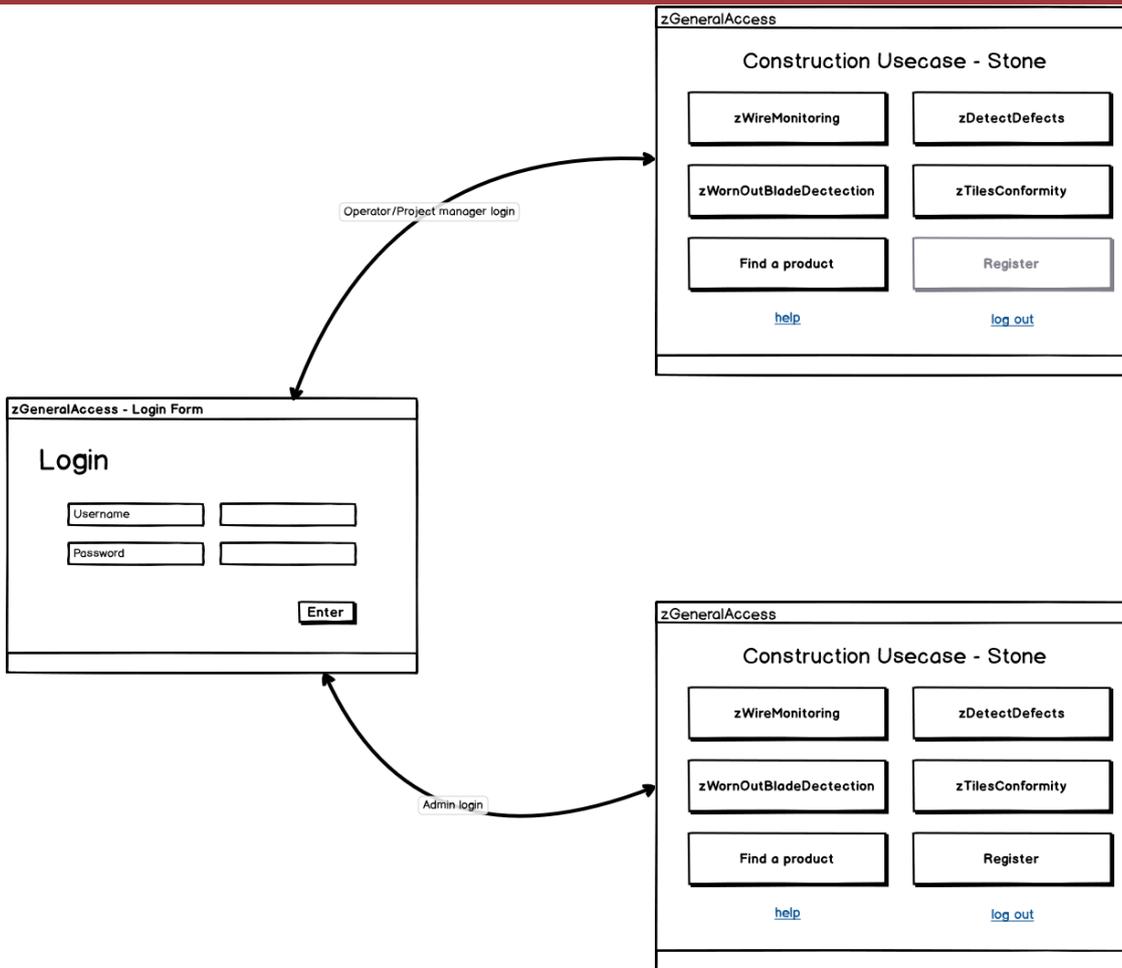


Figure 61: Login Menu

The main menu has a simple interface that allows users to have single-platform access to all stone zApps, where it is possible for each user to select what they intend to do. This menu consists of six buttons, four of which allow direct access to zApps, and two others: One to control the historical data and another to register the user (only available for admin users). The Main Menu is shown in Figure 62.

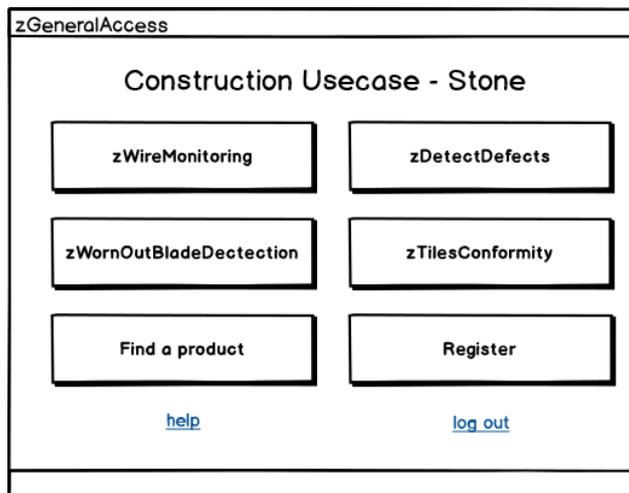


Figure 62: Main Menu

In Figure 63, the Registration Menu is illustrated. In this menu, only the Administrator has permissions to access it, giving the possibility for creating new users by defining their name, company, type, and password.

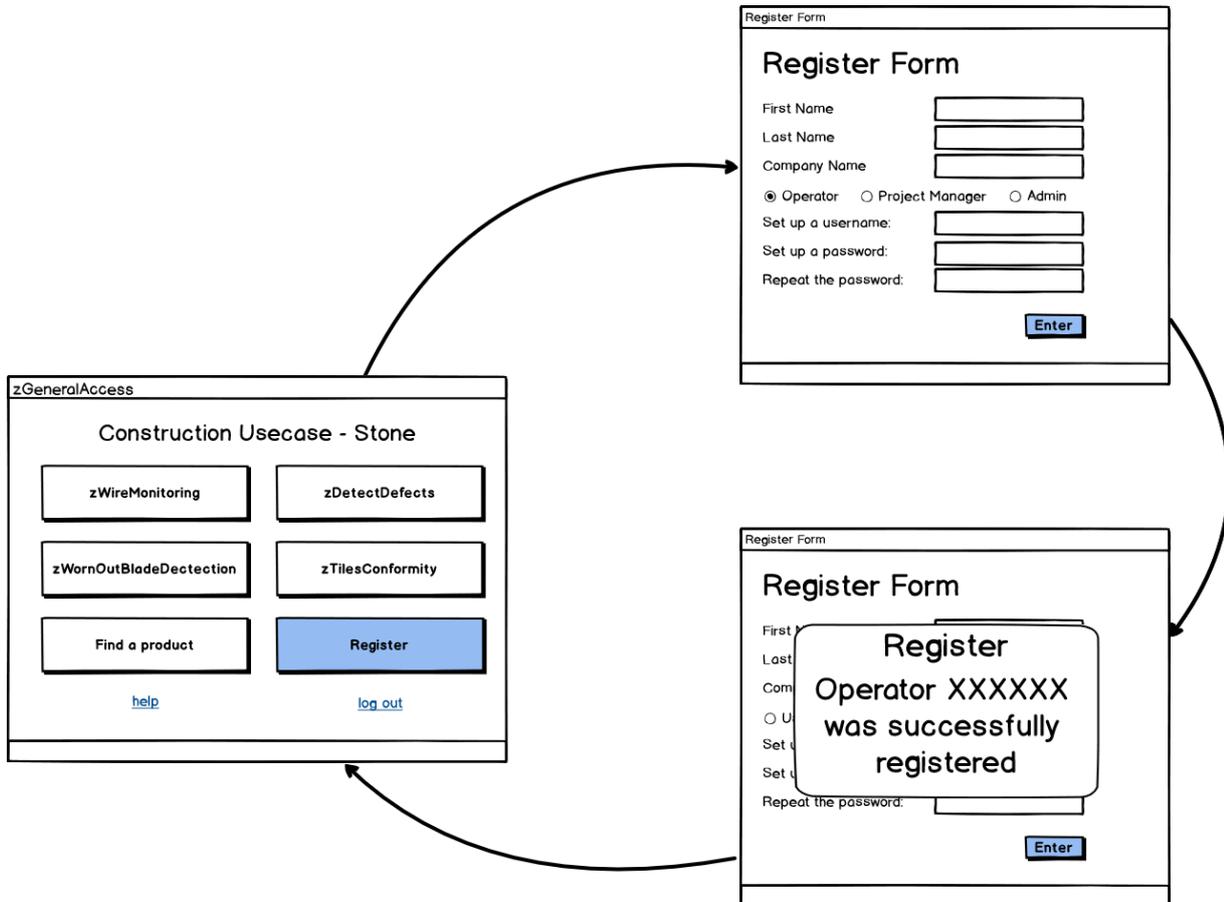


Figure 63: Registration Menu

The first zApp that users can select from the Main Menu is the zSteelSheetWidthMonitor. It is intended to monitor the cutting cables, to automatically detect broken cables or irregular movements of cables, and the alignment of the cable. The zSteelSheetWidthMonitor zApp is divided into two phases: setup (Figure 64) and monitoring (Figure 65).

In the setup phase, the operator selects the ID that of the stone to be cut. In case the ID does not exist, all users must be able to register the block through the block registration form. In the registration form, some block specifications are asked to users, such as the size, stone type, and so on. Then the number of slabs that are going to be cut, or the width of each slab are specified. This allows the creation of an information sheet about the block. After that, the setup is ready and cutting can begin. This stage can be seen in Figure 64.

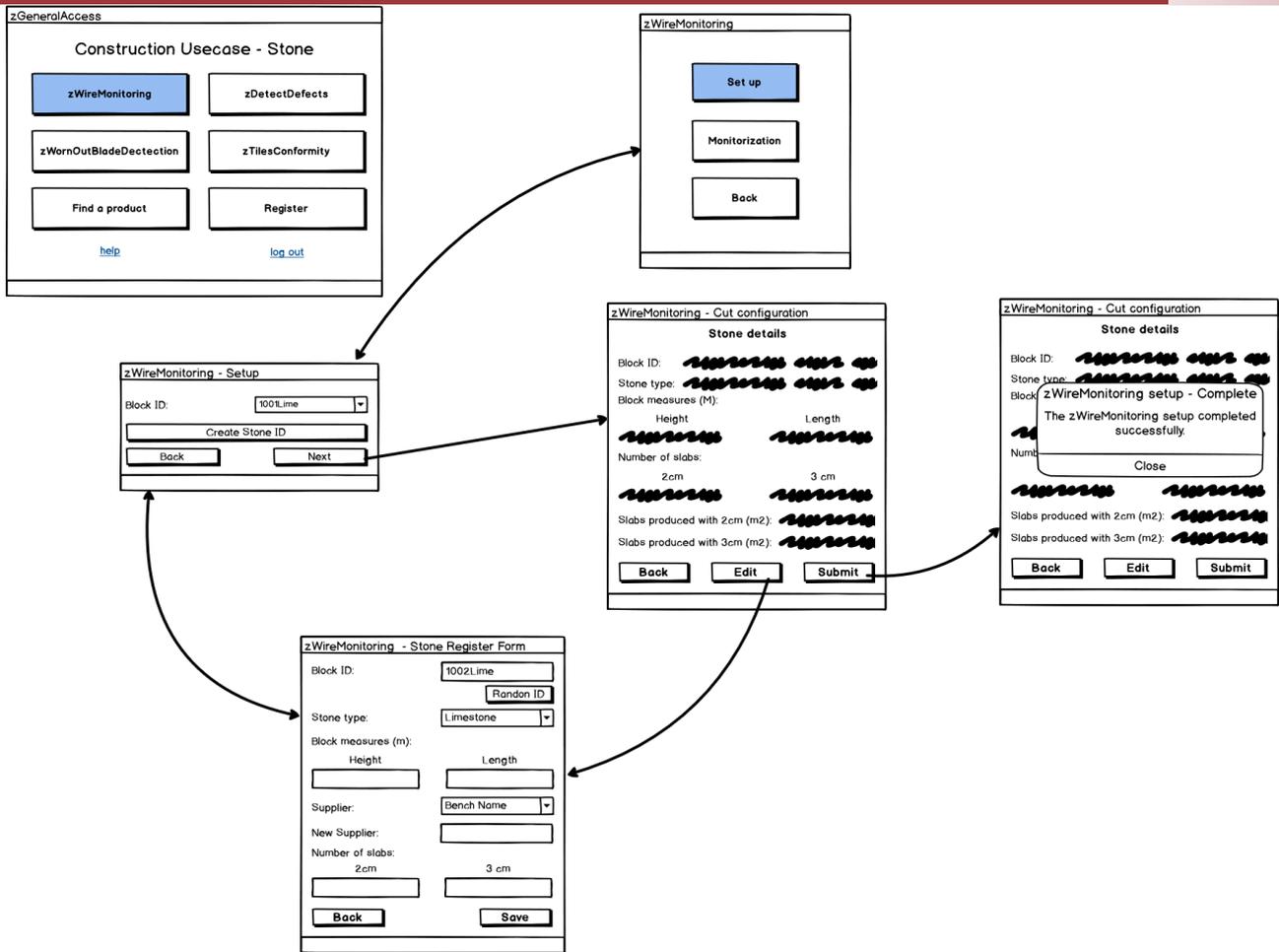


Figure 64: zWiresMonitor setup

The monitoring phase starts by defining the block ID which will be cut. Then the cut configuration menu appears, in which it is possible to see all the cutting information. Users need to validate this information. After validation, when the machine is cutting the block, the app starts to monitor the wire cutting cables, identifying broken, misaligned, or irregular movements of the wire cables. When the app detects one of these situations, it warns the operator with a physical alarm and waits for the decision of the operator. In this situation, the operator can decide to stop or continue the block cutting depending on the problem.

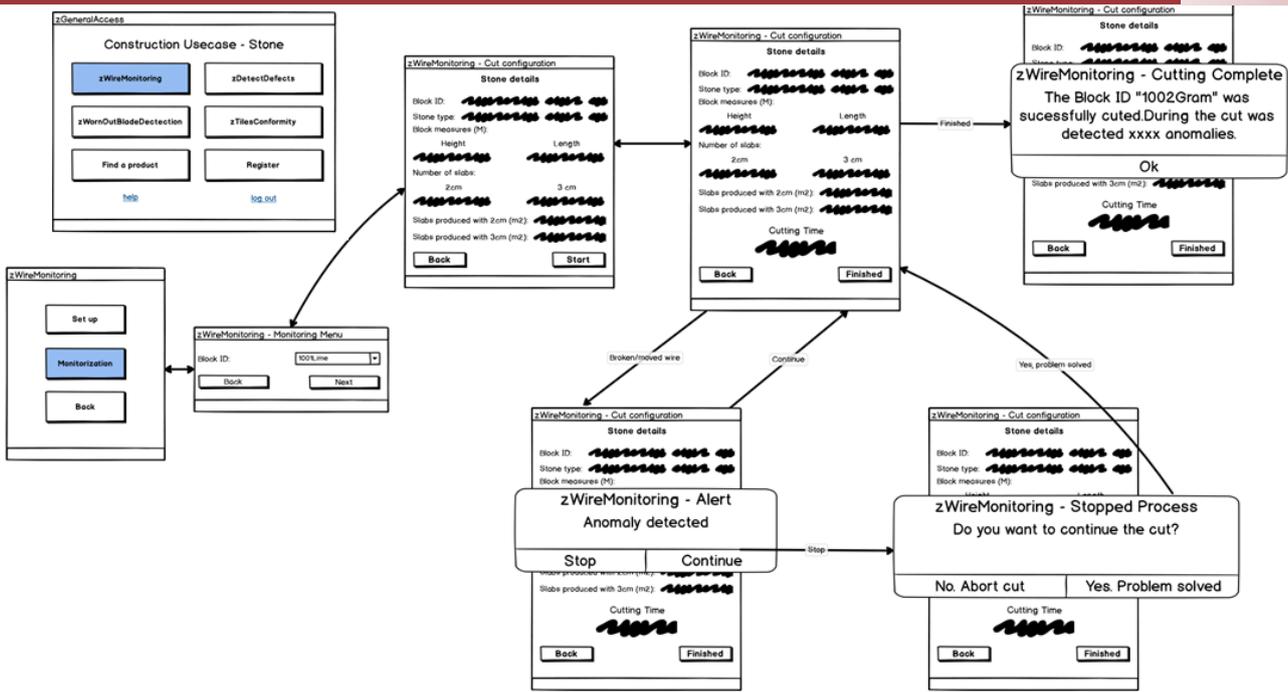


Figure 65: zWiresMonitor monitoring

The second zApp, the zDetectDefects App is illustrated in Figure 66. All users must have permission to access it. This app is for the automatic detection of stone slab defects. The app starts by asking the user what is the ID of the stone to be cut? If the ID does not exist, a registration form appears to create it. After this, the app takes a photo of the slab and automatically marks the defects in the slab. The users also can edit, remove, or confirm it. When the operation is finished, the user must validate all defects.

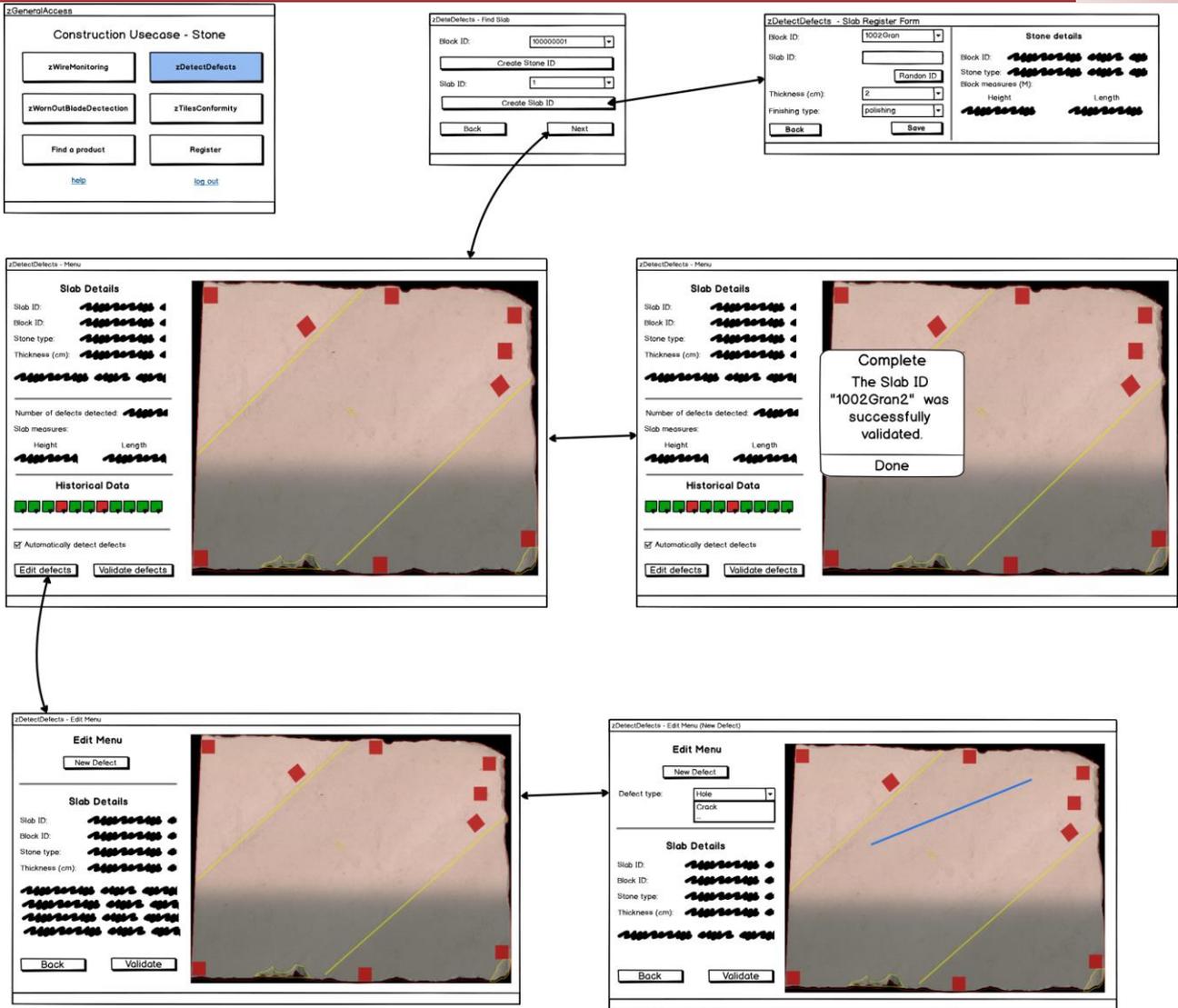


Figure 66: zDetectDefects

The zWornOutBlade zApp aims to monitor the quality of the blade in two phases: Setup and monitor. The setup phase is to define the blade ID and relate this ID with the machine ID and block ID.

The monitoring phase allows the checking of the state of the blade during cutting. This monitoring is based on the vibration of the machine. When the blade starts to be worn, the motor begins to have higher vibrations, which will be detected by vibration sensors. When an anomaly is detected, the user must be alerted by a physical alarm. Then, the user decides what to do; eg stop and changes the blade or continue the work.

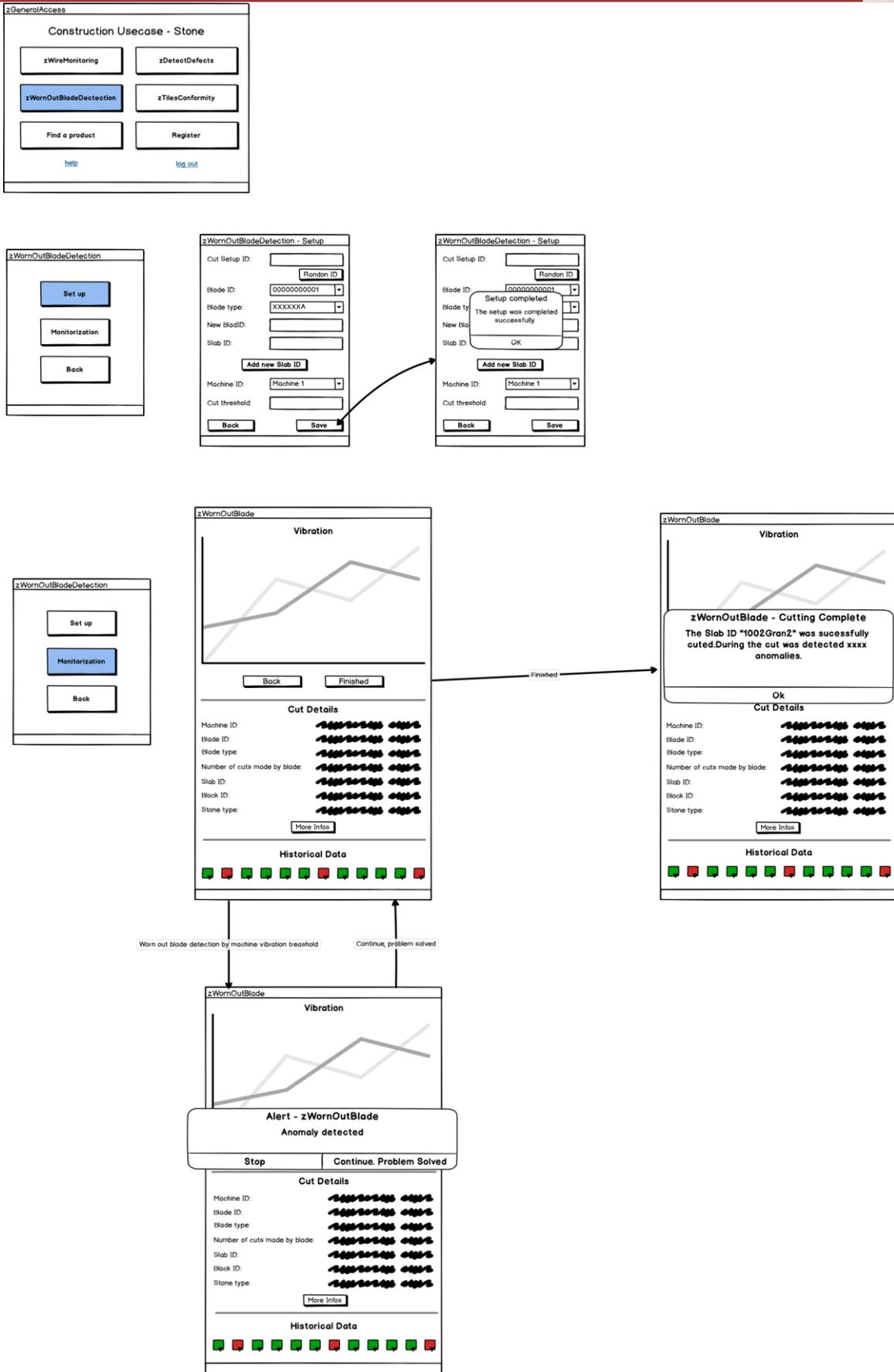


Figure 67: zWornOutBlade.

The fourth button represents the zTilesConformity App. This app is visualized in Figure 68. This app aims to monitor the shape of the cut block to verify its conformity. This app starts by asking the operator about the slab ID. Then it compares the dimensions of the tile with the mould and validates it or not, by informing the operator. All the users have permission to access it.

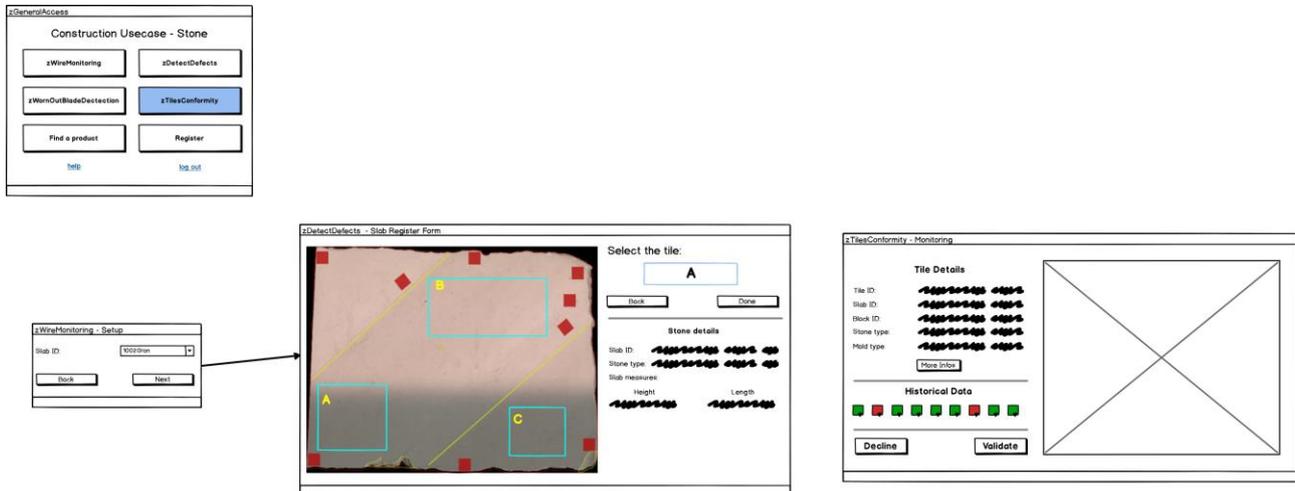
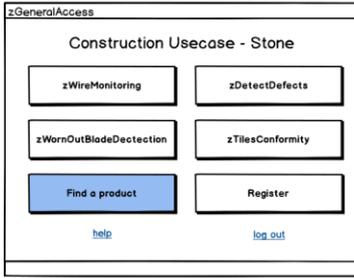


Figure 68: zTilesConformity

Finally, the next menu illustrated in Figure 69, represents 'Find a Product'. This allows all users to find all the orders, products, and material produced, with all the monitoring information acquired by the zApp.



Stone ID Filter Slab ID Filter Tile ID Filter

Block ID: Date: -

Block ID	Stone Type	Block Height (m)	Block Length (m)	Supplier	Slabs ID List	Tiles ID List	Certificate List	Notes
1000	Limestone	5	4	LADAAD	Slabs A	Tiles A	Certificate A	Note A
1001	Granite	5	5	LADAAD	Slabs B	Tiles B	Certificate B	Note B
1002	Limestone	5	5	LADAAD	Slabs C			Note C
1003	Marble	5	5	LADAAD	Slabs D	Tiles D		Note D

Stone ID Filter Slab ID Filter Tile ID Filter

Slab ID: Date: -

Slab ID	Block ID	Stone Type	Block Height (m)	Block Length (m)	Supplier	Slab Thickness (cm)	Tiles ID List	Certificate List	Notes
10001	1000	Limestone	5	4	LADAAD	2	Tiles A	Certificate A	Note A
10002	1000	Limestone	5	4	LADAAD	3	Tiles B	Certificate B	Note B
10003	1000	Limestone	5	4	LADAAD	2			Note C
10004	1000	Limestone	5	4	LADAAD	2	Tiles D		Note D

Stone ID Filter Slab ID Filter Tile ID Filter

Tile ID: Date: -

Tile ID	Block ID	Slab ID	Stone Type	Block Height (m)	Block Length (m)	Supplier	Slab Thickness (cm)	Tile Mold	Certificate List	Notes
100011	1000	10001	Limestone	5	4	LADAAD	2	R-4*4	Certificate A	Note A
100012	1000	10001	Limestone	5	4	LADAAD	3	R-4*3	Certificate B	Note B
100013	1000	10001	Limestone	5	4	LADAAD	2			Note C
100014	1000	10001	Limestone	5	4	LADAAD	2	C-2*2		Note D

Figure 69: Find a product

2.15 zA4.10 zRemoteQC

At this stage zRemoteQC zApp has been detailed by the users at quite a deep level. Mock-ups have been proposed for every functionality of the zApp. While this section of the deliverable includes the high-level mock-ups for this application, a much more refined and detailed version can be found in ANNEX C.

zRemoteQC allows the sharing of information concerning lots of materials to be supplied to a construction site by a Supplier and the corresponding reception Quality Control, carried out by the Works Contractor and Works Supervisor at the construction site.

Each party has access to its own area in the application. For this, they need to login to its specific area (Figure 70).

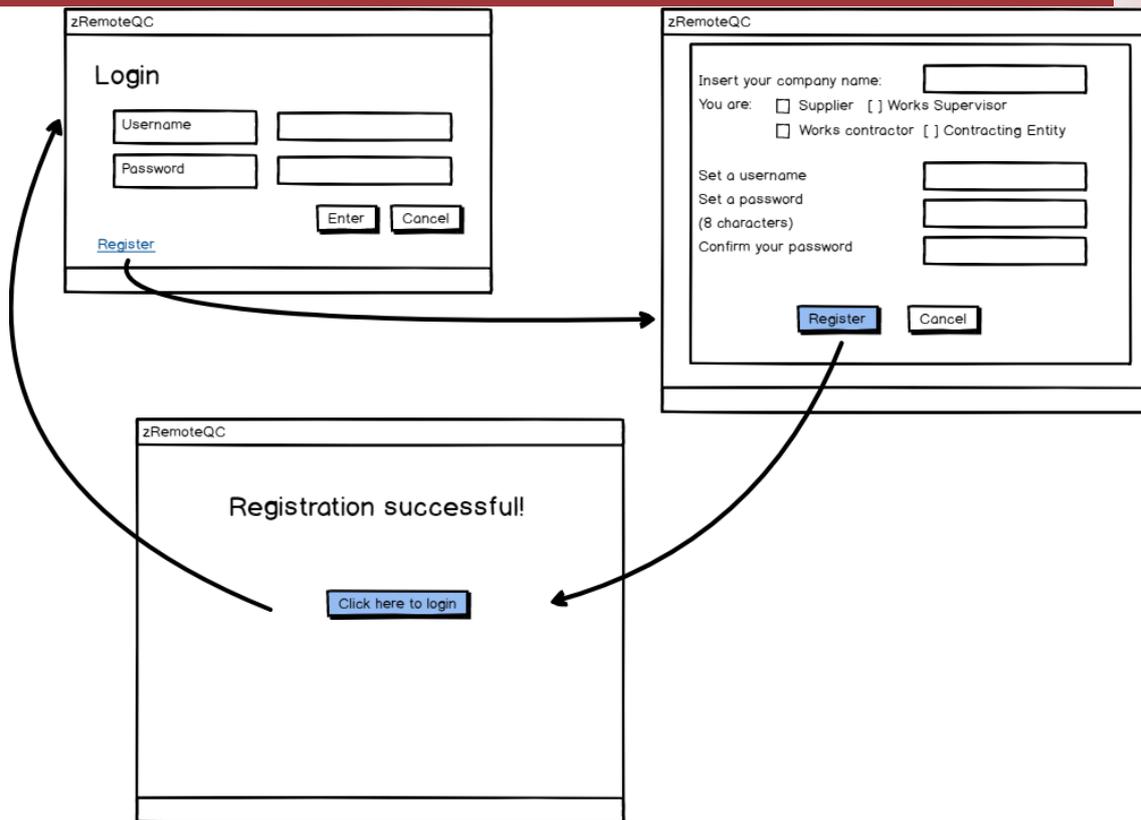


Figure 70: login page

This zApp has different areas dedicated to different actors:

- The Supplier Area allows access to the following options: Set Up, Lots Status, Deliveries, Shipment, and Notifications
- The Works Contractor Area allows access to the following options: Set Up, Deliveries, Quality Control, Statistics, and Notifications
- The Supervisor Area is similar to the Works Contractor Area, although the information displayed and the interaction with it is different. This work area is composed of Start, Set Up, Deliveries, Quality Control, Statistics, and Notifications

The Supplier Set Up area allows to define a new Client (Works Contractor), receiving information regarding an existing Client (or editing it) including adding new materials. The Supplier's Client is the Works Contractor.

The projects drop-down list includes those added by the Supervisor and selected by the Works Contractor in their own set-up areas.

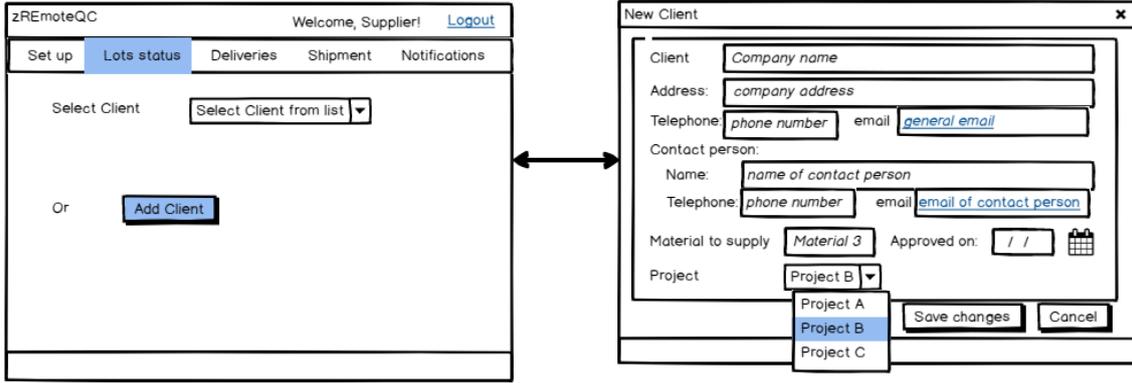


Figure 71: add client

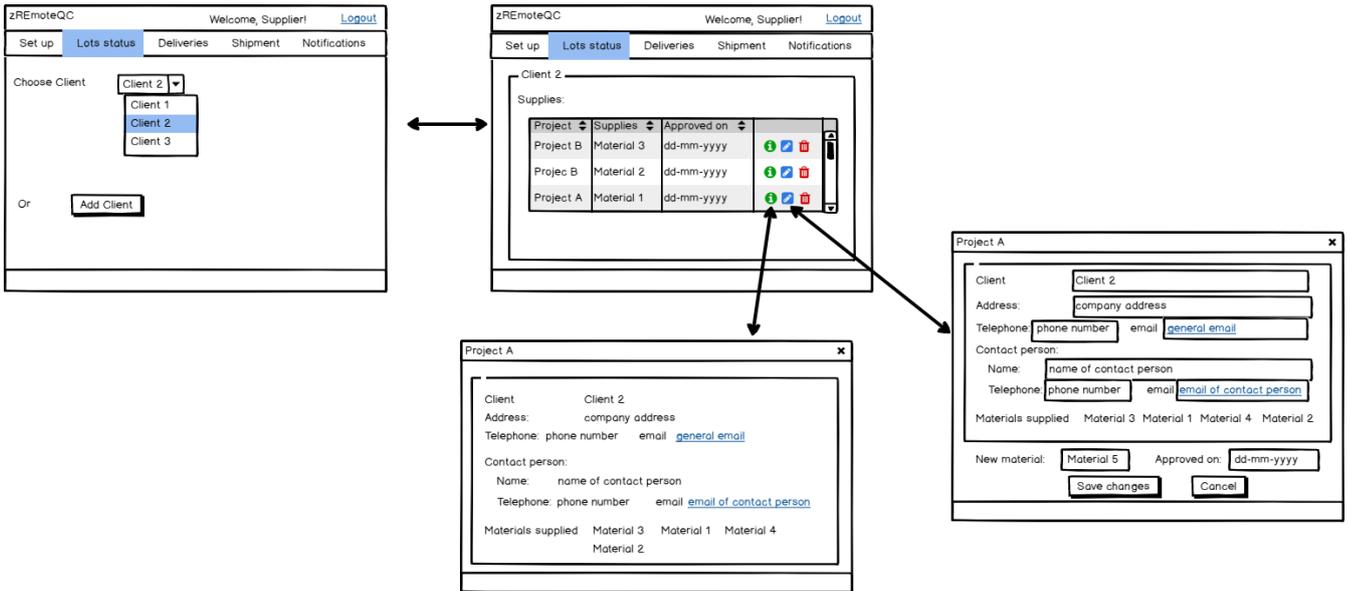


Figure 72: chose client

The Client is selected from a drop-down list containing the registered Clients. The zApp returns information on the Projects and Materials associated to that Client. By clicking on 'Info', the zApp returns currently available information about the Client. By clicking on 'Edit', the zApp allows the editing of Client information and adding a new material to be supplied to a specific project.

The Lots status option allows getting access to information about the lots being produced or already supplied and also to their corresponding documentation.

For gathering this information, the zApp must interact with the Suppliers legacy systems.

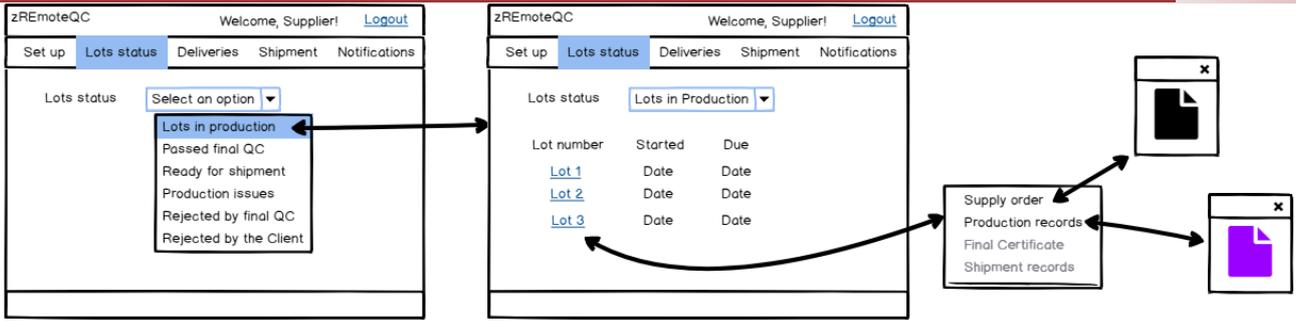


Figure 73: lots status

This option lists the lots being produced, their production start date, and the date when production is expected to end. By clicking on the lot number, the zApp allows access to documentation available at that stage. By clicking on each of them, the zApp opens a window displaying the relevant document.

The deliveries section allows the Supplier to obtain information about the delivery dates of the various orders and, most importantly, it allows the Supplier to change a pre-scheduled delivery date. This becomes input for the zRescheduler zApp.

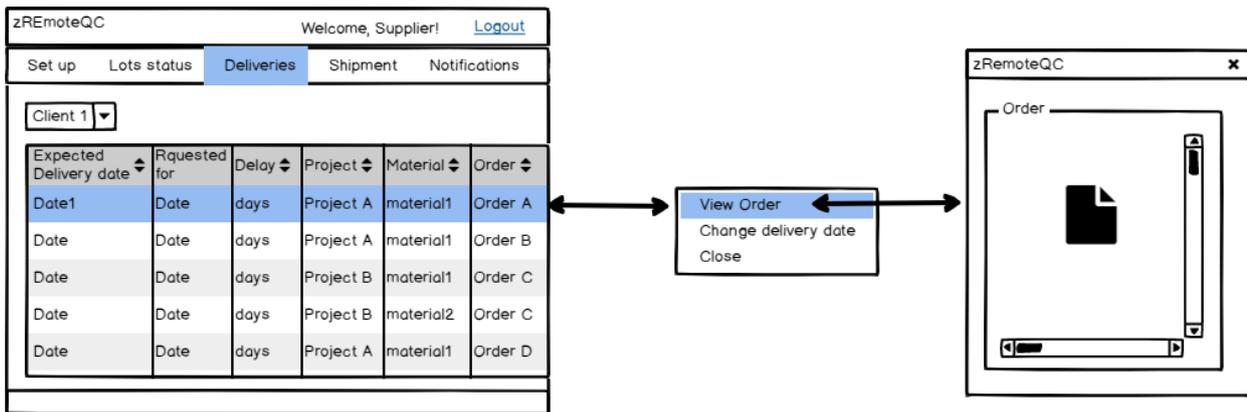


Figure 74: Deliveries page

The supplier has access to a list of deliveries scheduled for a specific Client (selected from a combo box). By selecting a specific delivery date, the supplier can have access to the order placed by the Client and scheduled to be fulfilled on the selected date.

In the shipment section, the Supplier is able to allocate a certain material lot to a supply order and release it for shipment.

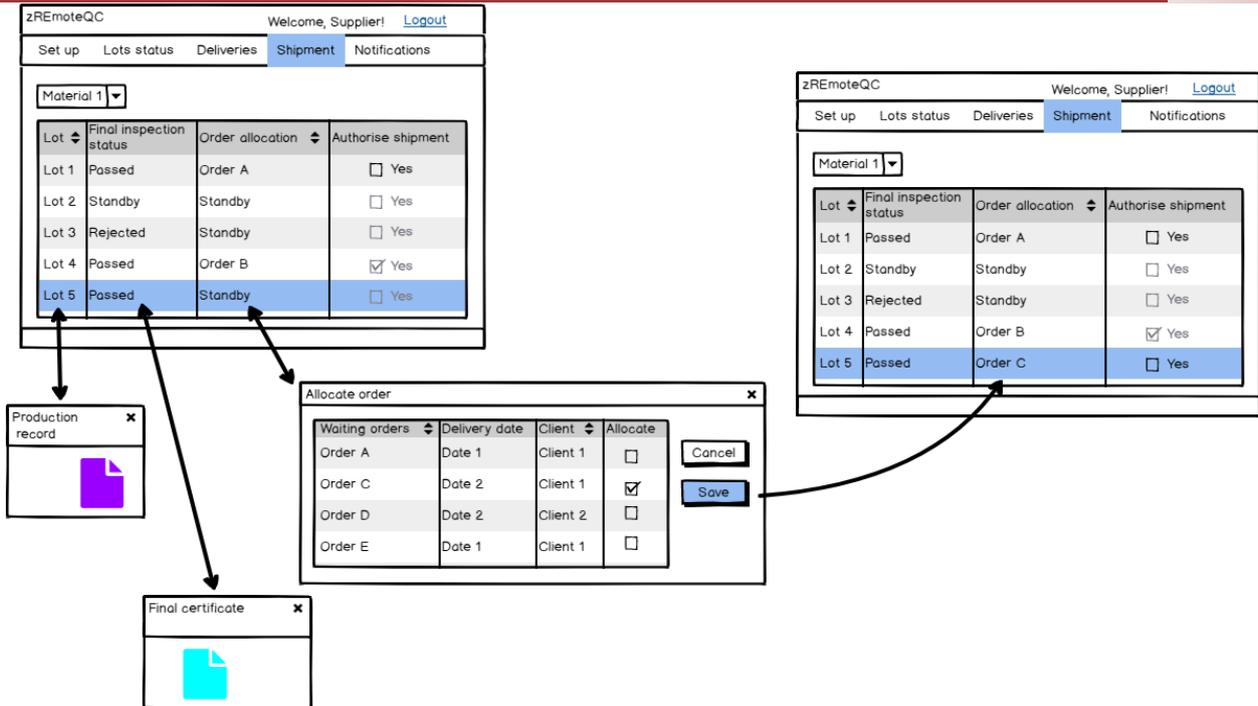


Figure 75: Shipment page

Upon clicking the lot number, the Supplier is able to see the lot's production records.

Upon clicking on the lot's final inspection status, the Supplier is able to see the final quality control certificate. If the status is 'Passed' (ie approved by quality control) or 'Rejected'. This option is disabled if the status is 'Standby'.

Upon clicking on the lot's order allocation, the zApp returns a window with a list of orders waiting to be fulfilled, the corresponding expected delivery dates, and clients.

Upon ticking the box in the column 'Allocate', the Supplier allocates a specific lot (eg lot 5, in the example above) to a specific order. This information is updated on the list upon clicking on 'Save'. The Supplier can change a lot allocation to an order.

Upon ticking the box in the column "Authorise shipment", the Supplier releases the corresponding lot for shipment thus fulfilling the order the lot was allocated to.

The 'Yes' box in column "Authorise shipment" will be disabled by default for lots with a status of "standby" or "rejected". This thus prevents lots which are not approved by quality control being accidentally shipped. Similarly, the boxes will be disabled after being allocated to a specific lot.

The notification section allows the Supplier to access and read notifications from both its Clients and from the Works Supervisors for projects in which its clients are involved.

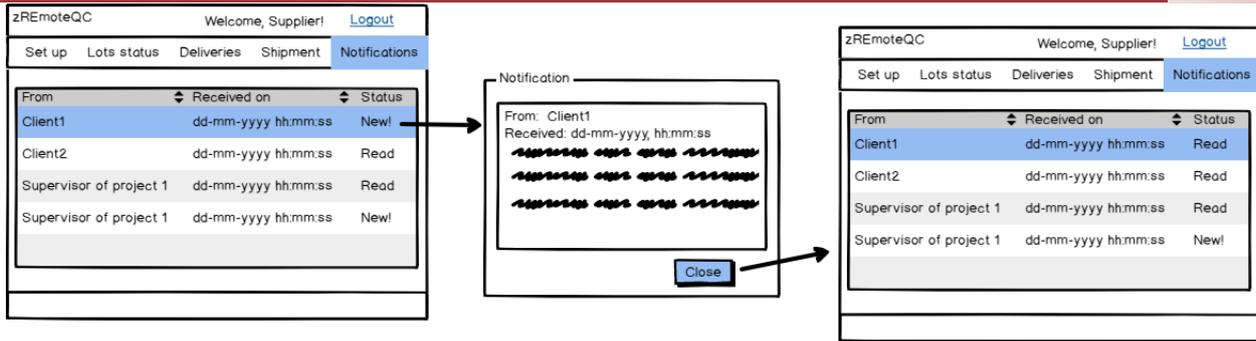


Figure 76: Notifications page

The notifications area lists the messages received, indicating the date and time of reception and their status ('New' for notifications not yet read and "Read" otherwise).

By clicking on the line corresponding to a new message, the zApp shows the message.

By clicking on 'Close', the zApp returns to the notifications list and the notification status changes from 'New' to 'Read'.

2.16 zA4.11 zRescheduler

At this stage zRescheduler zApp has been specified by the users at a deep level of detail. Mock-ups have been proposed for every functionality of the zApp. While this specific section includes the high-level mock-ups for this application, the more refined and detailed version can be found in ANNEX C.

This zApp enables the sharing information between the Works Contractor and the Works Supervisor concerning materials' delivery dates, especially delays, and processes the impact of such delays on both party's work schedules and that of the project.

The Supplier interacts with this zApp through the section Deliveries, in its workspace on zRemoteQC, and through direct access to this zApp by the driver transporting the materials.

The zApp needs to interact with the Works Contractor and the Works Supervisor legacy systems to have access, retrieve information, and edit files in MS Project or MS Excel format.

The Works Contractor and Works Supervisor will have access to independent workspaces, through login data. The Login and Register are identical to those shown for zRemoteQC and, most certainly, will be the same.

In fact, zRescheduler may share the same interface as zRemoteQC, but it is shown separately for a better understanding of its functionalities.

This zApp has different workspaces dedicated to different actors:

- The Supplier Area interacts with the mobile version of the app, having the possibility to report delays and end delivery real-time
- The Works Contractor Area allows access to Notifications and Schedule
- The Work Supervisor Area is similar to the Works Contractor Area, although the information displayed and the interaction with it is different

In the Notification section, the Works Contractor will have access to notifications from the suppliers and works supervisors of projects in which it is involved (zRemoteQC).

It is assumed that all notifications in the examples relate to materials delivery date changes.

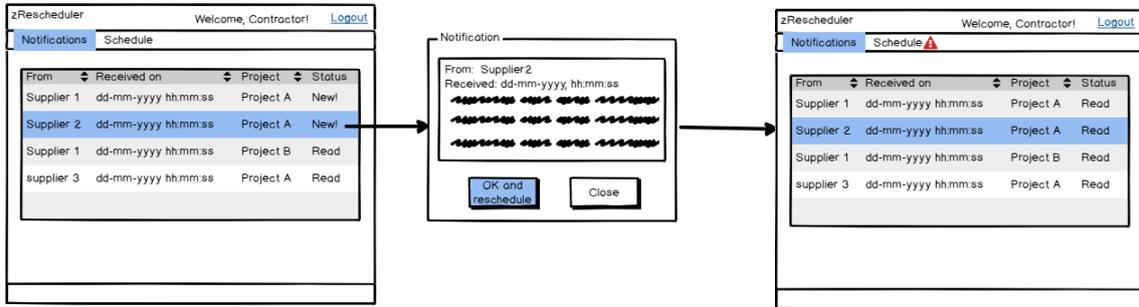


Figure 77: Notification page

If the Works Contractor chooses “OK and reschedule”, the zApp recalculates the impact of the delivery date change on the Works Contractor tasks and on the project schedule. As a consequence, an alert icon is displayed in the menu bar, indicating that new schedules have been produced. The notification status is changed to “Read”.

In the schedule section, it is possible to compare new schedules generated as a result of a delivery date change, with current schedules and edit them.

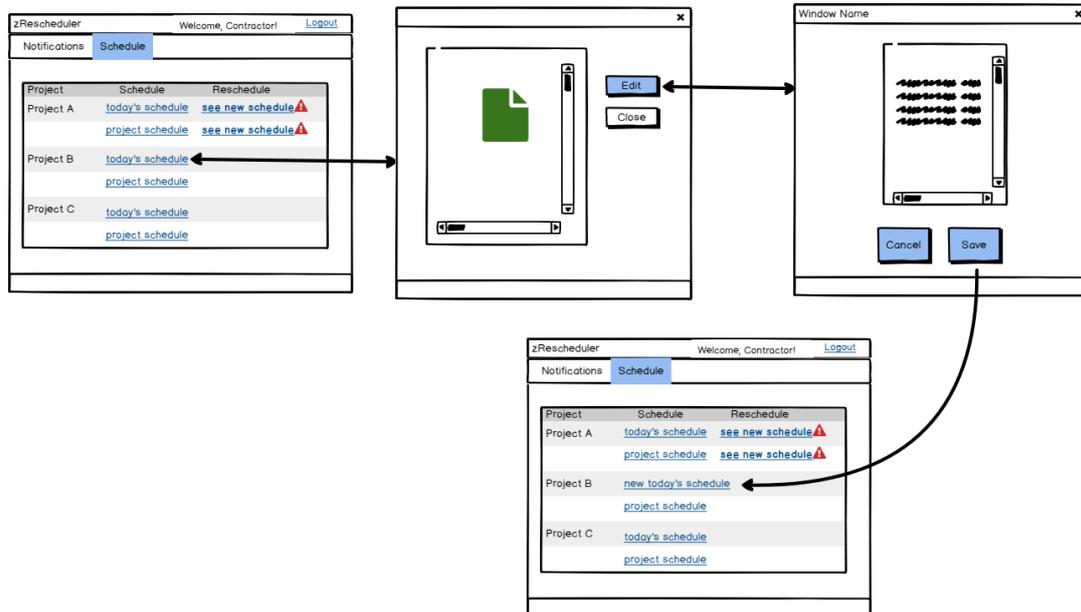


Figure 78: Schedule page

The page lists the projects in which the Works Contractor is involved and links to the schedules: Current approved schedules, under the column ‘Schedule’, and modifications under the column ‘Reschedule’. The Works Contractor can edit current schedules, ie its day activities schedule (shown as today’s schedule) and the project schedule.

Upon selecting the schedule, the zApp allows this to be viewed. When the current day schedule is edited and saved, it is shown under the column schedule with a new identification (new today’s schedule).

2.17 zA4.12 zMaterialTracker

At this stage zMaterialTracker zApp has been specified by the users at a deep level of detail. Mock-ups have been proposed for every functionality of the zApp. While this specific section includes the high-level mock-ups for this application, the more refined and detailed version can be found in ANNEX C.

This zApp allows the allocation of a specific material lot and/or individual parts to a location at the work site. It is intended for use primarily by the Works Contractor, but also by the Works Supervisor. Thus, it will be necessary to enter login information, which can be performed through the same action as described for zRemoteQC. In fact, zMaterialTracker may share the same interface as zRemoteQC and be part of the Works Contractor and of the Works Supervisor's workspace. However, it is shown here separately for a better understanding of its functionalities.

The zApp needs to interact with the Works Contractor and Works Supervisor's legacy systems, to have access and retrieve drawing files (AutoCAD or equivalent) and for retrieving and storing files (Word, Excel, PDF).

The zApp must be able to allow the selection of a specific area on a drawing (be it by touch screen or via a mouse x or any other option) and to relate that selection with subsequent actions, namely material identification allocation.

The works contractor workspace will have two sections: One related to the use of a material for construction and another for tracking a material. They are:

- Apply material
- Materials use information

When entering the apply material section, the Works Contractor is prompted to define the location where it is going to work, ie, apply material(s).

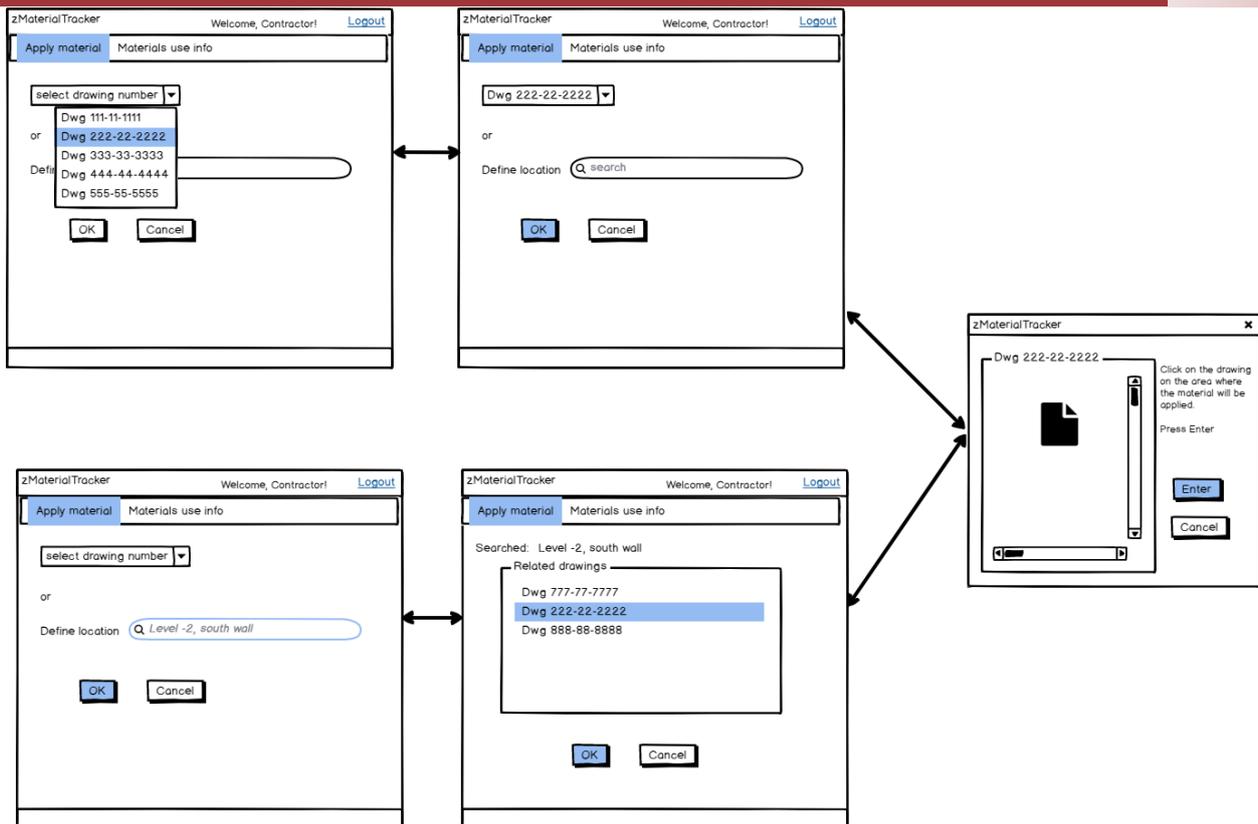


Figure 79: Apply material

The location definition is performed via selecting the corresponding drawing/design number from a list or through searching drawing(s) that match a certain search criterion. This assumes that the zApp has access to the legacy system and the directories where the current approved drawings are stored.

Once the drawing is selected, the zApp opens the corresponding file. The Works Contractor selects the area where it is going to work (ie, apply a material). Once the area is identified and 'Enter' is pressed the zApp opens the following section.

If 'Enter' is pressed without any specific area selection, the zApp will assume that the material will be applied to the whole area depicted in the drawing. In this way, the materials defined in the following sections will be associated to a construction site area.

The material use information section is particularly relevant in case:

- Problems occur during construction, the infrastructure operation, or the warranty period
- Supplier detects and alerts for problems on materials already used

This section will allow accessing all the documentation concerning a certain material based on the location where it was used or on its identification.

The section allows two options:

- Search by location
- Search by material

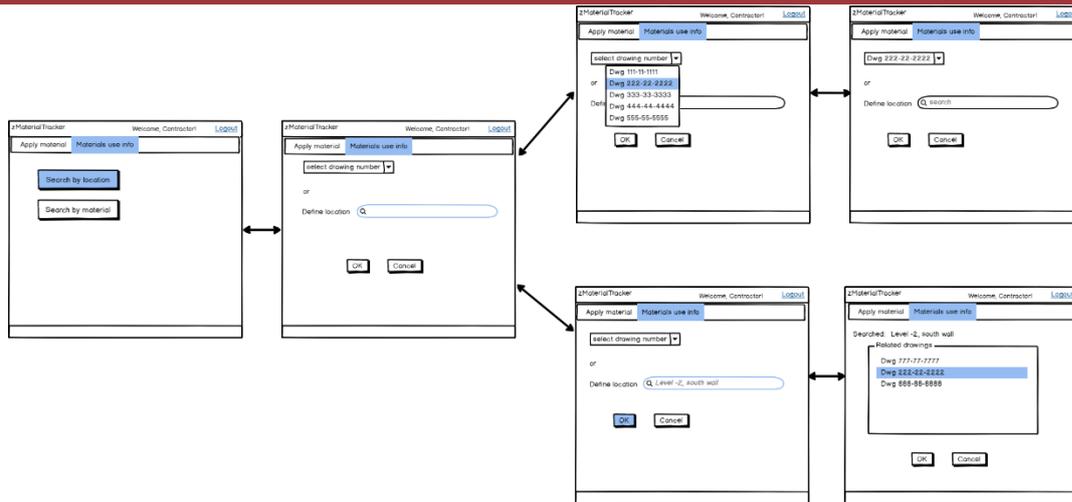


Figure 80: Material Use Info Section

2.18 zA4.13 zMaterialID

This zApp allows the definition of the identification to be applied to individual material items and/or material lots to be produced and supplied by the Supplier.

It is intended for use solely by the Supplier. Nevertheless, it will be necessary to input login information, which can be performed through the same action as described for zRemoteQC.

zMaterialID may share the same interface as zRemoteQC and be part of the Supplier's workspace. However, it is shown here separately for a better understanding of its functionalities.

The zApp needs to interact with the Supplier's production control legacy systems, to have access and retrieve information concerning the supplier's usual identification system and production process. It will also need to interact with the supplier's system for applying an identification onto the material parts produced.

The supplier workspace will have three options for use:

- Import Material ID
- Define Material ID
- See Material ID

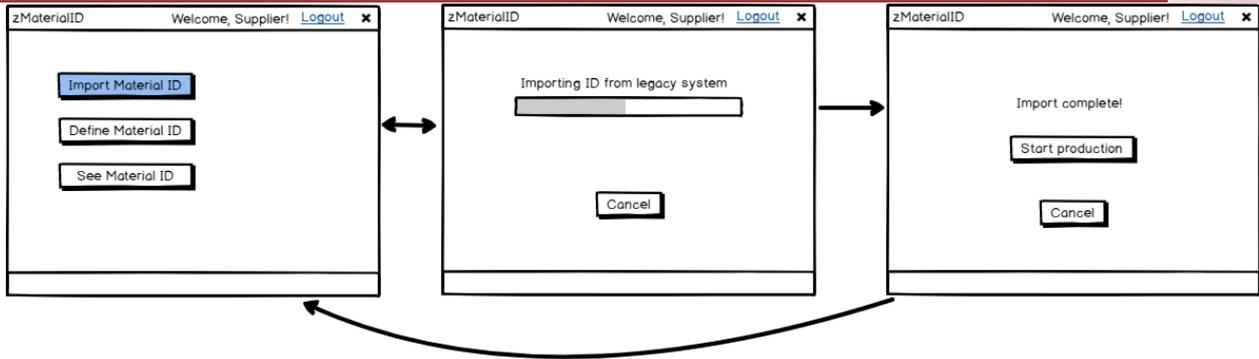


Figure 81: Import Material ID

When selecting the ‘Import Material ID’ option, the zApp will interact with the legacy production control system to retrieve information on the identification system it defined for the material to be produced.

The identification information is imported and, once finished, the Supplier clicks on ‘Start production’.

‘Start production’ will cause the zApp to interact with the legacy identification system so that the tags placed on the material parts produced follow the identification system. Also, the zApp will interact with zRemoteQC and zMaterialTracker databases to relate the tags issued to a Client and an order (and, later on, to a shipment and a location at the worksite).

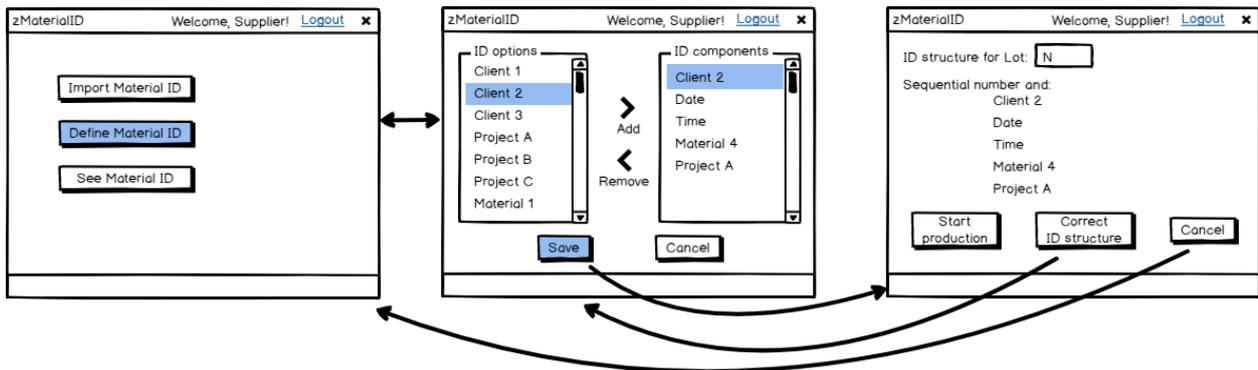


Figure 82: Define Material ID

If the Supplier prefers to define a specific identification structure for the parts to be produced, it clicks on ‘Define Material ID’. This could be relevant if, for example, the parts are identified with a bar code. The zApp shows a window with a list of all possible identification options. Most of these will be collected from zRemoteQC, while others will be there by default (for example, date and time).

The Supplier composes the identification structure by selecting an option on the ID Options list and clicking on ‘Add’. This will transfer the chosen option to the ID Components list. Items on this list will be used to compose the identification code to be applied on the material parts produced.

Items can be added or removed from the components list by clicking on the relevant icon.

Upon clicking on ‘Save’, the zApp shows a window where the components of the identification tags are shown. The identifications to be applied on the material parts will be, for example, a set of numbers, corresponding to each of these components, plus a sequential number. Example: considering the drawing above, a possible tag could be 10

190630 1505 5 2 0005 (10 for Client 2, 190630 for a part produced on the 30th of June 2019, 1505 for a part produced at 15:05, 5 for Material 4, 2 for Project A and 0005 being the sequential number corresponding to the 5th unit produced).

The Supplier can add a lot number, corresponding to a group of parts that share the same identification structure and the same production period. This lot number will be used to identify the group of parts in zRemoteQC. The lot number is not mandatory, as there may be situations in which each part needs to be controlled individually.

The identification structure defined can be corrected by clicking on ‘Correct ID structure’. By clicking on ‘Start production’, the zApp will issue the identification defined to each part produced from that point on.

The zApp must interact with the production control legacy system for parts identification according to the defined structure and for setting the start of production. End of production is defined by the legacy system.

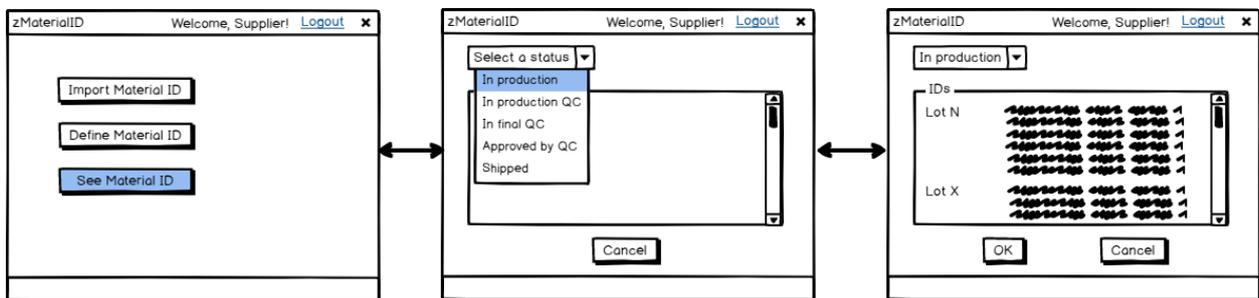


Figure 83: See Material ID

By clicking on ‘See Material ID’ the supplier will be able to see a list of lots and corresponding material parts identification at different stages in the production process. The production stage is selected from a combo box. For this, the zApp will interact with the production control legacy system and with zRemoteQC.

3 Conclusion

This deliverable provides an initial description of the mock-ups for each application from the user's perspective as well as a generic understanding of the main functions and usability-related requirements of the zApps in the respective fields. It provides several meaningful examples of specific actors of the value chain using the applications and their needs, from the data access and data sharing perspective.

For each zApp, the document presents the objectives, the principal non-technical features and the needed functionalities, mainly due to the approach to quality control, production logistics, and maintenance policies that are, in most cases, not integrated and relying more on the workers experience than on actual data.

The industrial partners participating to each use-case then describe graphically the zApps and how they will change the work and data flows. A change desired by all parties is a larger involvement of the supply chain actors and a better traceability of the product quality, whilst granting access restrictions and respecting data privacy.

A general desire is also expressed for the adoption and exploitation of condition-based and learning approaches for correlating the machine degradation state to the workpiece quality locally, directly on the machines and at the production line.

A further automatisisation of data and results visualization (graphs, plots, statistics, etc) is often a very central aspect in the mock-up's construction, given that the actual adoption will depend as much on this usability issue than on the algorithm's validity.

The use of the zApps and their functionalities will be further elaborated and specified in D9.1 and D10.1.

This deliverable will be exploited for the design of ZDMP core technologies in WPs 5, 6, 7 and 8.

Annex A: History

Document History	
Versions	<p>V0.1.x:</p> <ul style="list-style-type: none"> • Draft produced by editor <p>V0.2.x:</p> <ul style="list-style-type: none"> • Inclusion of all user partners • Upgrade of chapter 1 • First complete draft <p>V0.3.x:</p> <ul style="list-style-type: none"> • Feedback from first Reviewer <p>V0.4.x:</p> <ul style="list-style-type: none"> • Feedback from second Reviewer <p>V1.00:</p> <ul style="list-style-type: none"> • Third reviewer processing and EU Submitted version
Contributions	<p>FIDIA:</p> <ul style="list-style-type: none"> • Raffaele Ricatto • Alessia Focareta <p>UNIN:</p> <ul style="list-style-type: none"> • Jose Ferreira <p>MRHS:</p> <ul style="list-style-type: none"> • Mariano López-Catalá • Eduardo Vila <p>HSD</p> <ul style="list-style-type: none"> • Paolo Galli <p>FORM:</p> <ul style="list-style-type: none"> • Jindrich Svoboda <p>CONS</p> <ul style="list-style-type: none"> • Paulo Rodrigues <p>CONT:</p> <ul style="list-style-type: none"> • Petru Demian • Horia Petrila <p>EXTE:</p> <ul style="list-style-type: none"> • Juan José Gabilondo <p>ITI</p> <ul style="list-style-type: none"> • Santiago Cáceres Elvira – Formal Reviewer 2 <p>IKER:</p> <ul style="list-style-type: none"> • Eduardo Saiz • Oscar Salgado <p>SOFTECO</p> <ul style="list-style-type: none"> • Christian Melchiorre – Formal Reviewer 1 <p>FORD</p> <ul style="list-style-type: none"> • José Luis Monasor <p>ICE</p> <ul style="list-style-type: none"> • Stuart Campbell – Formal Reviewer

Annex B: References

[RB04] Ryppl, D., & Bittnar, Z. (2004). Triangulation of 3D surfaces reconstructed by interpolating subdivision. *Computers & structures*, 82(23-26), 2093-2103.

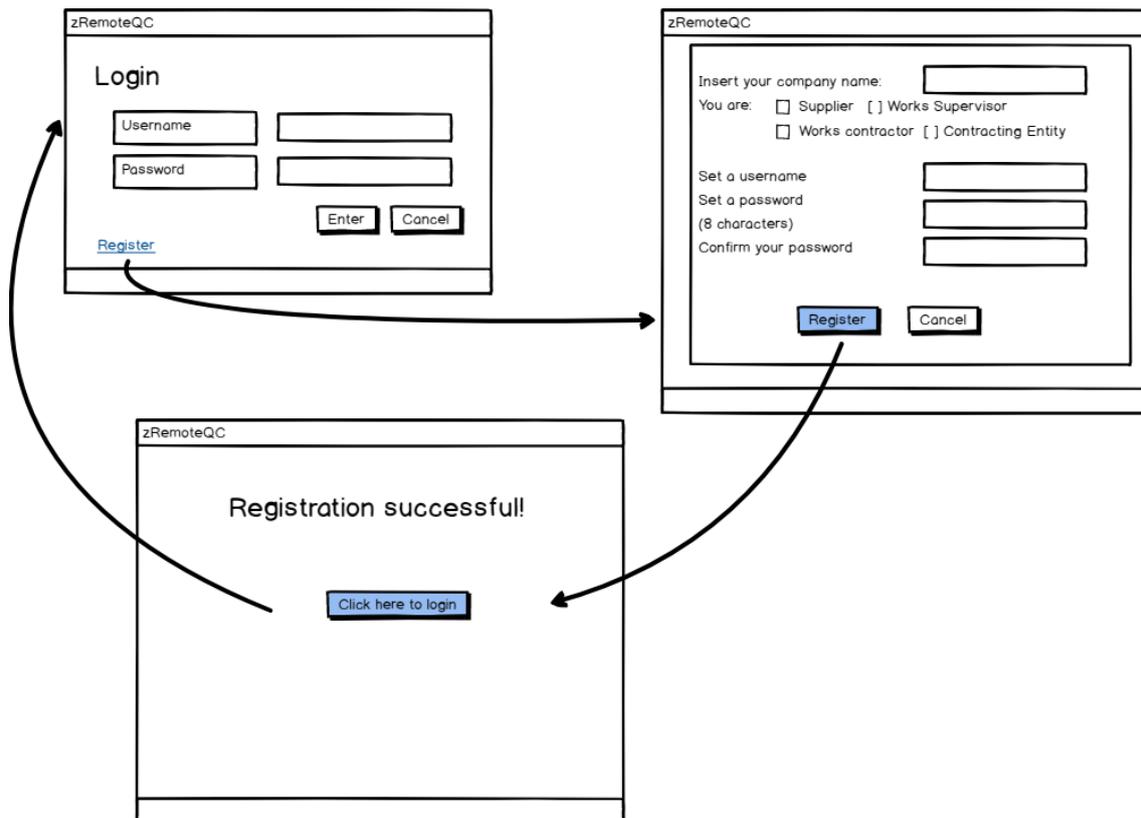
Annex C: Mock-ups details

This annex includes some zApp mock-ups for which at this stage a higher level of detail has already been identified by the users.

zA4.10 zRemoteQC

This zApp allows sharing information concerning lots of materials to be supplied to a construction site by the Supplier and the corresponding reception Quality Control, carried out by the Works Contractor and Works Supervision at the construction site.

Each party has access to its own area in the application.



- Common to all parties
- Each party needs to register on first access by defining:
 - Company name
 - Role in the project
 - Username set as an email. This email will be used for future communications within the app
 - A password
- Access is performed using the username and password set on registration
- There is no need to set different login data for new projects, ie the login data is valid for a specific user

Supplier Workspace

The Supplier Area allows access to the following options:

- Set Up

- Lots Status
- Deliveries
- Shipment
- Notifications

Set Up

The Supplier Set Up area allows defining a new Client (Works Contractor) and fetching information or editing information on an existing Client, including adding new Material. The Supplier's Client is the Works Contractor.

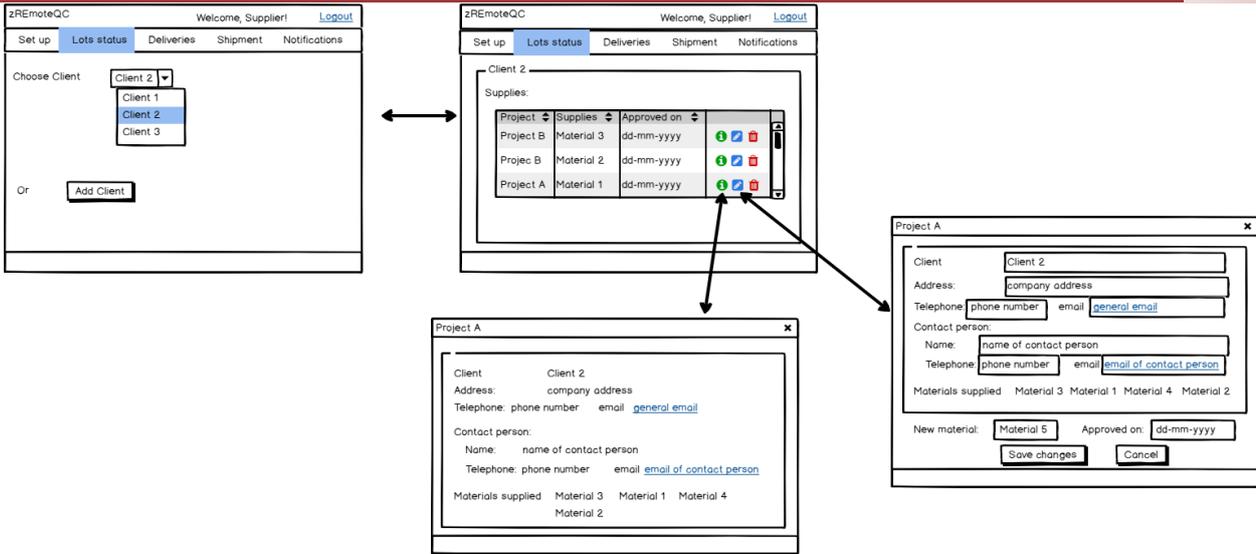
Projects listed are the ones added by the Supervisor and selected by the Works Contractor in their own Set Up areas.

The image shows two screenshots from the zREmoteQC application. The left screenshot shows the 'Set up' menu with options: 'Set up', 'Lots status', 'Deliveries', 'Shipment', and 'Notifications'. Below the menu, there is a 'Select Client' section with a dropdown menu labeled 'Select Client from list' and an 'Add Client' button. The right screenshot shows the 'New Client' form with the following fields: 'Client' (Company name), 'Address' (company address), 'Telephone' (phone number) and 'email' (general email), 'Contact person' (Name: name of contact person, Telephone: phone number, email: email of contact person), 'Material to supply' (Material 3), 'Approved on' (// /), and 'Project' (Project B). A dropdown menu for 'Project' is open, showing options: Project A, Project B (selected), and Project C. There are 'Save changes' and 'Cancel' buttons at the bottom right of the form.

- Upon clicking on 'Add Client' the Supplier fills in the Client's data:
 - The data includes:
 - The Material to be supplied
 - The approval date, which is the date the Supervision approved the Supplier proposed by the Works Contractor
 - The Project for which the Material will be supplied. This is selected from a dropdown list containing the Projects that Supervision has registered in its own Set Up area
- Contact information herewith registered will be used for communication with the Client
- This option is used also in case of supplies for a new Project of an already existing Client

Set Up allows also:

- Accessing summarised information about a Client
- Adding a new material to be supplied to the same Client and Project



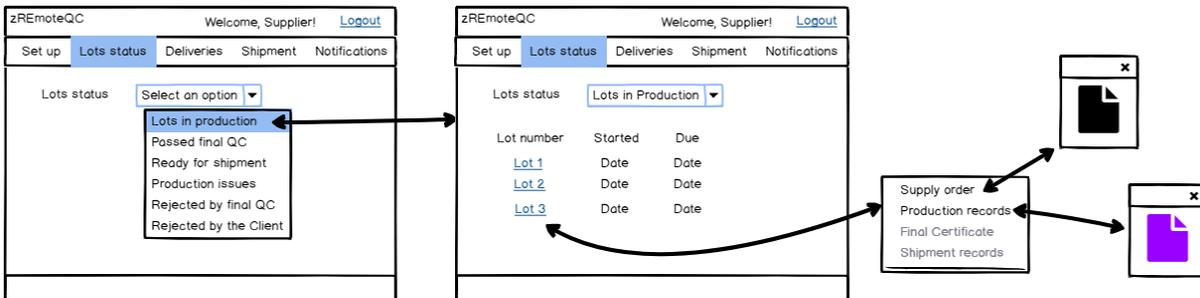
- The Client is selected from a dropdown list containing the registered Clients
- The zApp returns information on the Projects and Materials associated to that Client
- By clicking on 'Info', the zApp returns current available information about the Client
- By clicking on 'Edit', the zApp allows editing Client information and adding a new material to be supplied to a specific project

Lots Status

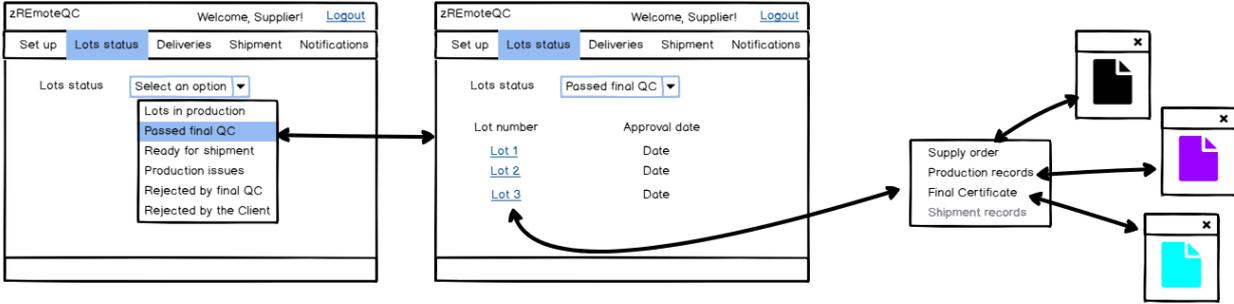
This option allows access to information about the lots being produced or already supplied and to their corresponding documentation.

The specific status for which information is required is accessed through a dropdown list.

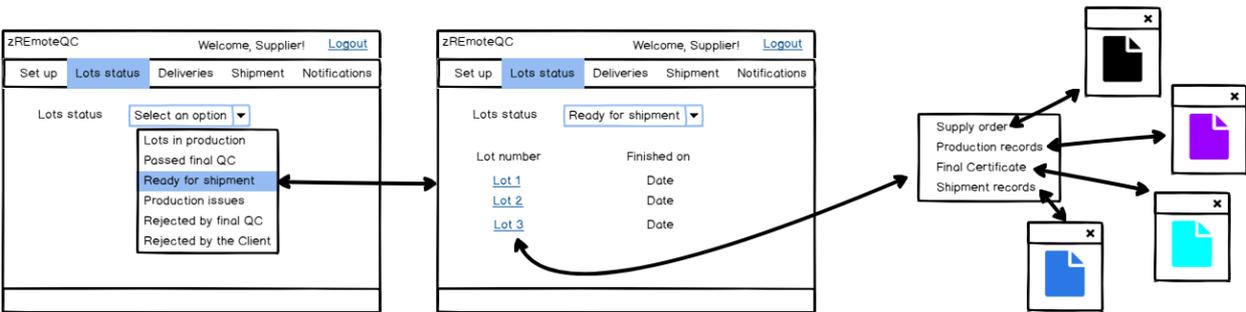
The zApp must interact with the Suppliers legacy systems.



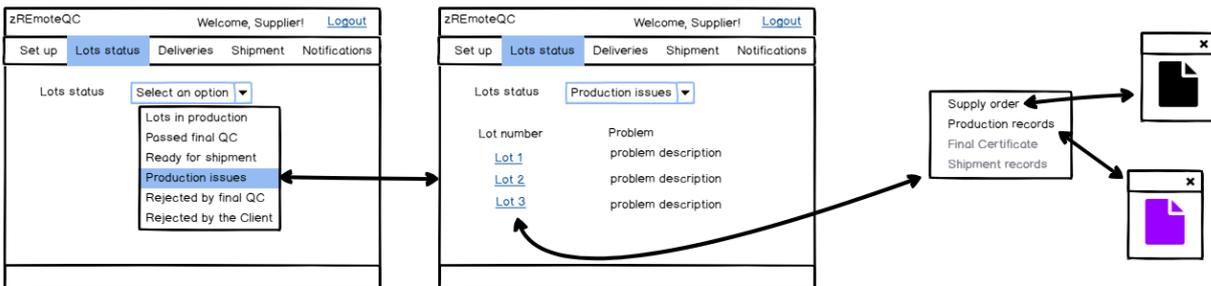
- The option lists the lots being produced, their production start date, and the date when production is expected to end
- By clicking on the lot number, the zApp allows access to documentation available at that stage for that lot, which should be the Supply Order and Production Records
- By clicking on each of them, the zApp opens a window displaying the document



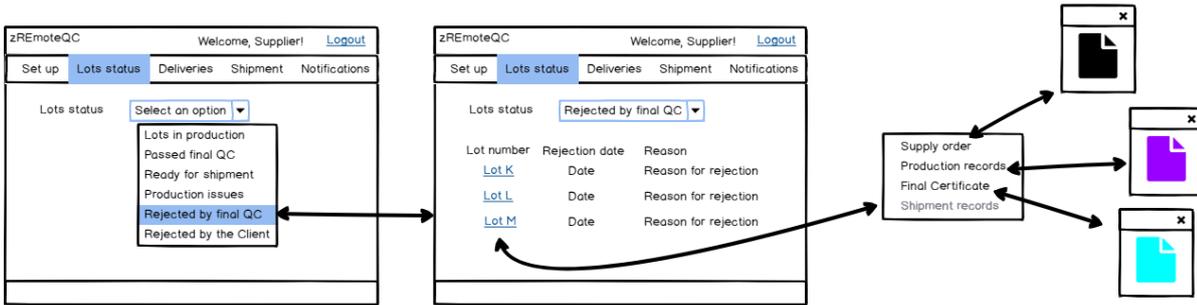
- This option lists the lots that have passed the final quality control and the date on which they were approved
- By clicking on the lot number, the zApp gives access to an additional document with respect to the previous option, which is the Final Certificate, ie, the final quality control certificate



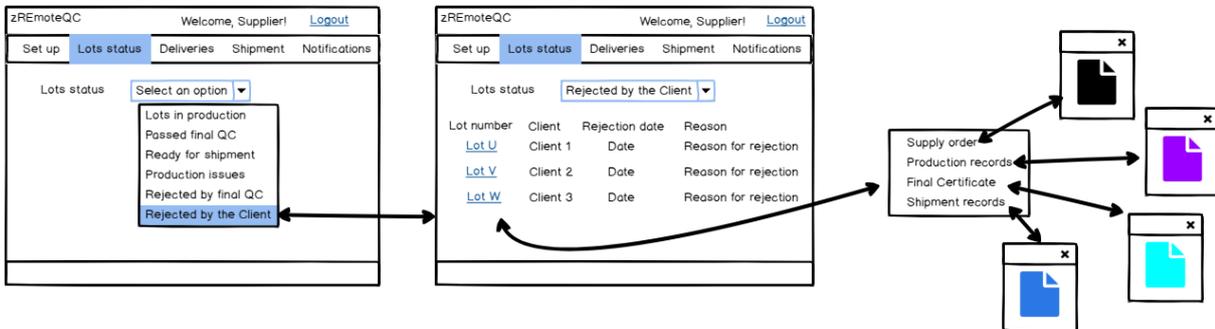
- This option lists the lots that have passed the final quality control and are ready for shipment, including the date on which they were released for shipment
- This option collects information for the 'Shipment'
- By clicking on the lot number, the zApp gives access to an additional document with respect to the previous option, which is the Shipment Records



- This option lists the lots for which problems during production have occurred and a description of the corresponding problem
- By clicking on the lot number, the zApp allows access to documentation available at that stage for that lot, which should be the Supply Order and Production Records
- This option will interact with the Supplier's production control legacy systems



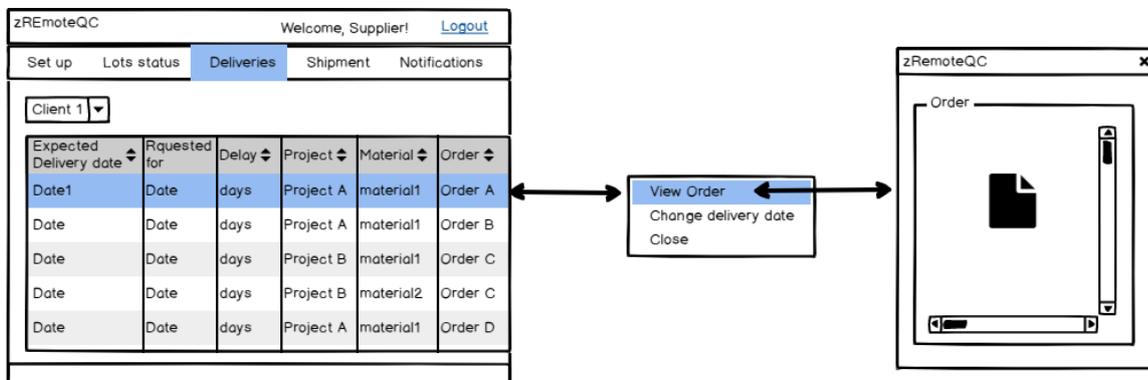
- This option lists the lots rejected during final quality control, the corresponding date, and the reason for rejection
- By clicking on the lot number, the zApp gives access to an additional document with respect to the previous option, which is the Final Certificate, ie the final quality control certificate which should describe the tests carried out that led to the lot's rejection



- This option lists the lots rejected during quality control at the work site by the Client, including the corresponding date and reason for rejection
- By clicking on the lot number, the zApp gives access to an additional document with respect to the previous option which is the Shipment Record(s)
- This option will receive information from the 'Quality Control' section on the Works Contract work area

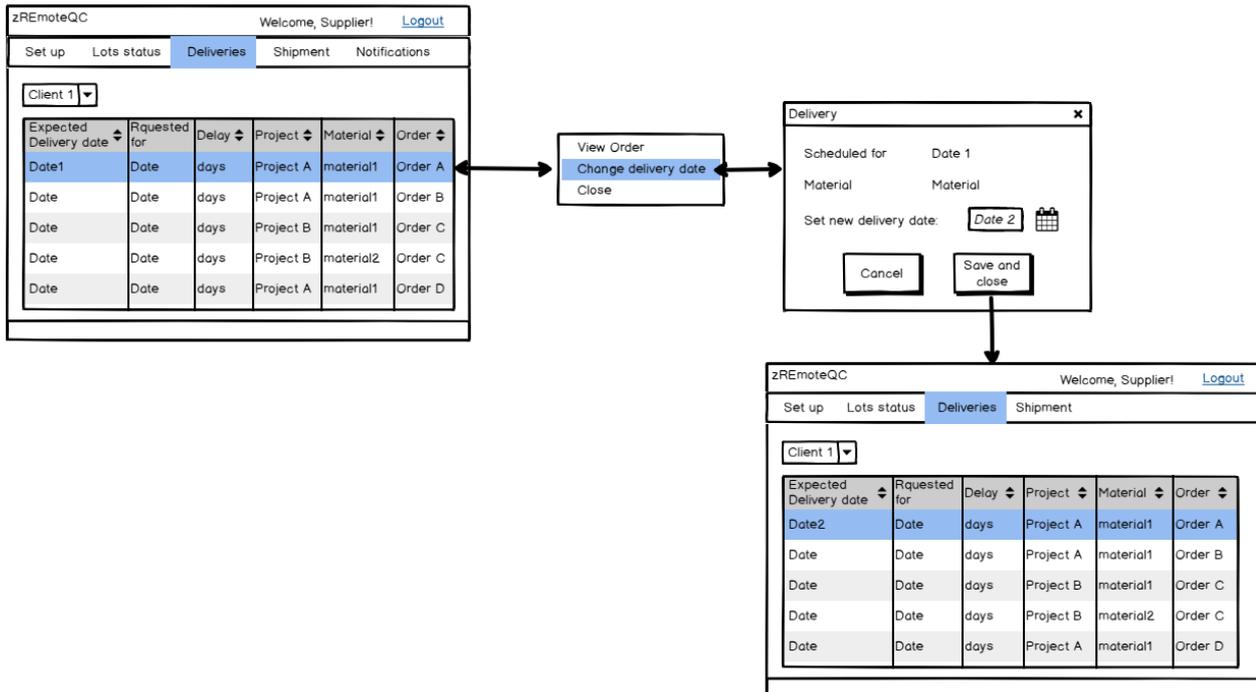
Deliveries

This section allows the Supplier to obtain information about the delivery dates of the various orders and, most importantly, it allows the Supplier to change a pre-scheduled delivery date. This becomes an input for the zRescheduler zApp.



- The Supplier has access to a list of deliveries scheduled for a specific Client (selected from a combo box);

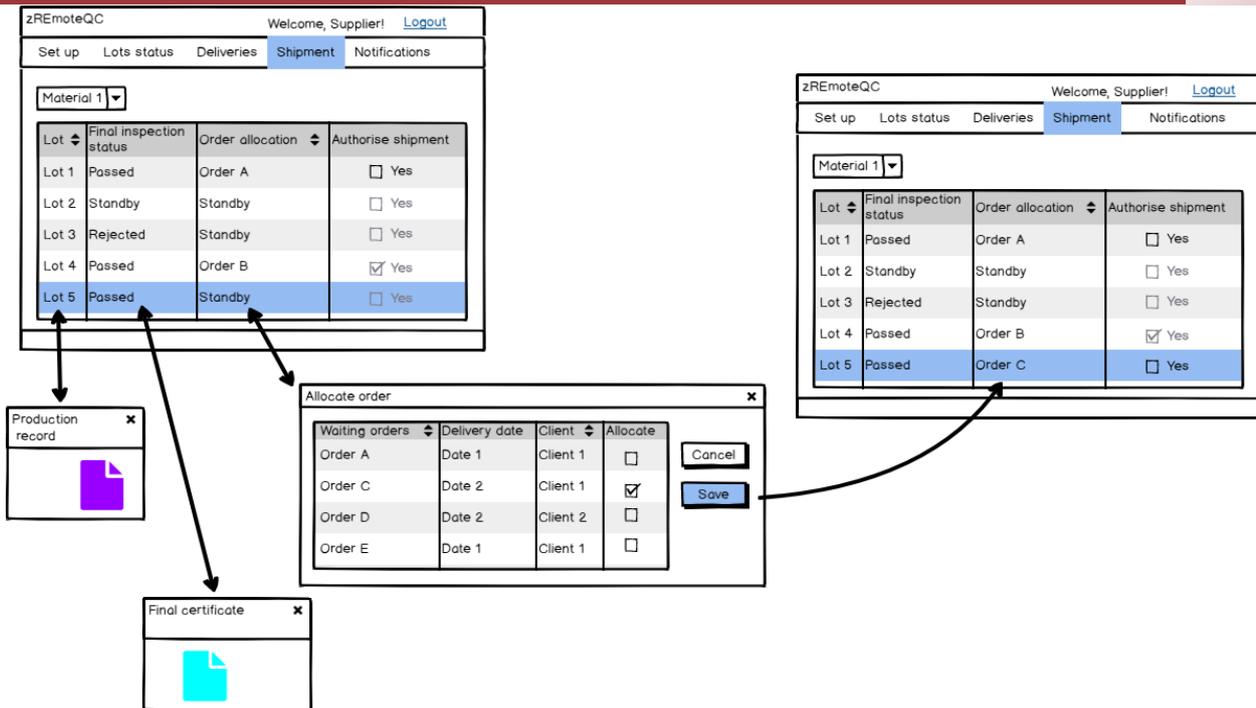
- By selecting a specific delivery date, the Supplier can have access to the order placed by the Client and scheduled to be fulfilled on the selected date



- By selecting a specific delivery date, the Supplier can change that date and set a new one
- Upon clicking on “Save and close”, the new date replaces the previous scheduled delivery date and now shows under the heading “Expected delivery date”
- The new delivery date is reported to the Contractor and the Supervisor, via the zReschedule zApp

Shipment

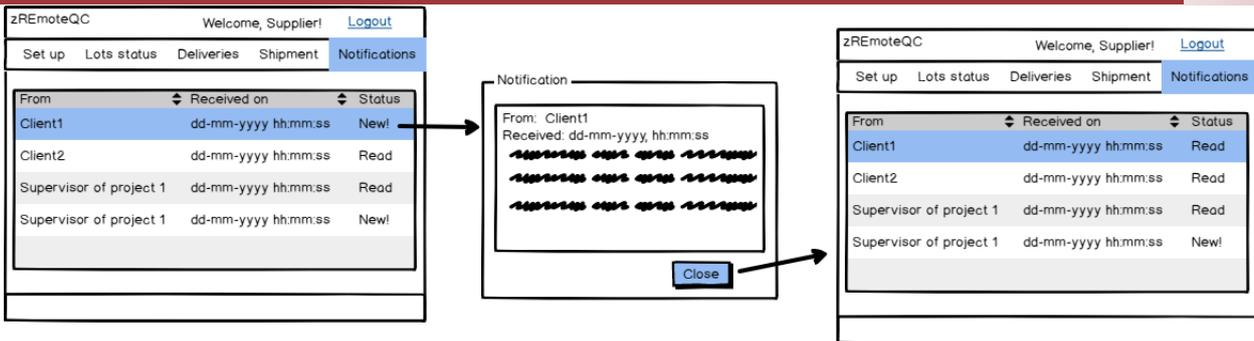
In this section, the Supplier is able to allocate a certain material lot to a supply order and release it for shipment.



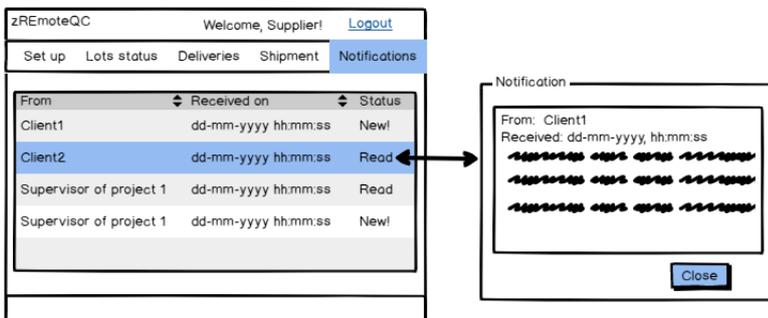
- For a specific material, chosen from a set of options under a combo box, the Supplier obtains a list of all lots of that specific material, with an indication of their status on what concerns final quality control and supply order that is going to be fulfilled
- Upon clicking on the lot number, the Supplier will be able to see the lot's production records
- Upon clicking on the lot's final inspection status, the Supplier will be able to see the final quality control certificate; if the status is 'Passed' (ie approved by quality control) or 'Rejected'. This option will be disabled if the status is 'Standby'
- Upon clicking on the lot's order allocation, the zApp returns a window with a list of orders waiting to be fulfilled, the corresponding expected delivery dates and clients.
- Upon ticking the box in the column 'Allocate', the Supplier will be allocating a specific lot (Lot 5, in the example above) to a specific order. This information is updated on the list, upon clicking on 'Save'
- The Supplier can change a lot allocation on an order
- Upon ticking the box in the column "Authorise shipment", the Supplier will be releasing the corresponding lot for shipment, thus fulfilling the order the lot was allocated to
- The 'Yes' boxes in the column "Authorise shipment" will be disabled by default for lots with status "standby" or "rejected", thus preventing that lots not approved by quality control are accidentally shipped. Similarly, the boxes will be disabled after being allocated to a specific lot

Notifications

This section will allow the Supplier to access and read notifications from its Clients and from the Works Supervisors of projects in which its clients are involved.



- The notifications area lists the messages received, indicating the date and time of reception and their status ('New' for notifications not yet read and "Read" otherwise)
- By clicking on the line corresponding to a new message, the zApp shows the relevant message
- By clicking on 'Close', the zApp returns to the notifications list and the notification status changes from 'New' to 'Read'



- A message previously read can be read again by clicking on the corresponding line
- After clicking on close, the zApp returns to the notifications list and the message status remains unchanged.

Works Contractor Workspace

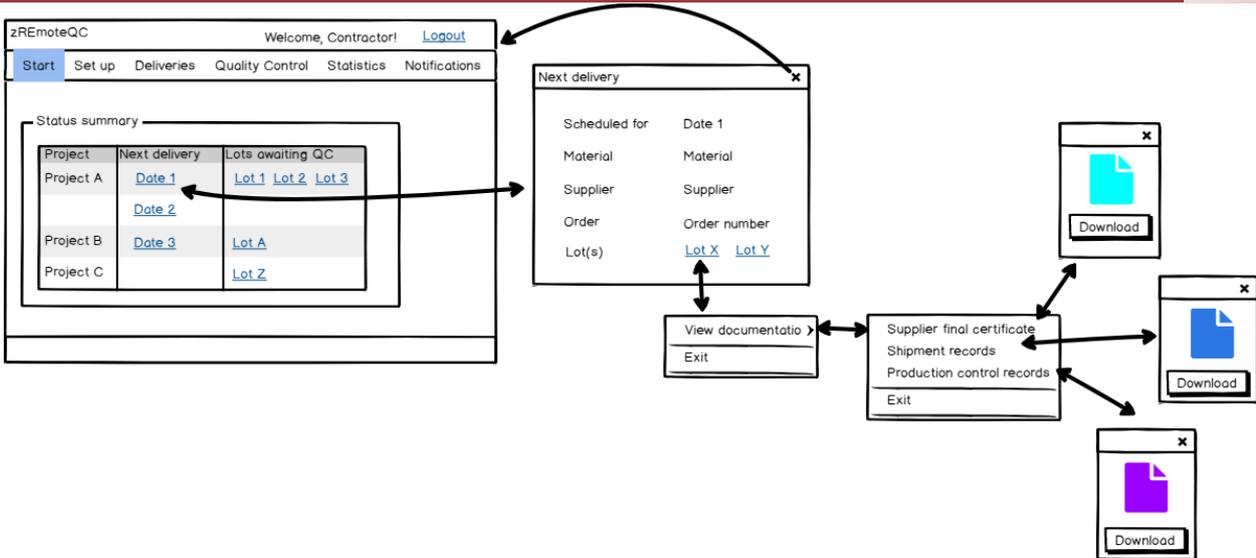
The Works Contractor Area allows access to the following options:

- Start
- Set Up
- Deliveries
- Quality Control
- Statistics
- Notifications

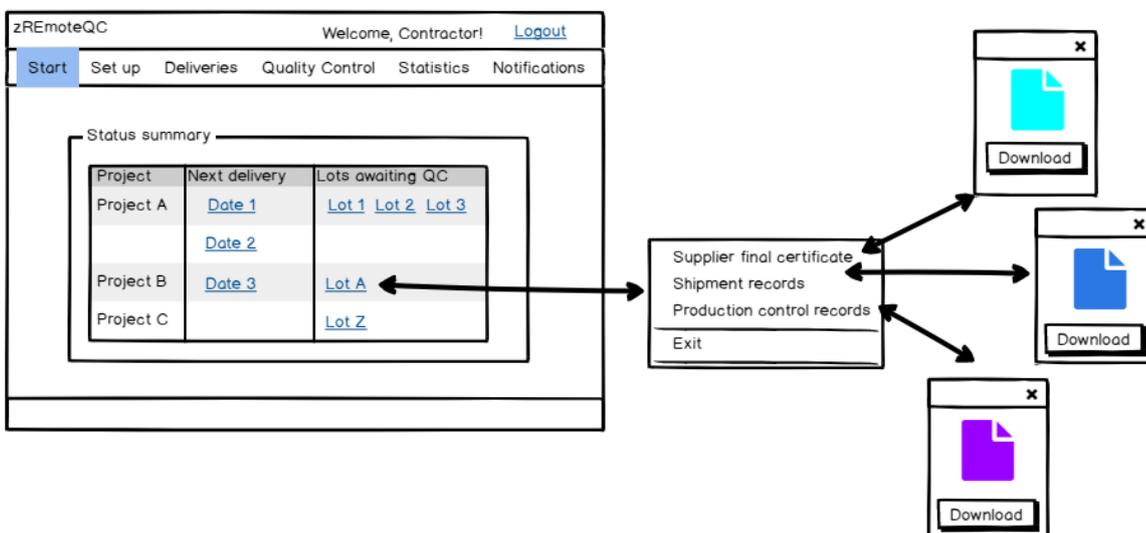
The zApp must be able to interact with the Works Contractor's legacy system for indication of where to save the downloaded documents.

Home screen

In this section, the Works Contractor will be able to have an overview of the pending issues for each project in which it is involved (it may happen that a specific Works Contractor operator is involved in more than one construction site, ie construction project).



- For each project in which it is involved, Works Contractor staff have access to information concerning future delivery dates and lots awaiting reception quality control
- Upon clicking on a specific delivery date, the zApp returns a screen with information concerning that delivery, namely:
 - Initial schedule delivery date (may be different from the date selected, in case the Supplier changed the delivery date for some reason)
 - The material to be supplied and its provenance (Supplier identification)
 - The supply order placed by the Works Contractor that is being fulfilled
 - The lots that are going to be supplied
 - Both the information on supply order and lots comes from the deliveries area in the Supplier workspace and is defined by the Supplier
- Upon clicking on the lot identification, the Works Contractor has access to the lot's documents issued by the Supplier and that supported its release for shipment, ie the final quality control certificate, the shipment records and production control records
- If it wishes to, the Works Contractor can see and/or download each of these documents



- Upon clicking on a lot identification, in the column “Lots awaiting QC”, the Works Contractor will have access to see and/or download the lots documents issued by the Supplier

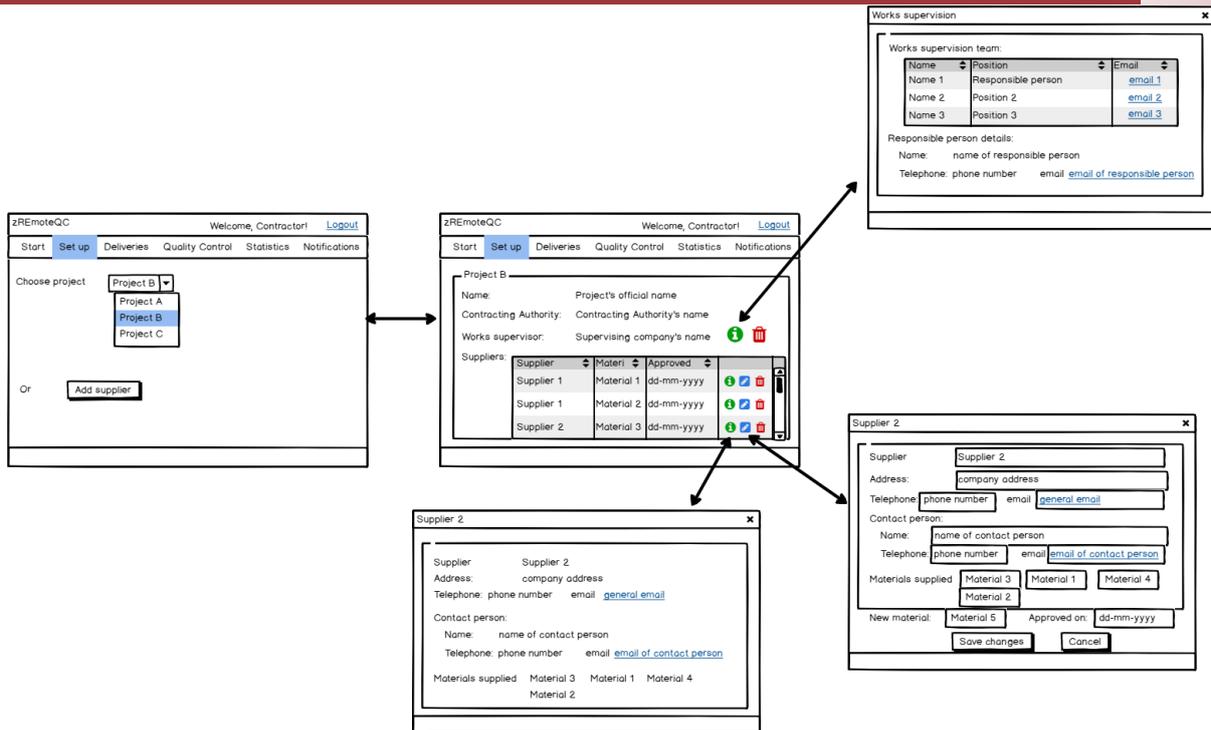
Set Up

In this section, the Works Contractor will be able to record information about a new Supplier, see information concerning Suppliers allocated to a specific project (ie, construction site), and add materials to the list of materials already provided by a specific supplier to a specific project.

The Works Contractor can interact with the zApp by selecting a project or by adding a new Supplier.

The image shows two parts of the zREmoteQC interface. On the left is the main application window titled 'zREmoteQC' with a 'Welcome, Contractor!' message and a 'Logout' link. The navigation menu includes 'Start', 'Set up', 'Deliveries', 'Quality Control', 'Statistics', and 'Notifications'. Under 'Set up', there is a 'Select project' dropdown menu with the text 'Select project from list' and an 'Add supplier' button. On the right is a 'New supplier' dialog box. It contains the following fields: 'Supplier' (text box with 'New Supplier'), 'Address' (text box with 'company address'), 'Telephone' (text box with 'phone number') and 'email' (text box with 'general email'), 'Contact person' section with 'Name' (text box with 'name of contact person') and 'Telephone' (text box with 'phone number') and 'email' (text box with 'email of contact person'), 'Material to supply' (text box with 'Material 3') and 'Approved on:' (text box with 'dd-mm-yyyy'). At the bottom of the dialog are 'Save changes' and 'Cancel' buttons. A double-headed arrow points from the 'Add supplier' button to the 'New supplier' dialog.

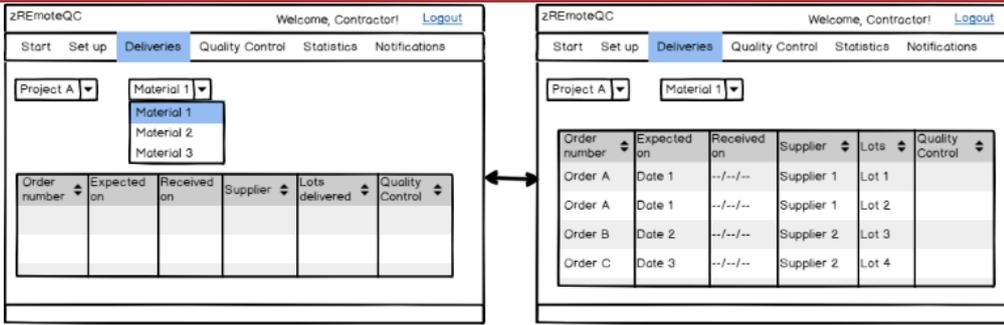
- The option ‘Add Supplier’ allows a new supplier to be registered
- By clicking on “Add Supplier” the zApp returns a template that the Works Contractor completes with information concerning the Supplier
- In general, this should be performed after a Supplier proposed by the Works Contractor is approved by the Works Supervisor, but in practice can be performed at any time
- The Works Contractor inserts contact information and the material to be supplied



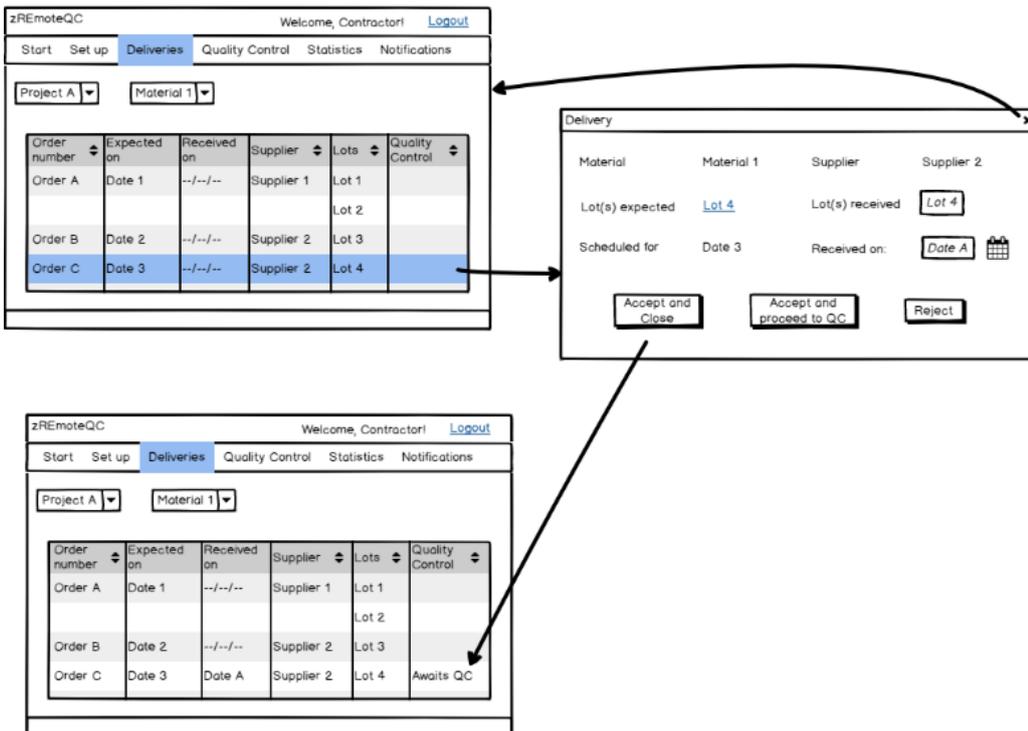
- The Works Contractor can have access to information concerning all suppliers allocated to a specific project through the 'Choose project' option
- The project is selected from a combo box. The projects listed must be registered by the Works Supervisor in its workspace Set Up option
- Upon selecting a project, the Works Contractor gets information concerning that project, namely the other intervening parties and a list of suppliers for that project
- The list of suppliers shows the materials supplied by each one and the date in which the supplier was approved by the Works Supervisor for the supply of a specific material
- The same Supplier can be approved to supply more than one material
- By clicking on the icon , the Works Contractor has access to specific information on the concerned party
- By clicking on the icon , the Works Contractor is able to edit information concerning the Supplier, namely inserting a new material to be supplied and the corresponding approval date. This option is available only for information concerning the Suppliers
- By clicking on the icon , the Works Contractor deletes the concerned information

Deliveries

In this section, the Works Contractor will be able to record the shipments received at the work site and decide on their acceptance or rejection. This is different from quality control but relates only to authorising a shipment to proceed to quality control or not.

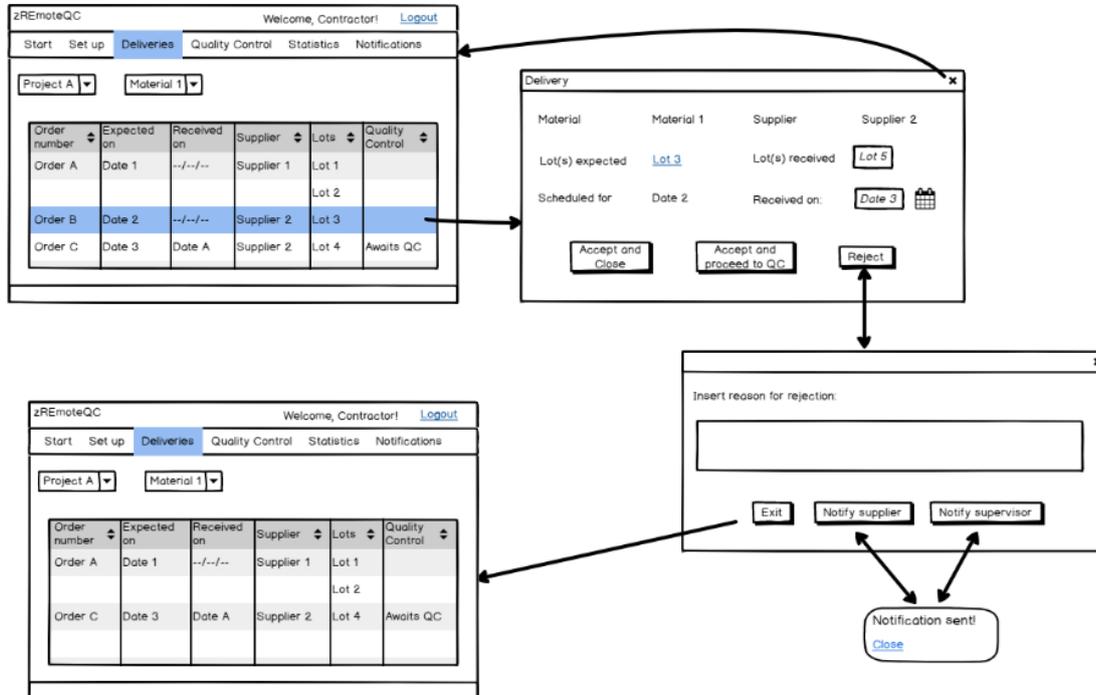


- For a specific project and for a specific material associated to that project, both selected from a combo box, the Works Contractor accesses information concerning:
 - The supply orders awaiting to be delivery
 - The expected delivery date, which is the date defined by the supplier in the Deliveries section of its own workspace
 - A field to be completed with the effective reception date
 - The Supplier that will provide the chosen material
 - The expected lots to be delivered (information from the Supplier works space)
 - Quality control status



- When a shipment arrives, the Works Contractor checks the shipment documents and identifies the order they correspond to
- The Works Contractor selects the line corresponding to that order and/or delivery date
- The zApp gives access to information concerning the expected delivery. The Works Contractor can then fill in information concerning the actual delivery; namely lot effectively delivered and effective deliver date

- In the case the shipment is acceptable (as per the Works Contractor judgement) and the material will go through detailed quality control at a later stage, the Works Contractor clicks on “Accept and close”
- The information on the orders list is updated with the actual delivery date and the lot status is set to “Awaits QC”



- The Works Contractor will click on “Reject” if, for any reason, it decides that it cannot accept the shipment (For example, the lot supplied is different from what was expected)
- In this case, the Works Contractor is prompted to insert a reason for rejection
- The Works Contractor clicks on ‘Notify Supplier’ and/or ‘Notify Supervisor’, in which case the reason for rejection is notified to both entities
- The Works Contractor can only leave the reason for rejection window through clicking on ‘Exit’
- The order in question disappears from the list of scheduled orders, as the supervisor will need to allocate a new shipment

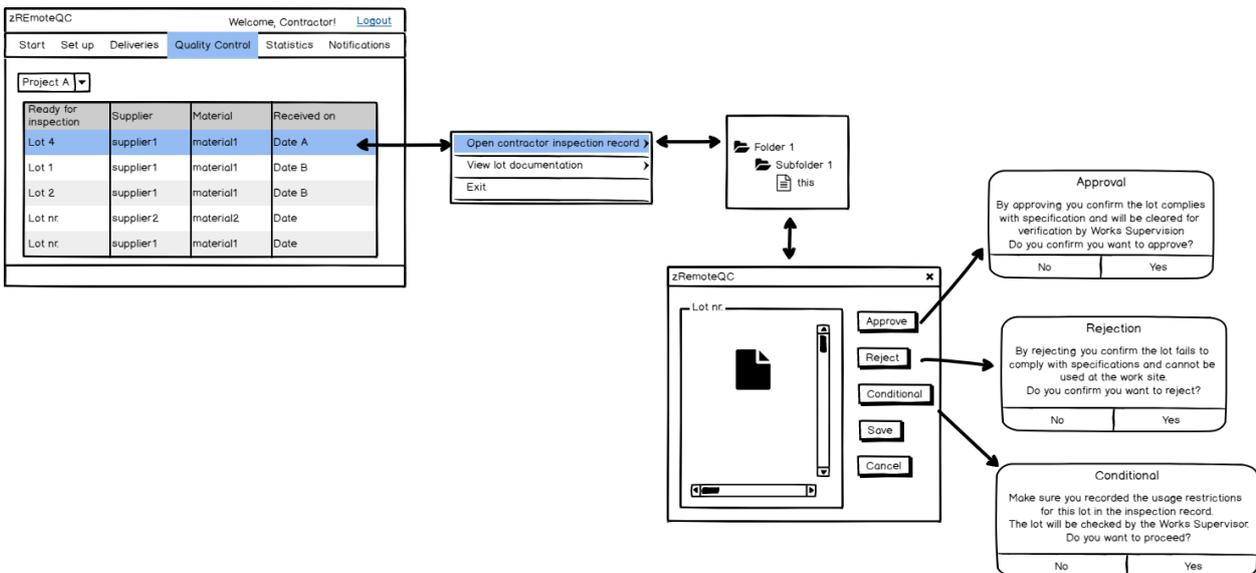


- The Works Contractor clicks on “Accept and proceed to QC” if it considers the shipment can be received at the work site and the lot needs to go through immediate quality control for full acceptance
- In this case, the corresponding order is removed from the list and transferred to the Quality Control area

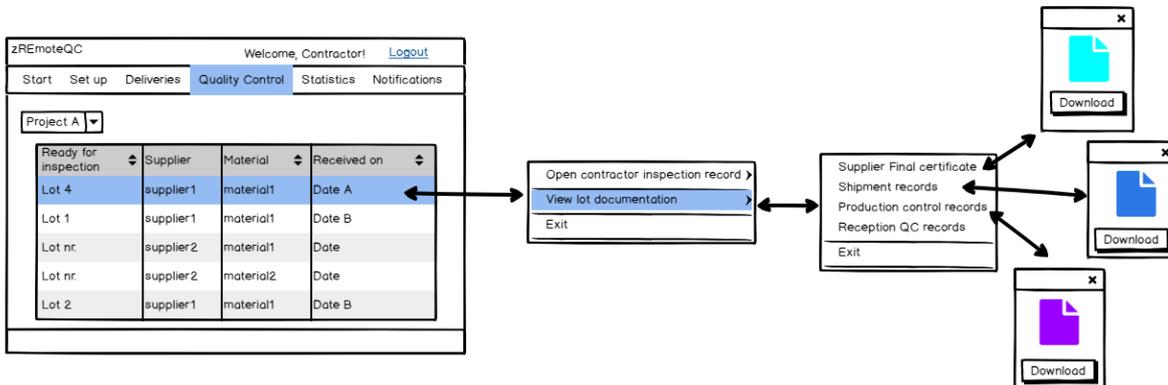
Quality Control

In this section, the Works Contractor will process information concerning the supplies reception quality control, which is essential to authorise the use of any material at the work site.

The zApp should interact with the Works Contractor’s legacy system to allow access to stored/to be stored templates/documents downloaded from the zApps database.



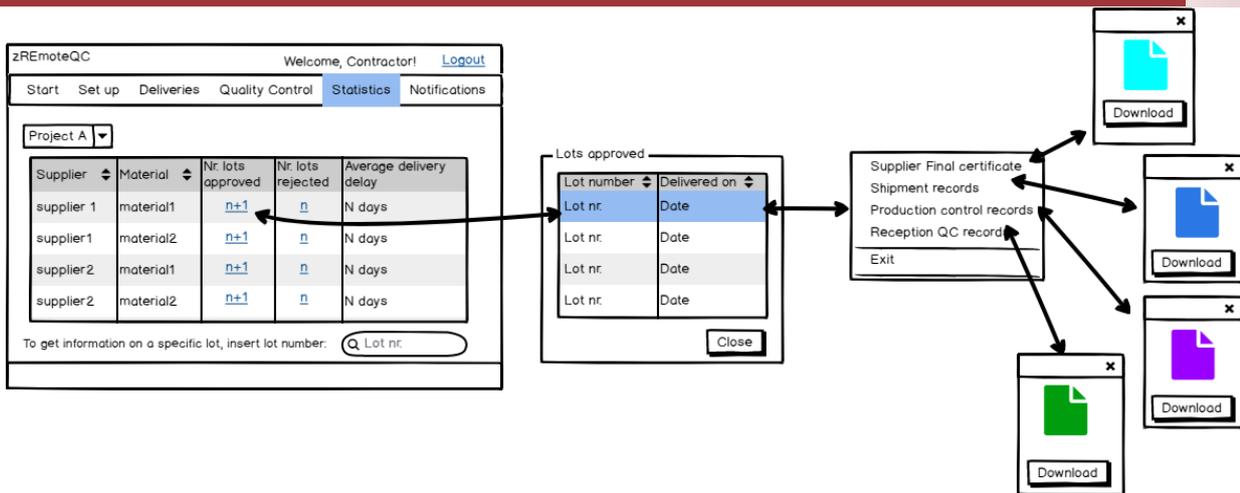
- For a specific project, selected from a combo box, the zApp lists information concerning all lots awaiting reception quality control
- The Works Contractor has the obligation to carry out quality control of all materials supplied to the works site
- When selecting a line corresponding to one lot, the Works Contractor has the possibility to open its own inspection record template, where the inspections to that lot will be recorded
- Upon finalising inspection, the Works Contractor needs to click on the button corresponding to its decision:
 - Upon clicking on 'Approve', the lot is considered adequate for use and is listed in the Works Supervisor quality control section as ready for verification by the supervisor
 - Upon clicking on 'Reject', both the Supplier and the Works Supervisor will receive an immediate notification of rejection
 - Upon clicking on 'Conditional', the lot is accepted for use with restrictions and these need to be recorded in the inspection record
- The Works Supervisor has also access to the Works Contractor's decisions in its own workspace
- After a decision has been issued concerning the lot, this will be removed from the list of lots awaiting inspection



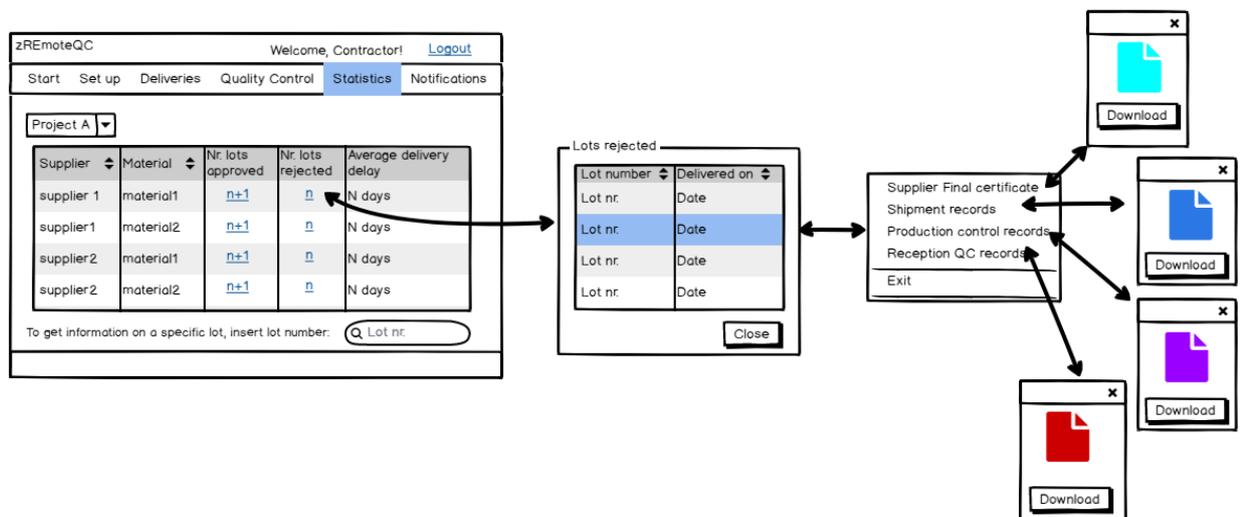
- Alternatively, the Works Contractor will have access to view and/or download the available lot's documentation

Statistics

In this section, the Works Contractor will have access to summary information concerning lots accepted or rejected and to information on a specific lot.



- For a specific project, the Works Contractor has access to information concerning the number of lots rejected or approved and average delivery delay, for a certain supplier and material
- By clicking on the number of lots approved of a specific material supplied by a certain supplier, the Works Contractor has access to the list of lots and corresponding delivery dates
- By clicking on a line corresponding to a lot, the Works Contractor has access to view and/or download the documents concerning that lot



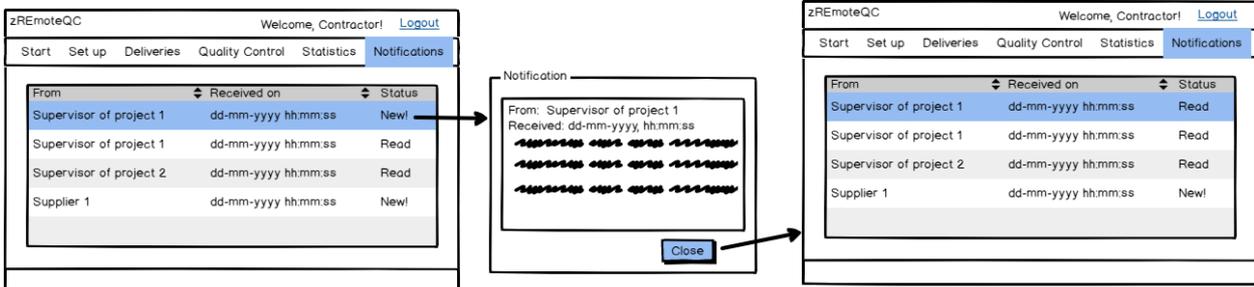
- In a similar way, the Works Contractor has access to information concerning lots rejected



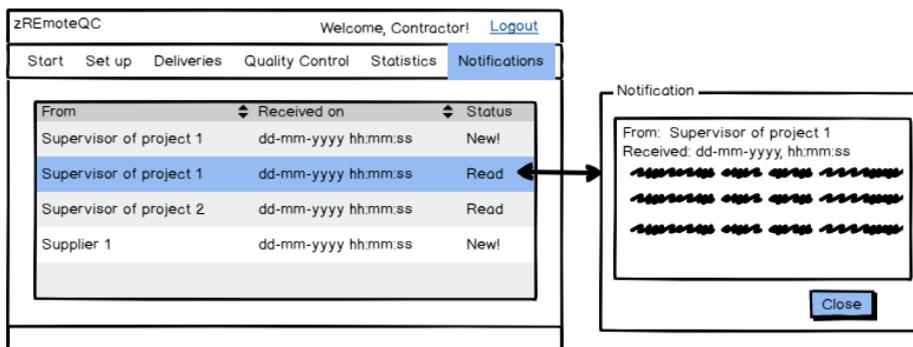
- The Works Contractor can also search for a specific lot number
- In this case, the zApp returns information concerning dates and delay and allows access to view and/or download the lots documents

Notifications

This section will allow the Works Contractor to access and read notifications from its Suppliers and from the Works Supervisors of projects in which it is involved.



- The notifications area lists the messages received, indicating the date and time of reception and their status ('New' for notifications not yet read and "Read" otherwise)
- By clicking on the line corresponding to a new message, the zApp shows the relevant message
- By clicking on 'Close', the zApp returns to the notifications list and the notification status changes from 'New' to 'Read'



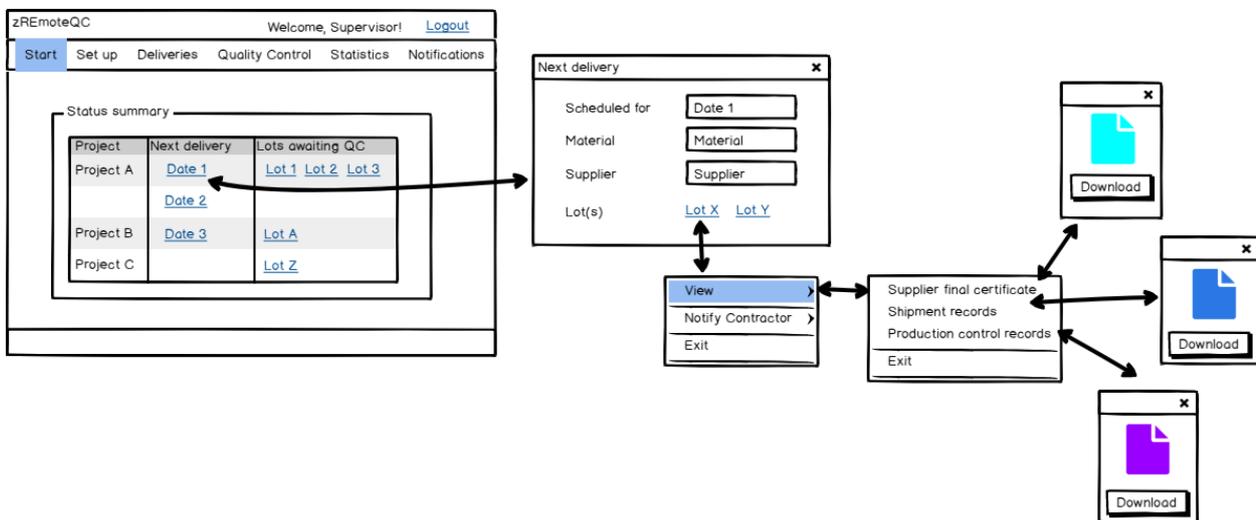
- A message previously read can be read again by clicking on the corresponding link
- After clicking on close, the zApp returns to the notifications list and the message status remains unchanged.

Works Supervision Workspace

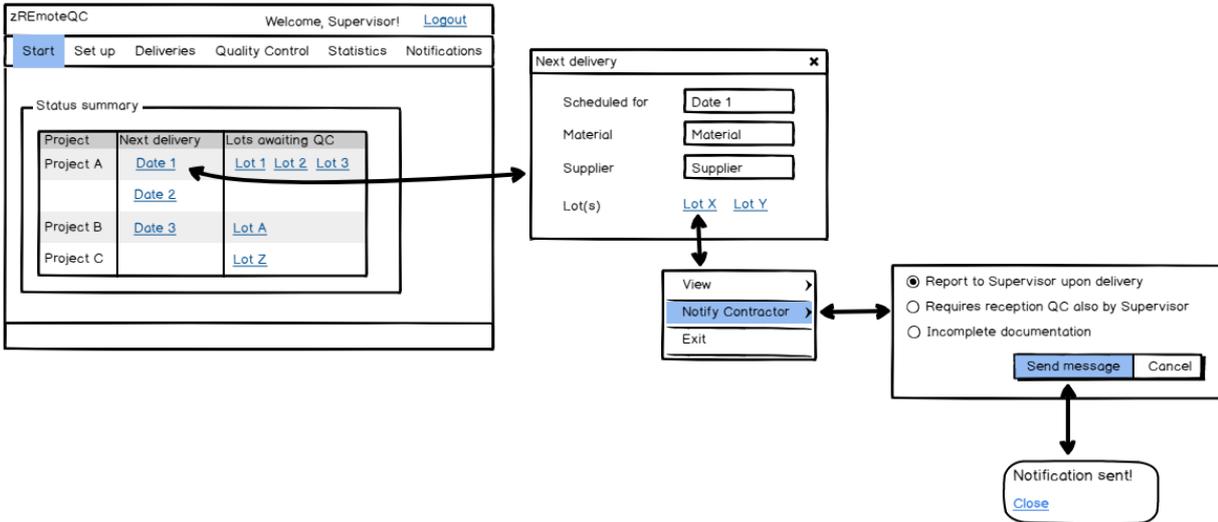
This is the work area of the Works Supervisor/Supervision. It is similar to the Works Contractor area, although the information displayed and the interaction with it is different. This work area is composed of:

- Start
- Set Up
- Deliveries
- Quality Control
- Statistics
- Notifications

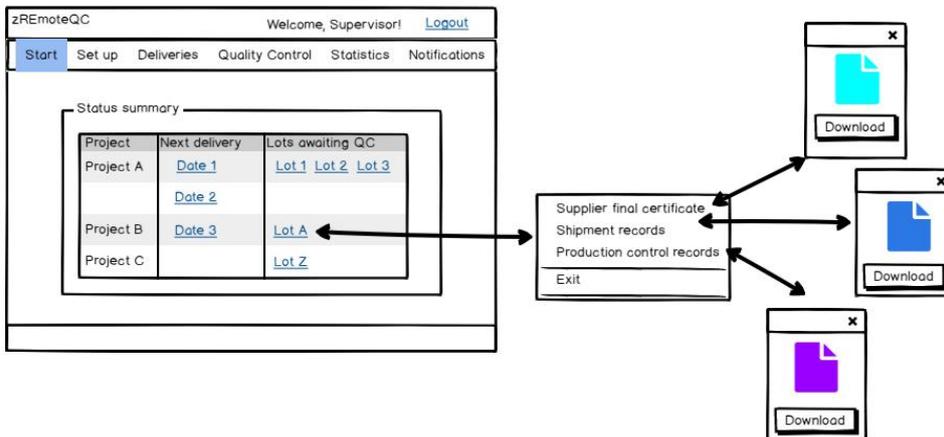
Home screen - Start



- The information displayed is identical to that in the equivalent section in the Works Contractor workspace
- Upon clicking on a date, the information provided is identical to that in the Works Contractor workspace, except for the order number, which is not displayed in the Works Supervisor area
- By clicking on a lot number, the Works Supervisor has access to the same options and actions as the Works Contractor, plus an additional action



- The additional action relates to the intervention the Works Supervisor may need which relates to when a material lot arrives
- Materials reception and reception quality control are to be carried out by the Works Contractor and validated by the Works Supervisor. However, the Works Supervisor may wish to only be present during reception and/or quality control or it may wish to carry out its own quality control actions.
- With the “Notify Contractor” option, the Works Supervisor will inform the Works Contractor if:
 - It needs to be informed when a particular lot arrives at the work site
 - It needs to carry out its own reception quality control actions
 - It encountered issues with the lot documentation (For example, missing information)

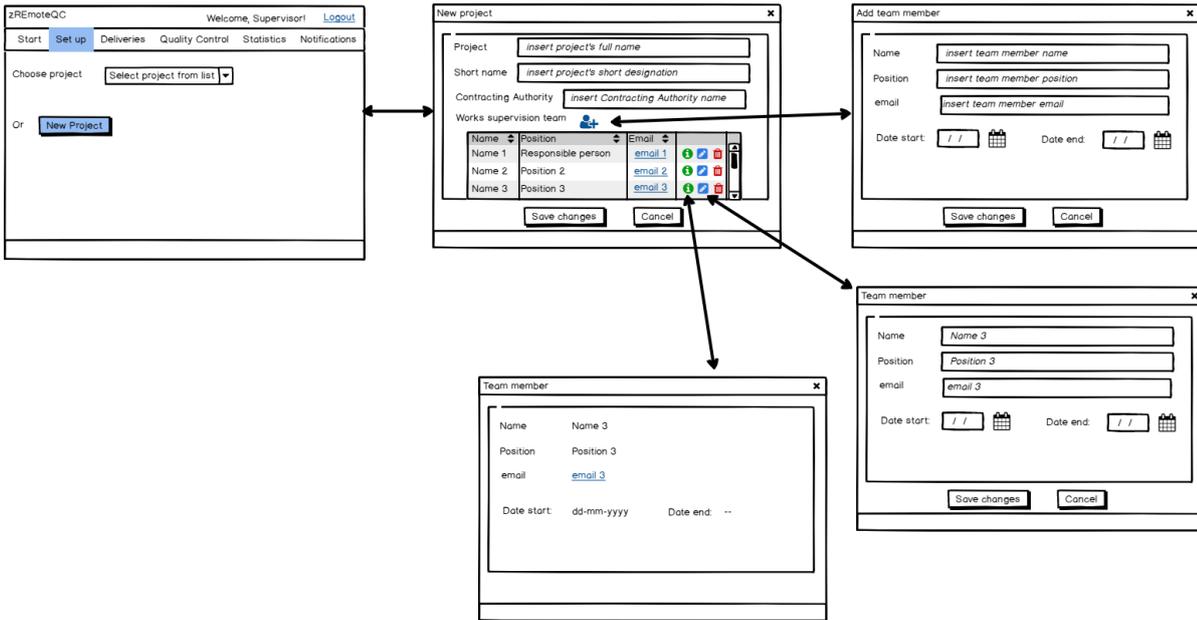


- By clicking on a specific lot identification, the Works Supervisor has access to the same information and actions as the Works Contractor in the equivalent section in its workspace

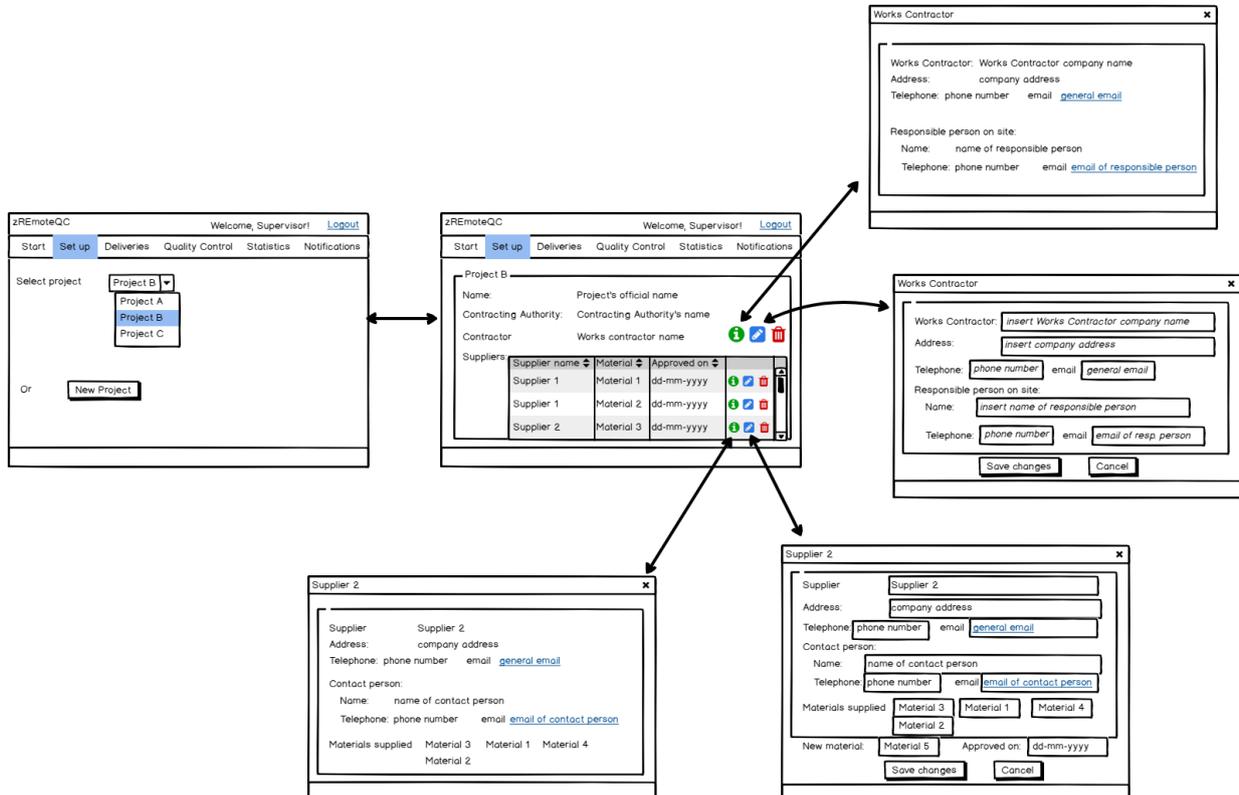
Set up

In this section, the Works Supervisor will register the project in the database, allowing it to be recognised in the other workspaces. The project will only be listed in the other workspaces after it is registered in this section.

The Works Supervisor can register a new project or access information on existing ones.



- When selecting New Project, the Works Supervisor inserts basic information concerning that project
- Also, the Works Supervisor registers the Works Supervision team members allocated to that project:
 - A new team member is added by clicking on and filling in the requested information
 - Information concerning each team member is accessed by clicking on , edited by clicking on and removed by clicking on
- After adding a new project, this becomes available for selection

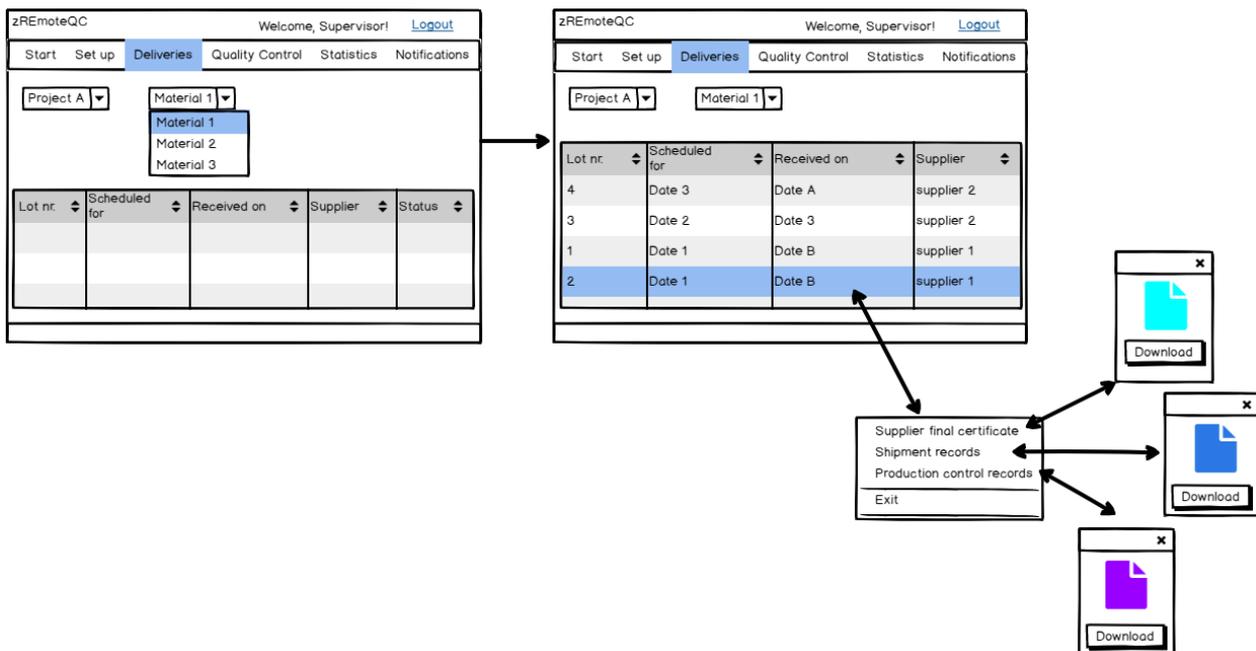


- By selecting a project (existing or recently created), the Works Supervisor has access to information concerning that project, its name, Contracting Authority, Works Contractor, and Suppliers involved
- For recently created projects, the Works Contractor and Suppliers information will be empty
- The Works Supervisor can add the Works Contractor details for new projects, or edit those details, for projects already existing by clicking on  on the Contractor field. The icons  and  will allow access to the Works Contractor data or to its elimination
- The Suppliers table is filled in by the Works Contractor in its workspace, although the Works Supervisor has the possibility to edit the corresponding information (setting the supplier's approval date, for example)

Deliveries

This will allow the Works Supervisor to access information concerning the shipments for a specific project similar to the Works Contractor case. The information displayed, however, is somewhat different.

The zApp will need to interact with the Works Supervisor legacy system to allow storage of documents downloaded from the zApp's database.

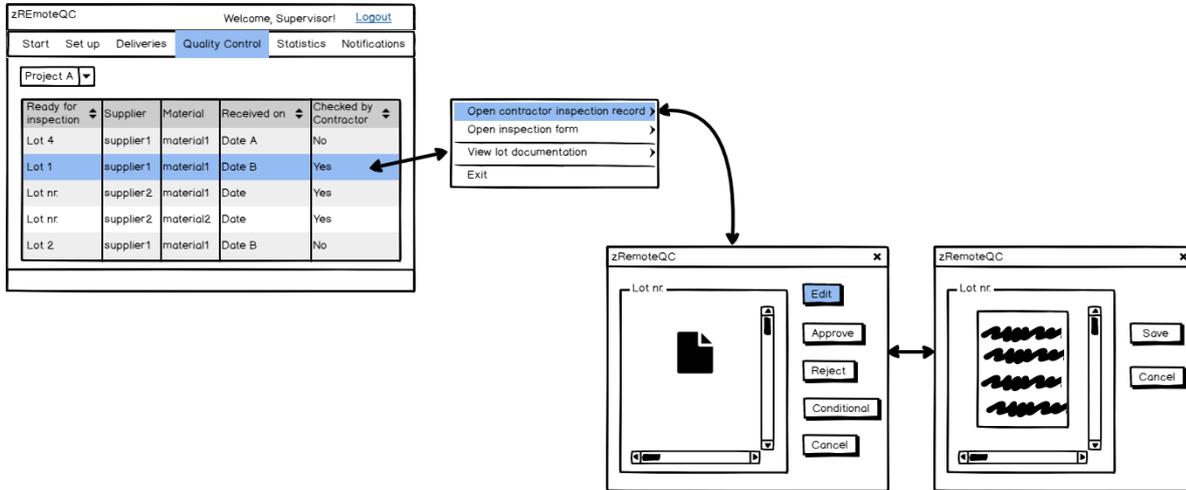


- After selecting a project and a material, the zApp display information concerning the lots received, expected date, effective arrival date and corresponding supplier
- By clicking on the line corresponding to a certain lot, the Works Supervisor has access to the corresponding documents issued by the Supplier – both for view and/or downloading
- The materials listed in the combo box are the ones for which a supplier has been approved for the selected project

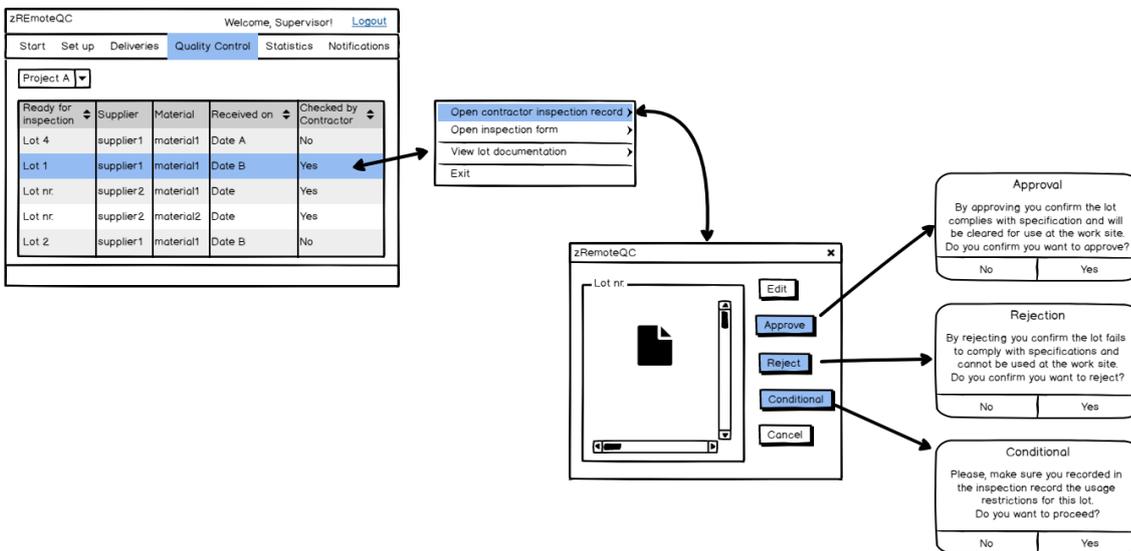
Quality Control

In this section, the Works Supervisor will handle its materials quality control related activity.

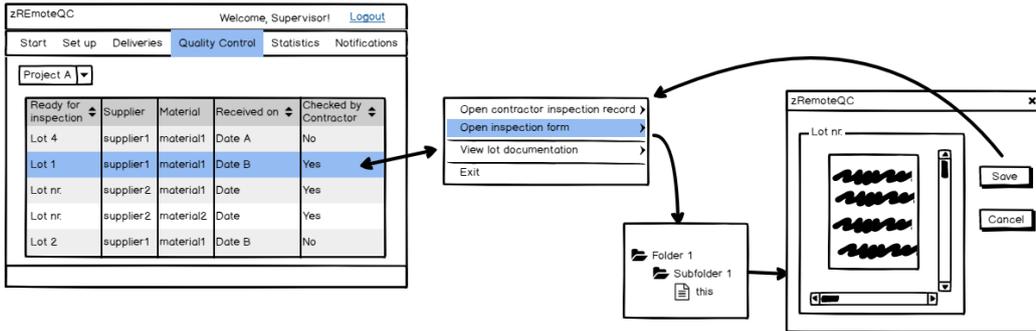
The zApp should interact with the Works Supervisor’s legacy system to allow access to templates to store and from the storage of documents downloaded from the zApps database.



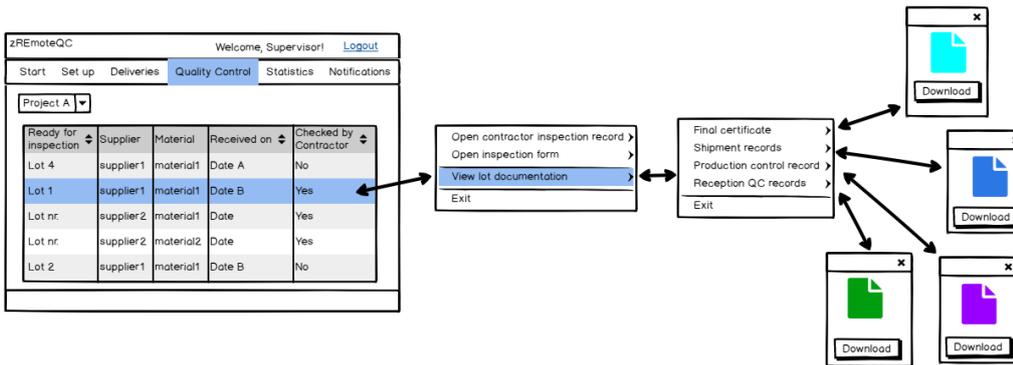
- After choosing a project from a combo box, the Works Supervisor has access to the same information as the Works Contractor in its equivalent section, with an additional column concerning whether the Works Contractor has issued a reception quality control record or not
- By clicking on the line corresponding to a lot for which the Works Contractor has issued a record, the Works Supervisor will be able to:
 - View the Works Contractor record
 - Open it and edit it in order to record its own observations (quality control actions or comments)



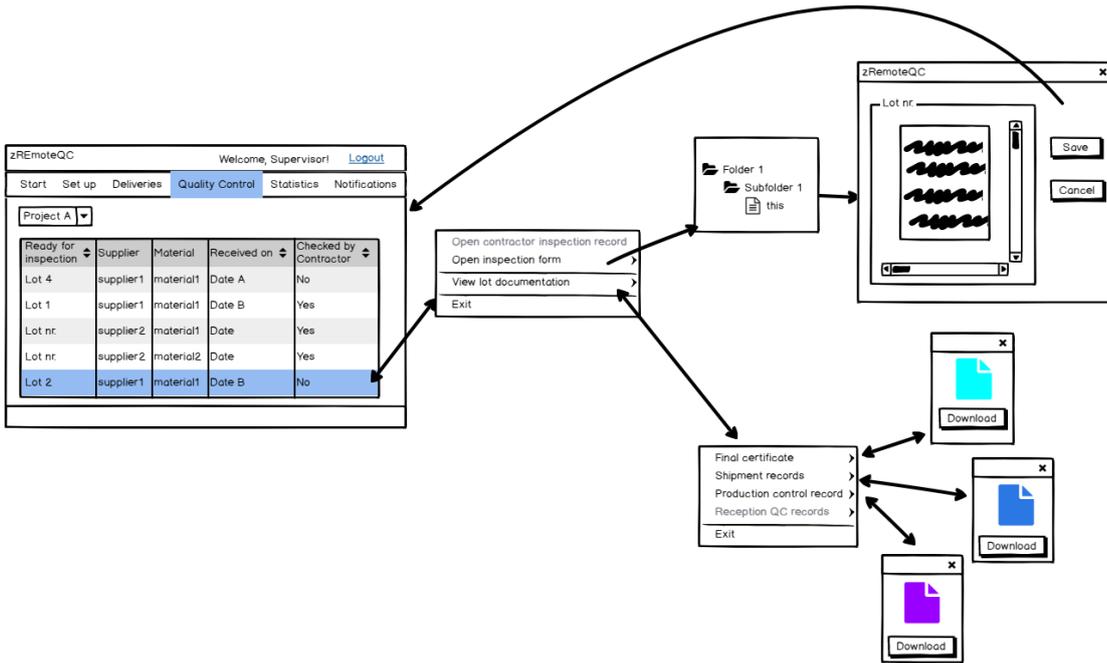
- After editing the record and/or viewing it, the Works Supervisor issues its decision
- Each decision will generate a notification to the Works Contractor and to the corresponding Supplier



- Alternatively/Additionally, the Works Supervisor may wish to carry out its own quality control inspection using its own templates
- The zApp must be able to interact with the Works Supervisor legacy system in order to allow selection of the adequate template
- The template is edited, and the resulting record saved
- Works Supervision quality control is performed on material lots that have also been inspected by the Works Contractor (Since it performs a 100% inspection). Thus, the Works Supervisor’s decision concerning the lot (approve, reject, or approved conditionally) must be performed through the Contractor inspection record option, even for lots where the Works Supervisor issued its own quality control record



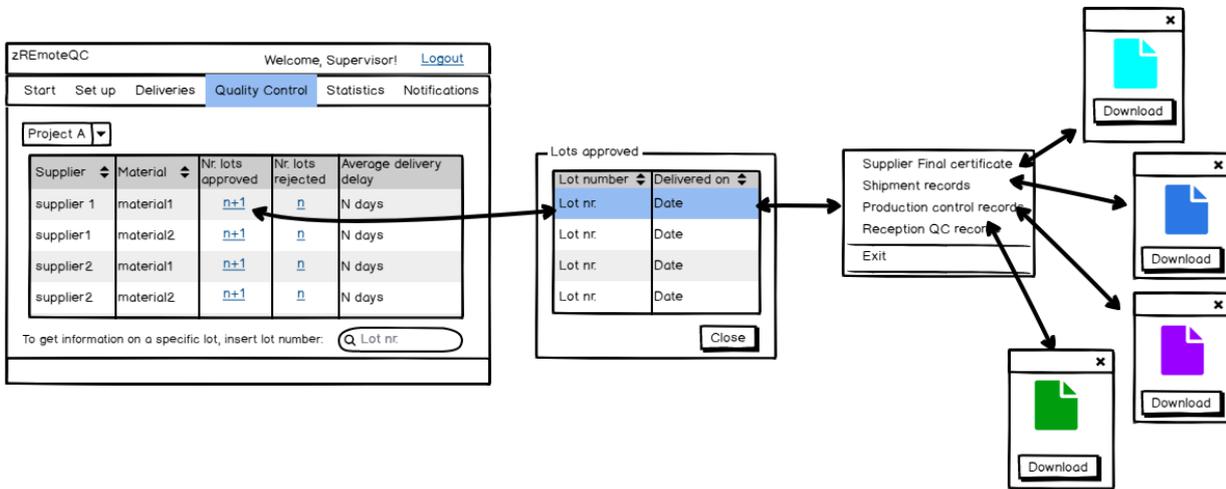
- The Works Supervisor can also access the lot’s existing documentation to view and/or download it
- For lots already checked by the Works Contractor, the corresponding QC records will also be available

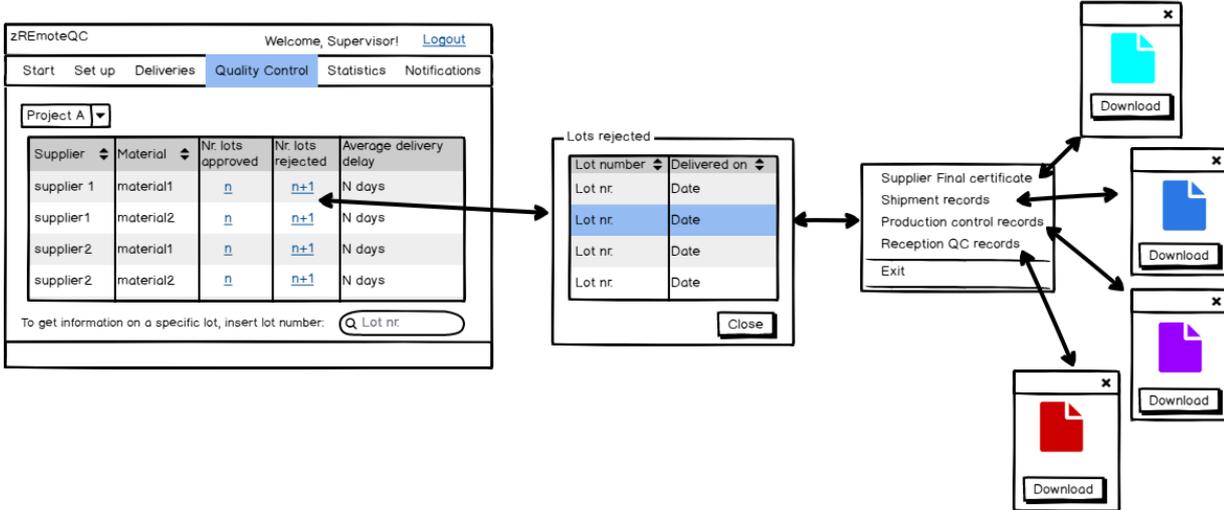


- For lots not yet checked by the Works Contractor, the only options available are:
 - To issue the Works Supervisor own QC record
 - The lots documentation will not include the Contractor's reception QC records

Statistics

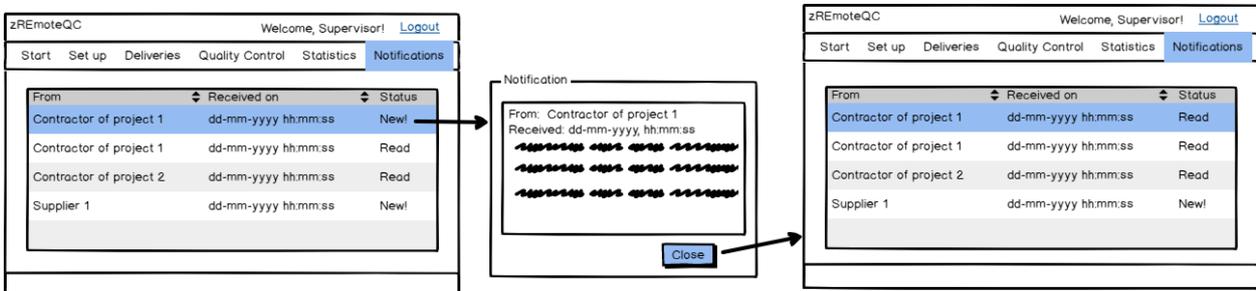
In this section, the Works Supervisor will have access to the same summary information as the Works Contractor in the equivalent section of its workspace, concerning lots accepted or rejected and information on a specific lot.

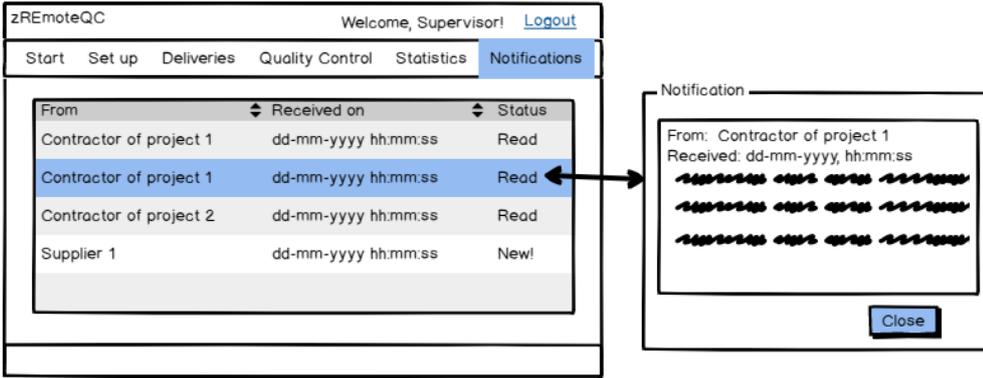




Notifications

In a similar way to that of the equivalent sections in the other workspaces, this section will allow the Works Supervisor to access and read notifications from Suppliers and Works Contractors of projects in which it is involved.





zA4.11 zRescheduler

This zApp allows sharing information between the Works Contractor and the Works Supervisor, concerning materials delivery dates, especially delays, and processes the impact of such delays on both party’s work schedules and that of the project.

The Supplier interacts with this zApp through the section Deliveries, in its workspace on zRemoteQC, and through direct access to this zApp by the driver transporting the materials.

The zApp needs to interact with the Works Contractor and the Works Supervisor legacy systems to have access, retrieve information, and edit files in MS Project or MS Excel format.

The Works Contractor and Works Supervisor will have access to independent workspaces, through login data. The Login and Registering are identical to those shown for zRemoteQC.

In fact, zRescheduler may share the same interface as zRemoteQC, but is shown separately for a better understanding of its functionalities.

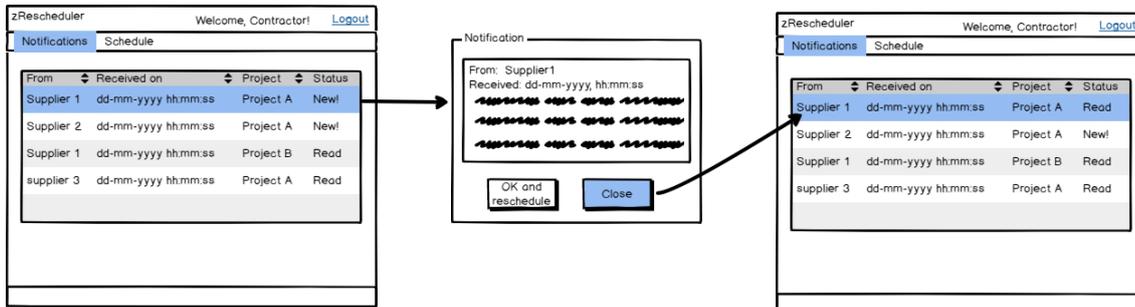
Works Contractor Workspace

This workspace will have two sections: Notifications and Schedule.

Notifications

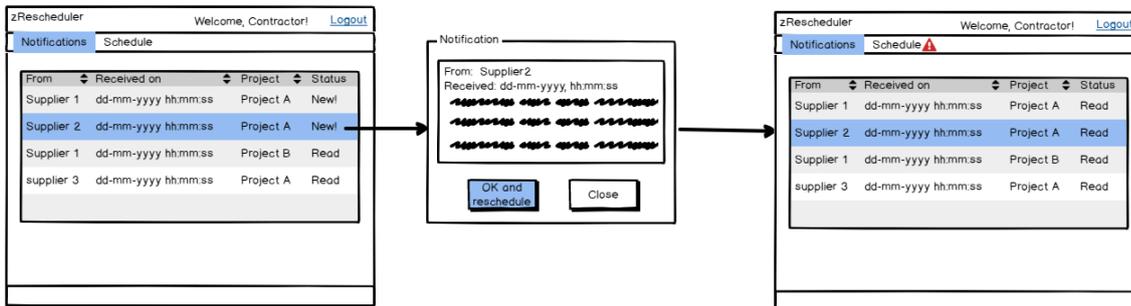
In this section, the Works Contractor will have access to notifications from the suppliers and works supervisors of projects in which it is involved (defined in zRemoteQC).

It is assumed that all notifications in the examples relate to material delivery date changes.

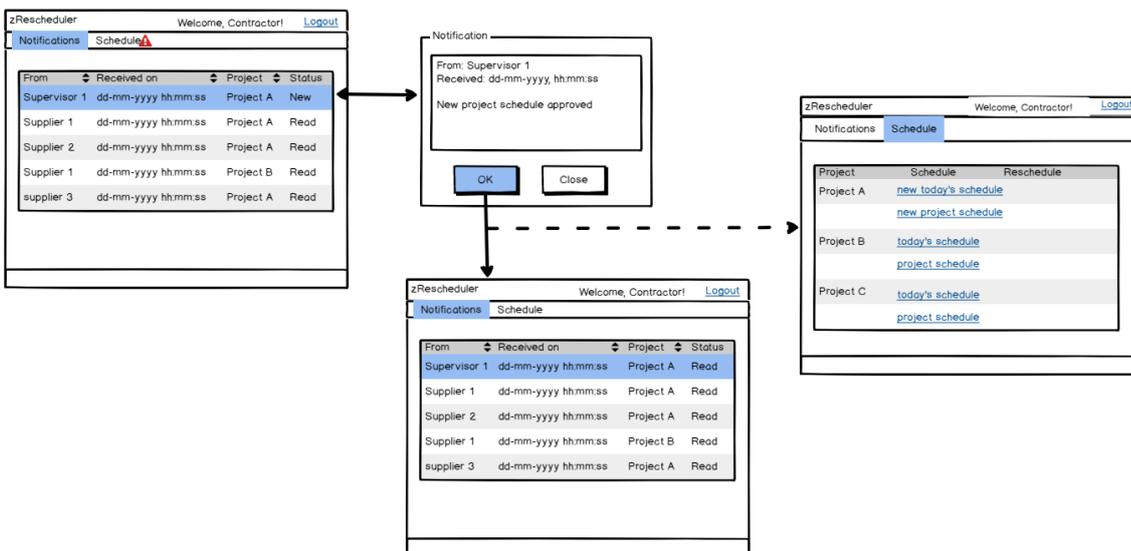


- When clicking on the line of a notification with status “New”, the zApp shows the notification text

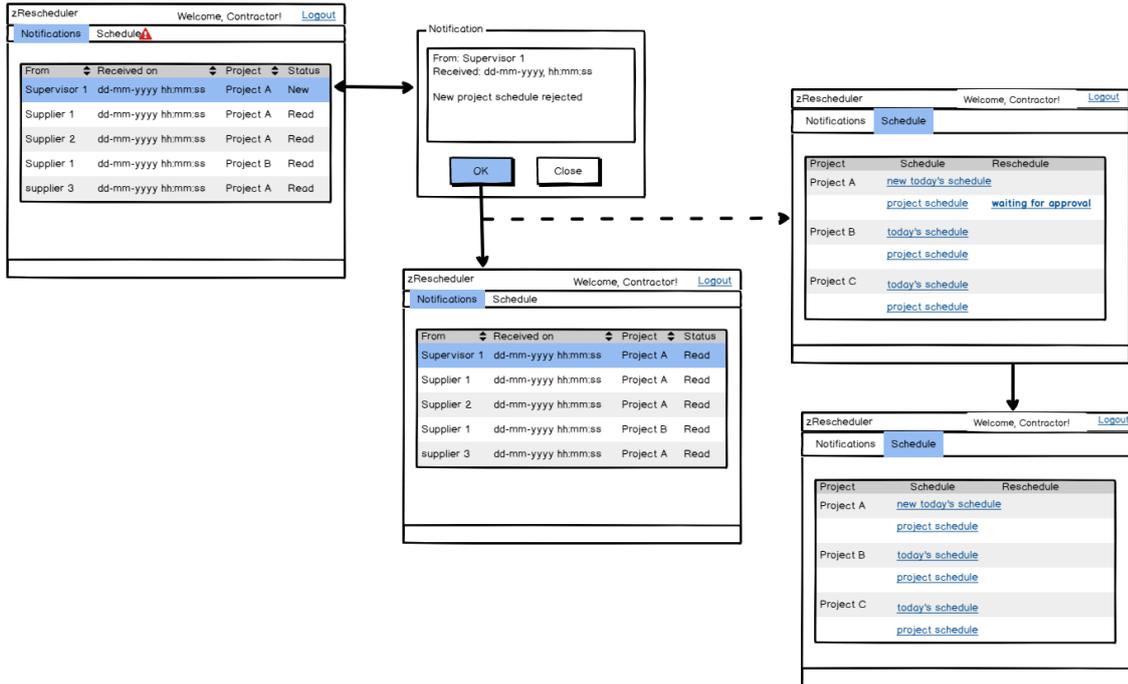
- The Works Contractor can choose to Close the notification window, in which case no reschedule action will be taken
- The notification status changes to “Read”



- If the Works Contractor chooses “OK and reschedule”, the zApp recalculates the impact of the delivery date change on the Works Contractor daily tasks and on the overall project schedule. As a consequence, an alert icon is displayed in the menu bar, indicating that new schedules have been produced
- The notification status is changed to “Read”



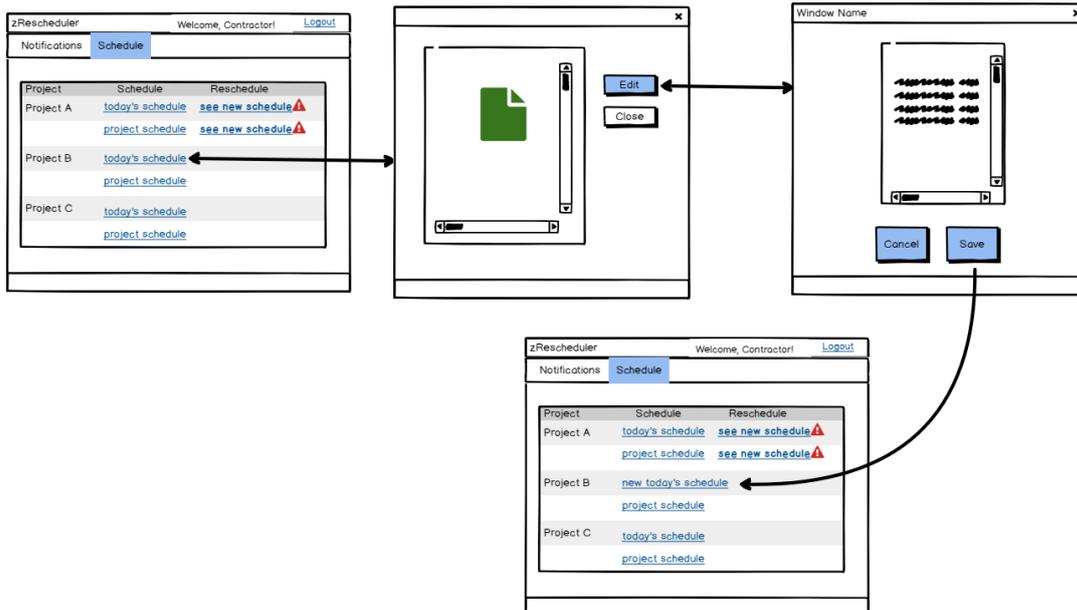
- The Works Supervisor can send notifications to the Works Contractor under this scope, when a new project schedule has been issued (see also Schedule section on Works Supervisor Workspace).
- If the Works Supervisor approved the new schedule:
 - An alert icon will show on the menu bar
 - In the Schedule section, a link for the new project schedule will appear
- The notification status is changed to “Read”



- If the Works Supervisor decides to reject the new schedule:
 - An alert icon will show on the menu bar
 - In the Schedule section, the link for the new schedule, identified as 'waiting for approval', will be automatically removed and the link for the current project schedule (identified as 'project schedule') will be kept
- The notification status is changed to "Read"

Schedule

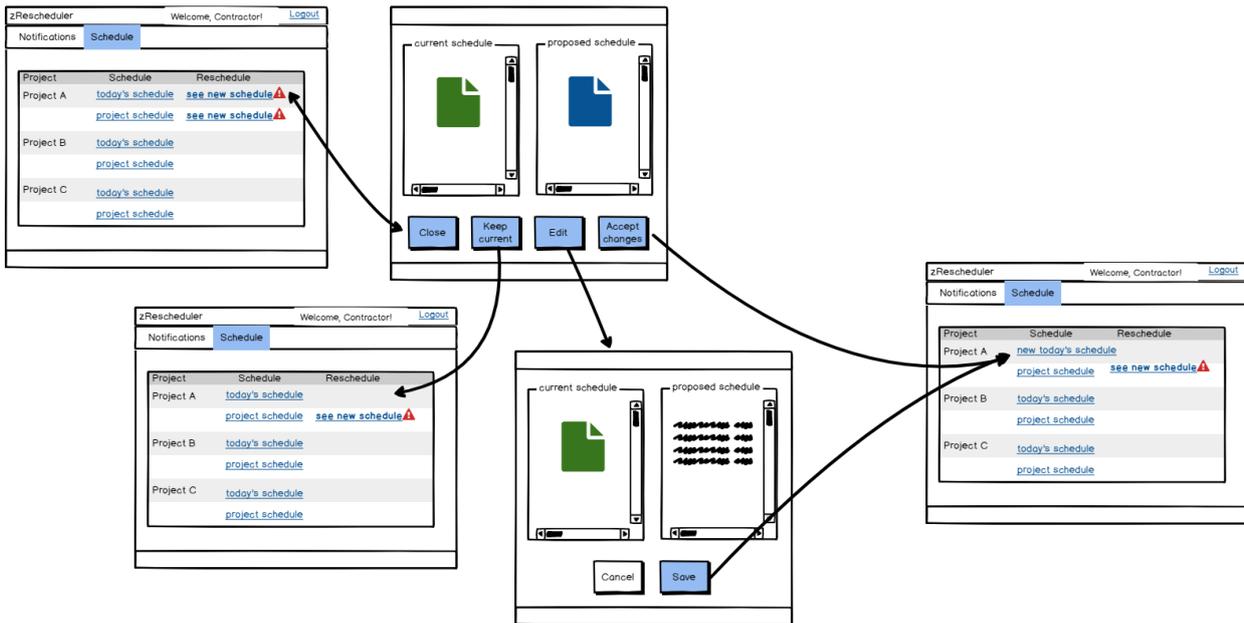
In this section, it is possible to compare new schedules generated as a result of a delivery date change, with current schedules and edit them.



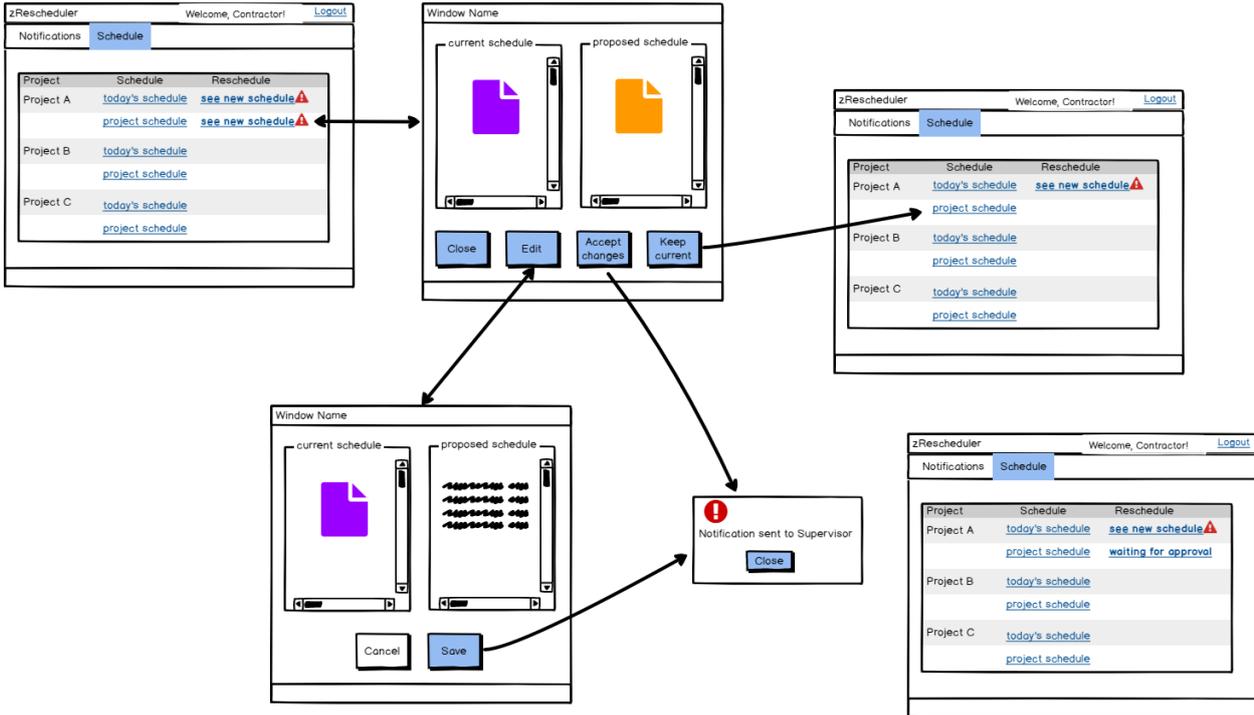
- The section shows the projects in which the Works Contractor is involved and links for the schedules: Current approved schedules, under the column ‘Schedule’ and modifications under the column ‘Reschedule’
- The Works Contractor can edit current schedules, ie its day activities schedule (shown as today’s schedule) and the project schedule
- Upon selecting the schedule, the zApp allows this to be viewed
- When clicking on ‘Edit’, the file can be edited
- If the today’s schedule is edited and saved, then it is shown under the column schedule with a new identification (new today’s schedule). Eventually, this may be the file name that should include the date of editing
- If the editing is cancelled the zApp returns to the previous screen



- If the project schedule is edited and saved, then a notification is automatically sent to the Works Supervisor, as it will require its approval
- The current project schedule will still be shown under ‘Schedule’ and the new one will be accessible through a link, identified as ‘waiting for approval’, under ‘Reschedule’



- If the zApp automatically generated new schedules, these will be accessible through links under 'Reschedule' placed in front of the link corresponding to the schedule they are intended to replace
- By clicking on the link corresponding to a new today's schedule, the zApp allows viewing both files side by side
- The Works Contractor can decide to reject the changes and keep the current schedule as valid, in which case it clicks on "Keep current" and the link "see new schedule" corresponding to today's schedule is removed
- If the Works Contractor decides to accept the new schedule without any changes, then it clicks on "Accept changes" and the today's schedule link is replaced with the new today's schedule link that gives access to this new schedule
- If the Works Contractor decides to edit the new schedule, the zApp allows it to do so keeping the current schedule visible side by side
- Clicking on 'Save' will be equivalent to clicking on "Accept changes"
- Modifications to the Works Contractor daily activities schedule do not require the Works Supervisor's approval



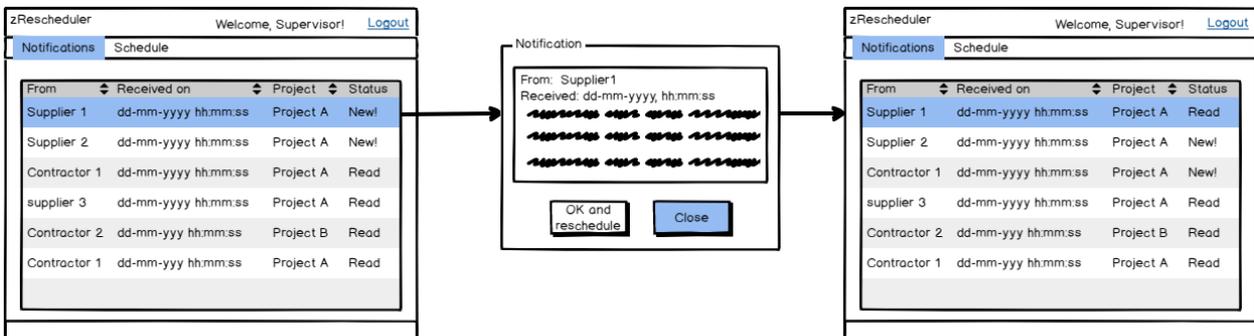
- In the case of the project schedule, all actions are identical to those of the today's schedule, except for 'Edit' and 'Accept changes'
- If the Works Contractor decides to edit the new project schedule, clicking on 'Save' will generate an automatic notification to the Works Supervisor. The same will happen if clicking on 'Accept changes'
- In this situation, the current approved project schedule will be kept accessible in the column Schedule and the new one will be accessible through the link 'waiting for approval' in the column Reschedule

Works Supervisor Workspace

This workspace is similar to that of the Works Contractor, although the information accessed is different.

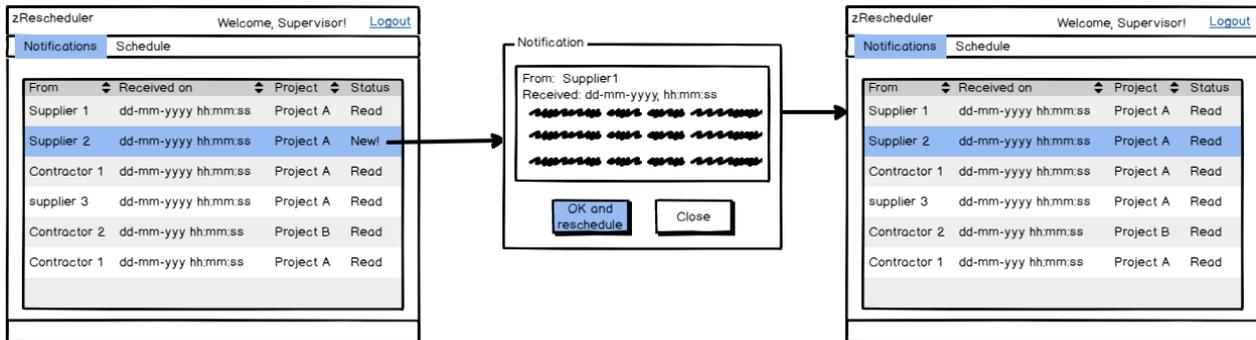
Notifications

In this section, the Works Supervisor will have access to the notifications received from the Suppliers and Works Contractors of the projects in which it is involved, particularly notifications concerning availability of new project schedules

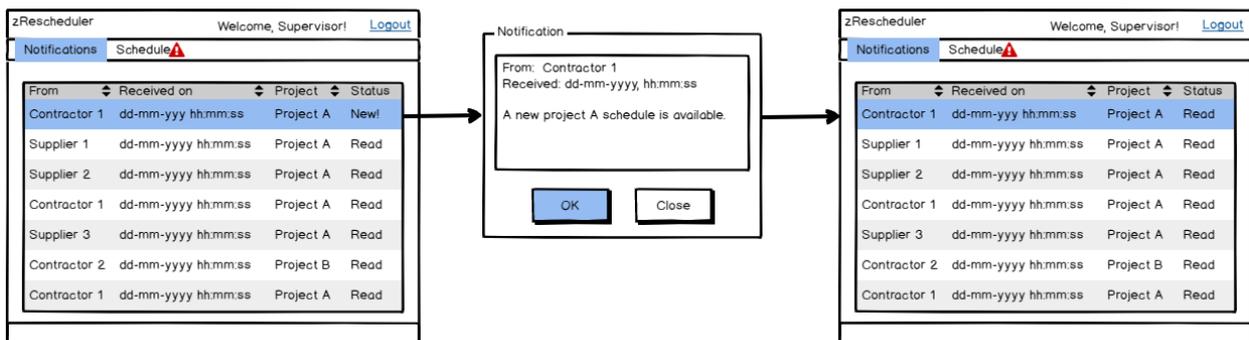


- When clicking on the line of a notification with status "New", the zApp shows the notification text

- The Works Supervisor can choose to Close the notification window, in which case no reschedule action will be taken
- The notification status changes to “Read”



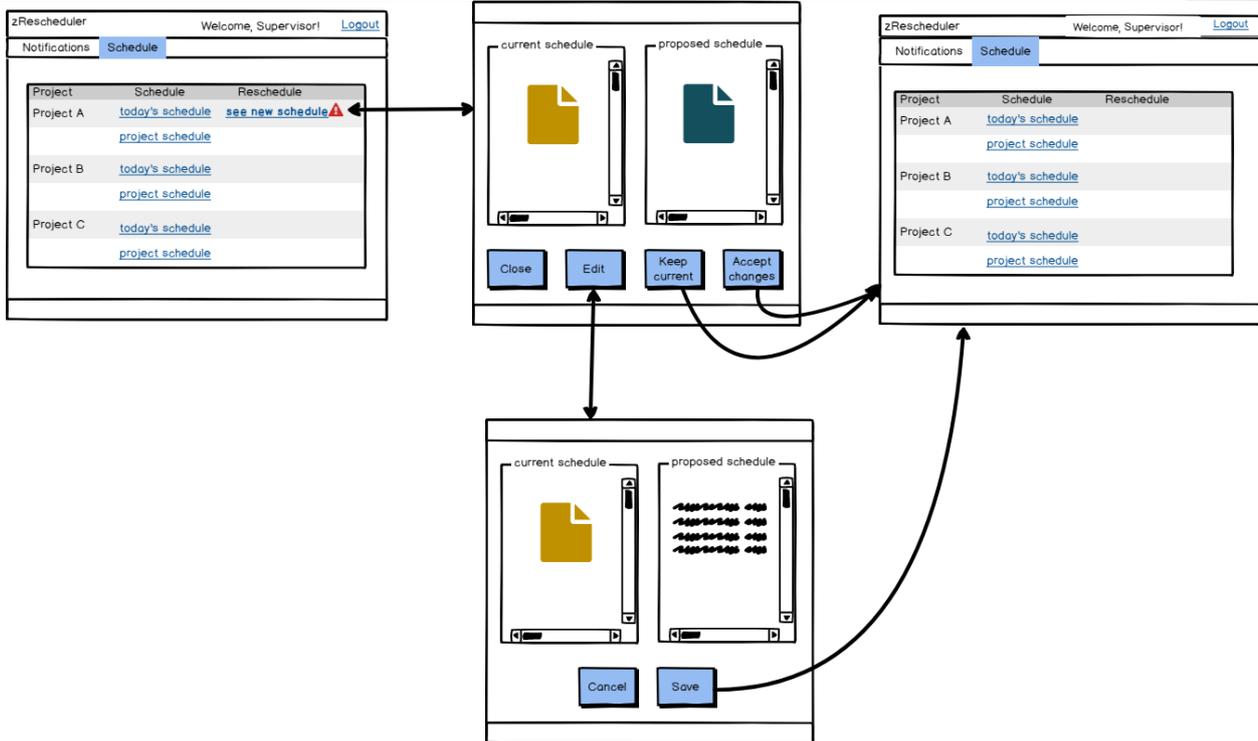
- If the Works Supervisor chooses “OK and reschedule”, the zApp recalculates the impact of the delivery date change on the Works Supervisor day’s tasks only. As a consequence, an alert icon is displayed in the menu bar, indicating that a new schedule has been produced
- The notification status is changed to “Read”



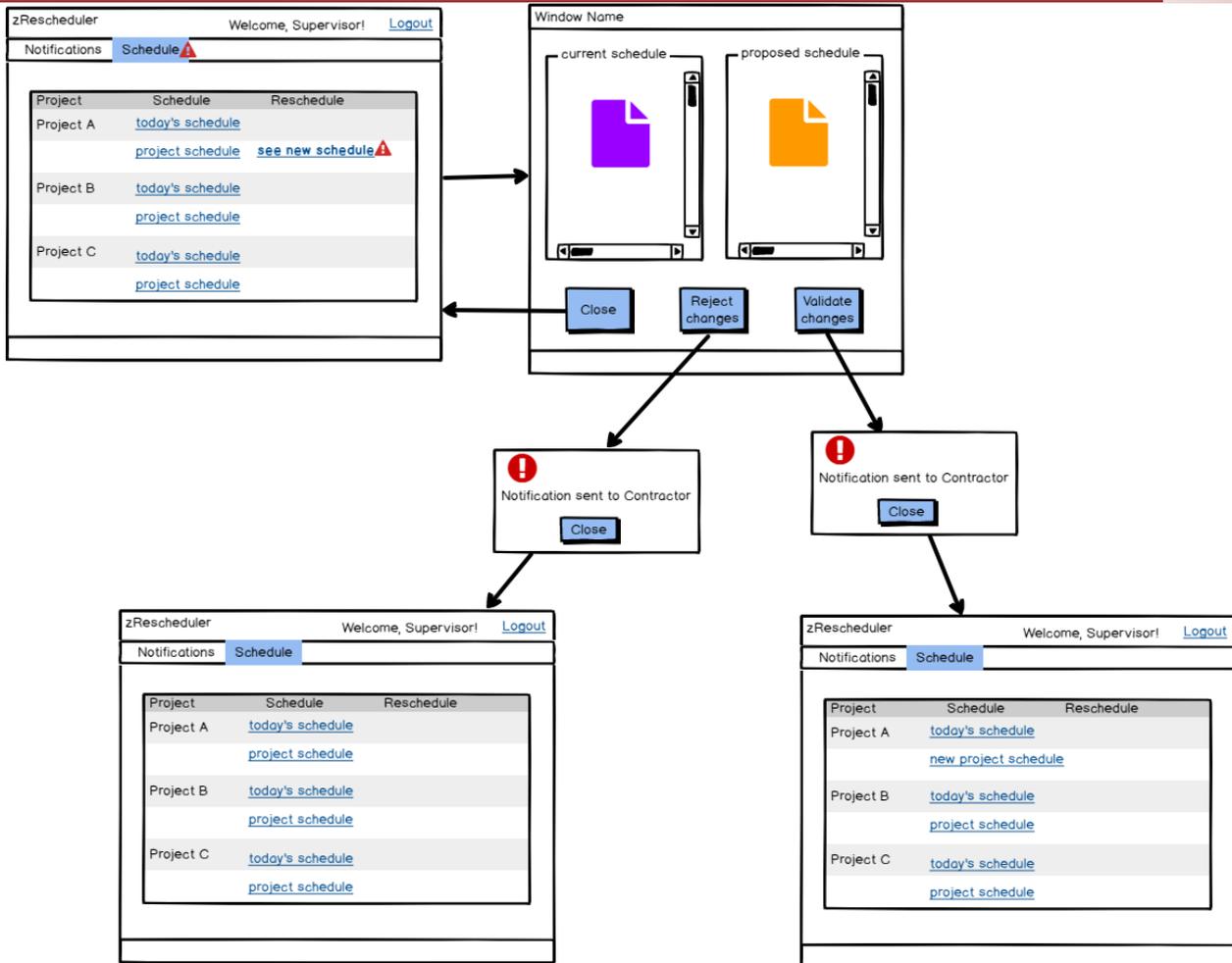
- If the Works Contractor generated a new project schedule, either by its own initiative, by editing, or accepting an automatic reschedule the corresponding notification is received and an alert icon will appear on the menu bar (regardless if the notification is read or not)

Schedule

In this section, the Works Supervisor will be able to see the current schedules, the new schedules and edit or validate them.



- The actions related to a new Works Supervision day's activities schedules are identical to those described for the similar actions carried out by the Works Contractor



- If the Works Contractor generated a new project schedule, the Works Supervisor can access it and view it side by side with the current approved project schedule by clicking on the link “see new schedule”
- If the Works Supervisor rejects the changes proposed, a notification is automatically sent to the Works Contractor and the link for “see new schedule” is removed
- If the Works Supervisor decides to approve the changes proposed, a notification is automatically sent to the Works Contractor and the link for “project schedule” is replaced by a link to “new project schedule”

Supplier Delivery Mobile zApp

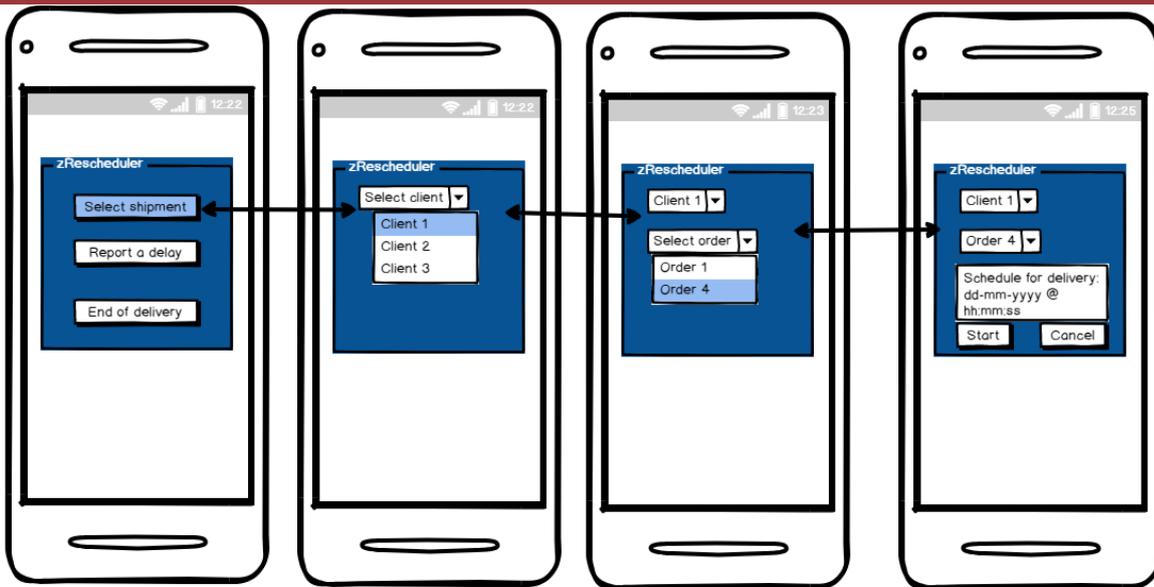
With this mobile version of the zApp, the driver will be able to report delivery time changes in real time.

This version will interact with zRemoteQC for information concerning Clients, order numbers, and estimated delivery dates.

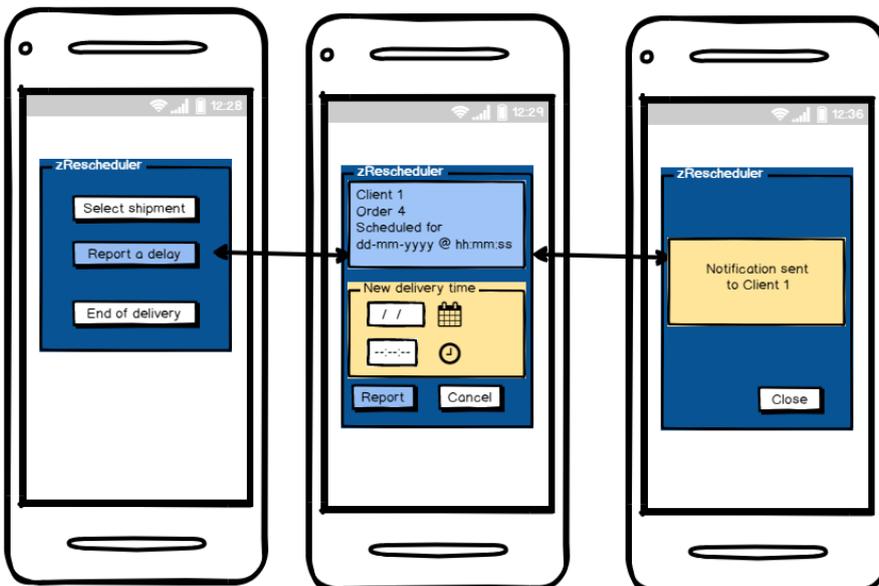
The zApp will have the following options:

- Select shipment
- Report a delay
- End of delivery

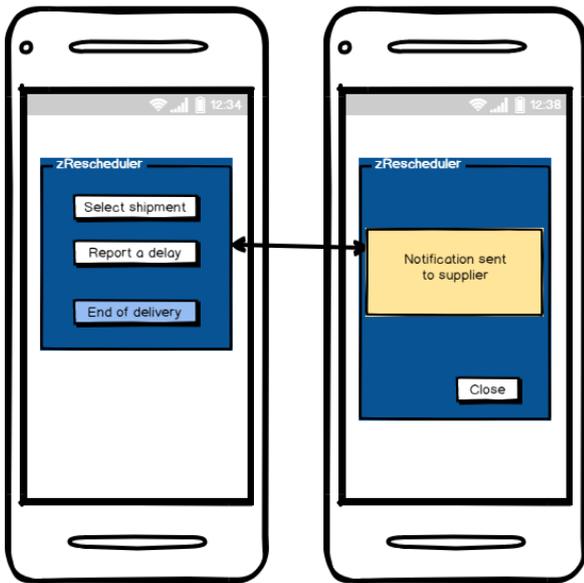
Select shipment



- When the shipment is ready to leave the manufacturing plant, the driver selects the Client and order number the shipment corresponds to
- The zApp automatically displays the scheduled delivery time (information collected from zRemoteQC)
- The driver clicks on 'Start' when the shipment leaves the plant



- If a situation causes a delivery delay occurs during transport the driver can define a new date/time for delivery
- Clicking on report will automatically issue a notification to the affected Works Contractor
- Since the combination of order and Works Contractor is unique for a project this also generates a notification to the Works Supervisor



- When the shipment is delivered and accepted, the driver clicks on 'End of Delivery', generating an automatic notification to the supplier and restarting the order identification and timing

zA4.12 zMaterialTracker

This zApp allows the allocation of a specific material lot and/or individual parts to a location at the work site.

It is intended for use primarily by the Works Contractor but also by the Works Supervisor. It will, thus, be necessary to input login information, which can be made through the same action as described for zRemoteQC.

In fact, zMaterialTracker may share the same interface as zRemoteQC and be part of the Works Contractor and of the Works Supervisor's workspace. However, it is shown here separately for a better understanding of its functionalities.

The zApp needs to interact with the Works Contractor and Works Supervisor's legacy systems, to have access and retrieve drawing files (AutoCAD or equivalent) and for retrieving and storing other files (Word, Excel, PDF).

The zApp must be able to allow the selection of a specific area on a drawing (be it by touch screen, mouse drag, or any other option) and to relate that selection with subsequent actions; namely material identification allocation.

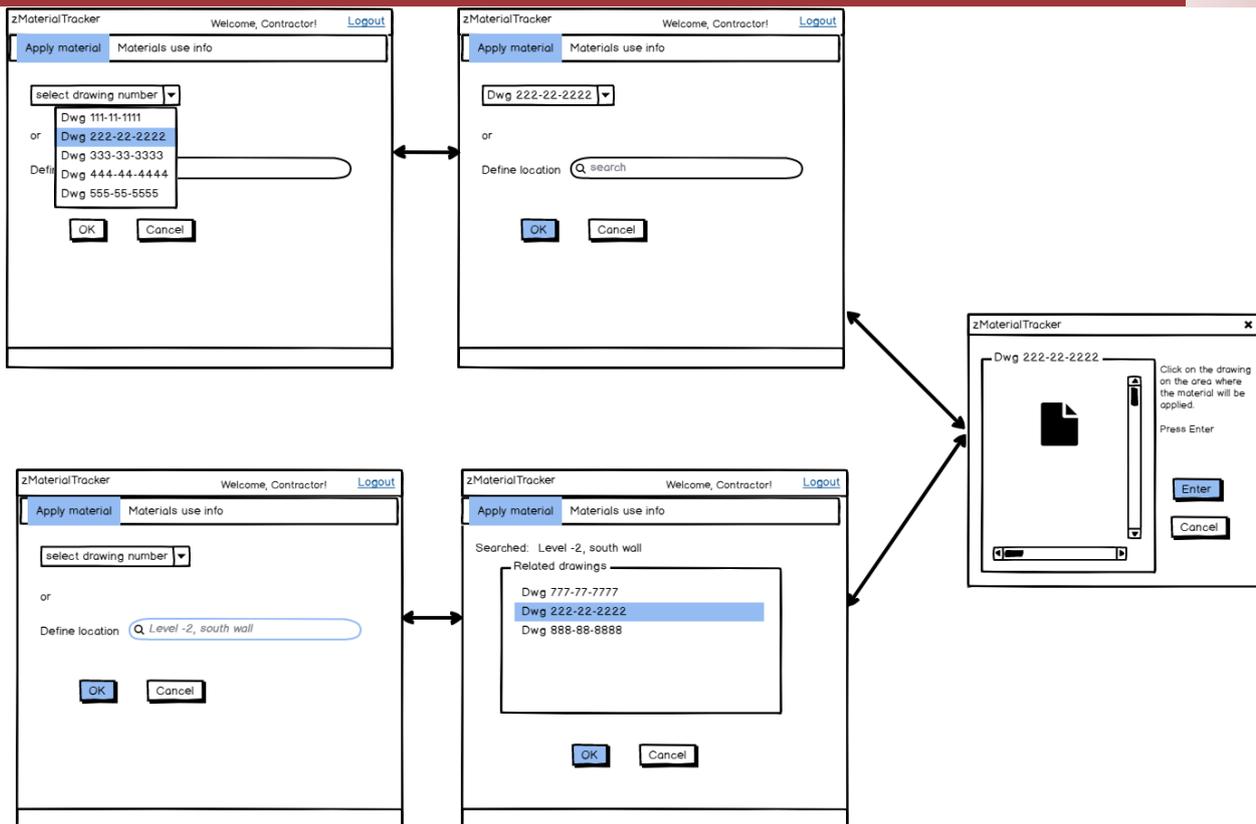
Works Contractor Workspace

This workspace will have two sections, one related to the use of a material for construction and another for tracking a material. They are:

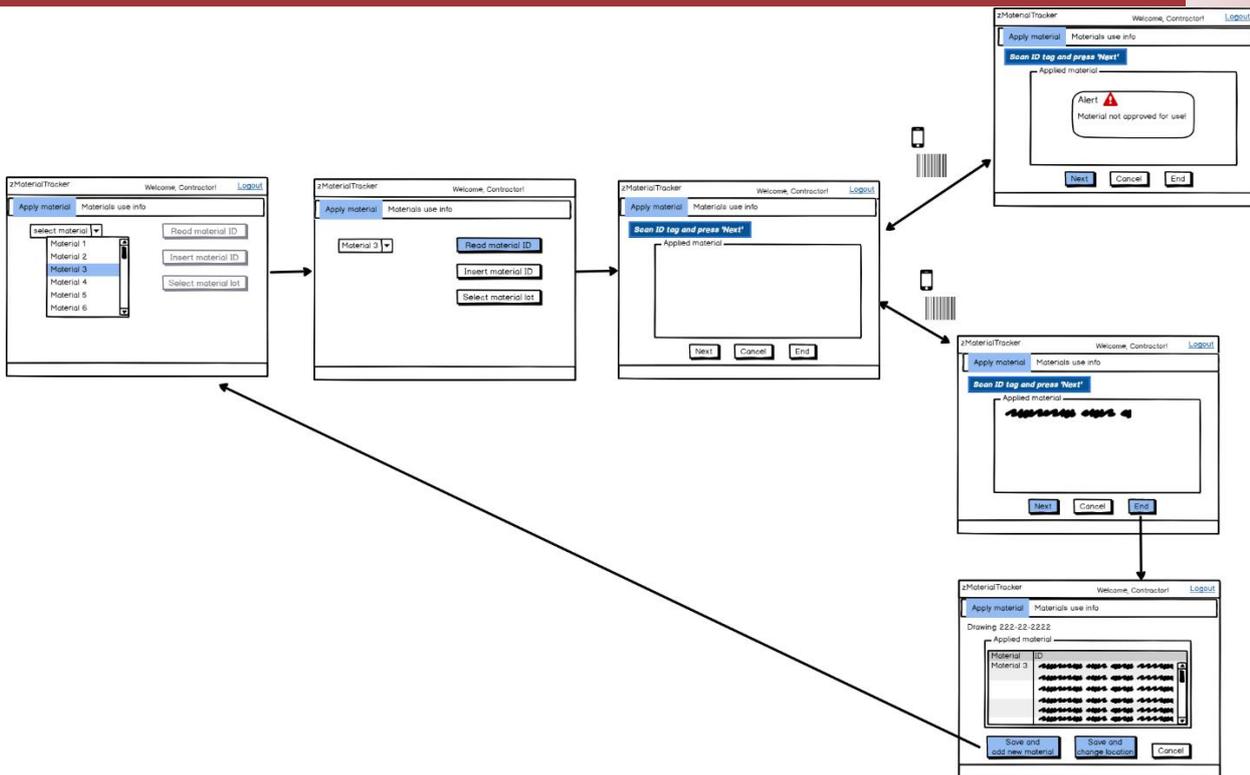
- Apply material
- Materials use info

Apply material

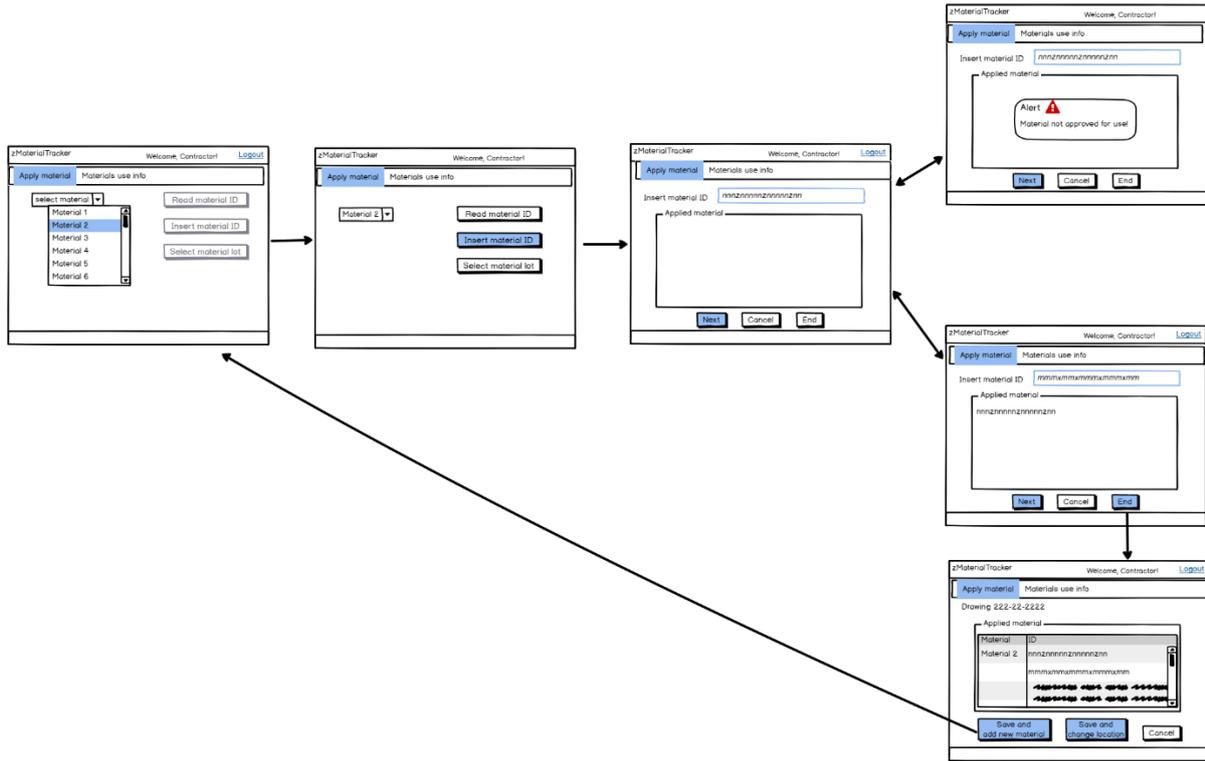
When entering this section, the Works Contractor is prompted to define the location where it is going to work, ie, apply material(s)



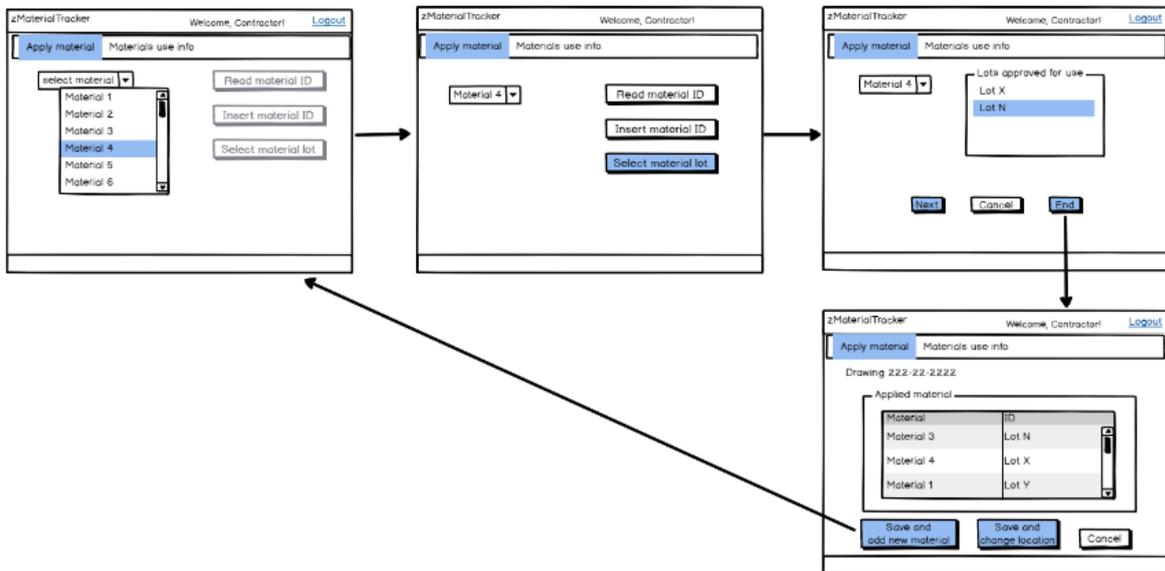
- The location definition is made through selecting the corresponding drawing/design number from a list or through searching drawing(s) that match a certain search criterion. This assumes that the zApp has access to the legacy system and the directories where the current approved drawings are stored
- Once the drawing is selected, the zApp opens the corresponding file
- The Works Contractor selects the area where it is going to work (ie, apply a material(s)). The selection is made by:
 - Touching the relevant area on the screen
 - Encircling the relevant area through dragging the mouse pointer
 - Pinning the relevant area with the mouse pointer
 - Any other equivalent means
- Once the area is identified and 'Enter' is pressed the zApp opens the following selections
- If 'Enter' is pressed without any specific area selection, the zApp will assume that the material will be applied to the whole area depicted in the drawing
- In this way, the materials defined in the following sections will be associated to a construction site area



- This area can only be accessed after defining the location
- Upon accessing this section, the Works Contractor selects the material it is going to use from a combo box
- The combo box lists all the materials to be used at the construction site, as per zRemoteQC
- Once the material is selected, the following options become active: Read Material ID, Insert Material ID, and Select Material Lot
- Selecting Read Material ID means the material tags will be scanned by a portable device (bar code reader, for example)
- When prompted, the Works Contractor scans the identification tag
- If the identification corresponds to a part that has not been approved by reception quality control (ie approved by the Works Supervisor, as per zRemoteQC), the zApp will issue an alert. 'Cancel' or 'Next' returns to the previous screen
- If the material is approved, the identification read is shown on screen. Clicking on 'Next' returns to the previous screen and allows the process to be repeated for another material part
- Upon clicking 'End', the zApp lists the tags read, also showing the drawing number they relate to. In fact, the zApp database relates these tags to the area selected on the drawing, if any
- 'Save and add new material' returns to the select material screen, since several materials can be used in a specific area and/or drawing
- 'Save and change location' returns to the select drawing screen



- Instead of using a portable device, the Works Contractor may need to add the identification tags manually. In this case, the 'Insert material ID' option should be chosen
- The remaining screens and actions are identical to the previous option



- The material identification may need to be made only through indicating a lot number (this should be the case for bulk materials, such as bricks, for example)
- In this case, the option 'Select material lot' is chosen
- The lots listed for a specific material are only the lots approved for use by the Works Supervisor (as per zRemoteQC)

Materials use info

This section is particularly relevant in case:

- Problems occur during construction, during the infrastructure operation, or warranty period
- The Supplier detects and alerts for problems on materials already used

This section will allow accessing all the documentation concerning a certain material based on the location where it was used or on its identification.

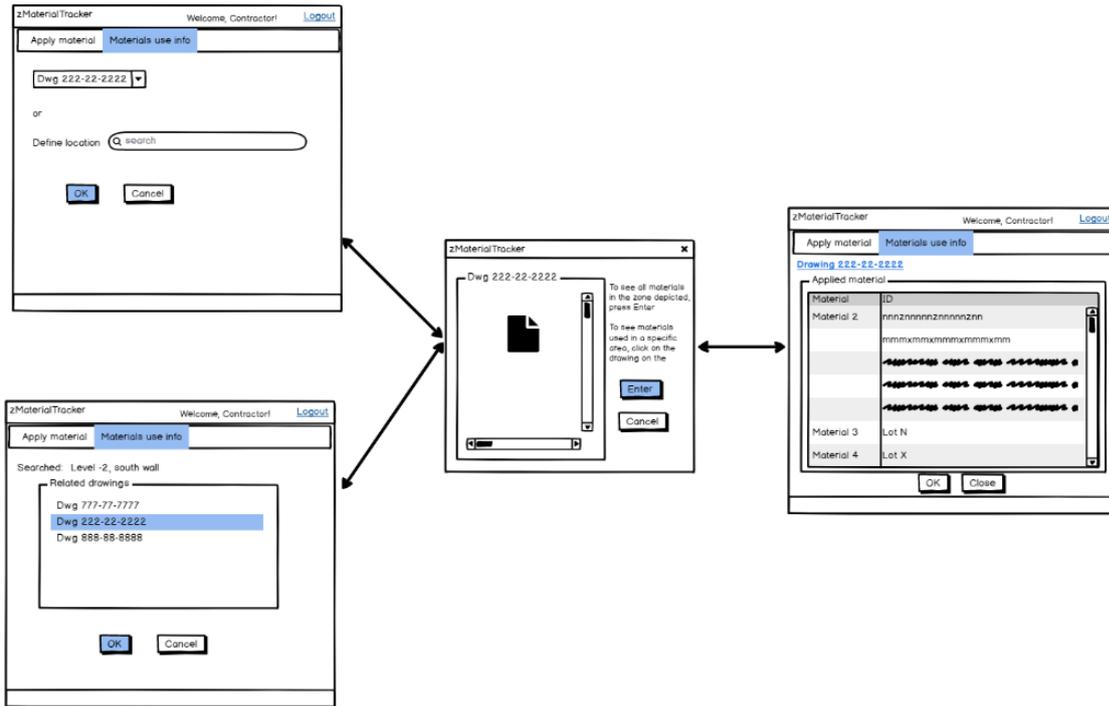
The section allows the following options:

- Search by location
- Search by material

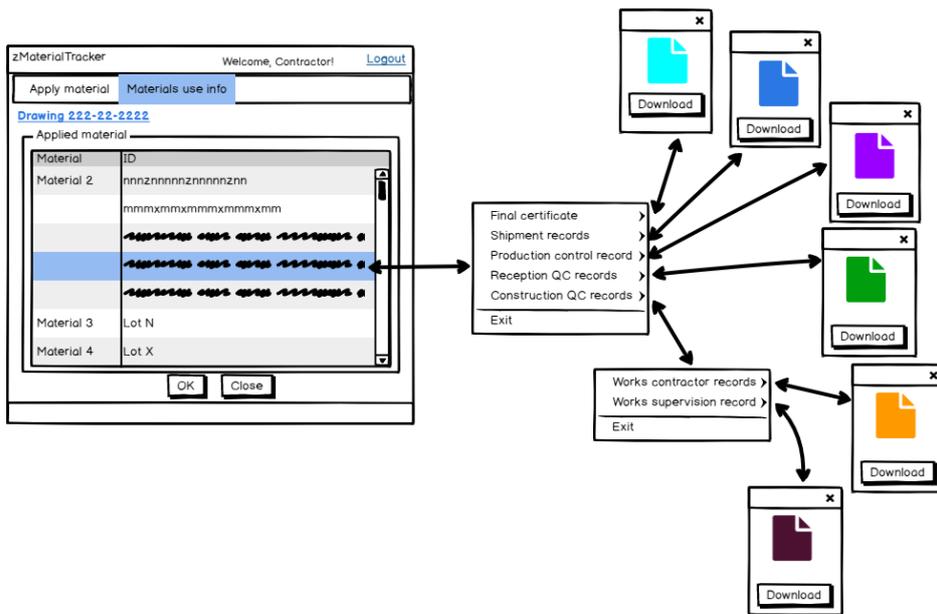


‘Search by location’ can be used if a defect in a certain area is detected (during operation, for example)

- Upon selecting this, the zApp will give the possibility to identify the location through:
 - Selecting the drawing number
 - Inserting a search term

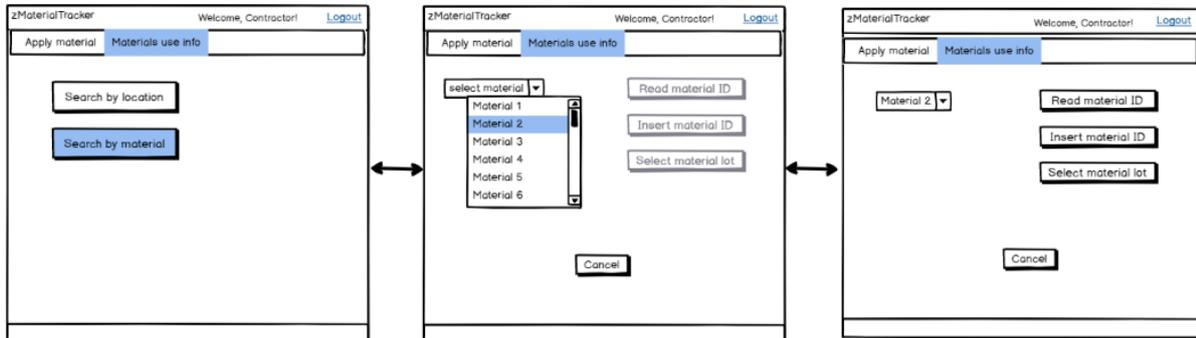


- The zApp opens the selected drawing file
- The zApp should give the possibility to select a specific area on the drawing corresponding to the place where the defect was detected, in a similar way to that described previously for section 'Apply Material'
- Upon clicking 'Enter', the zApp returns a list of materials and corresponding identifications used in the specified area

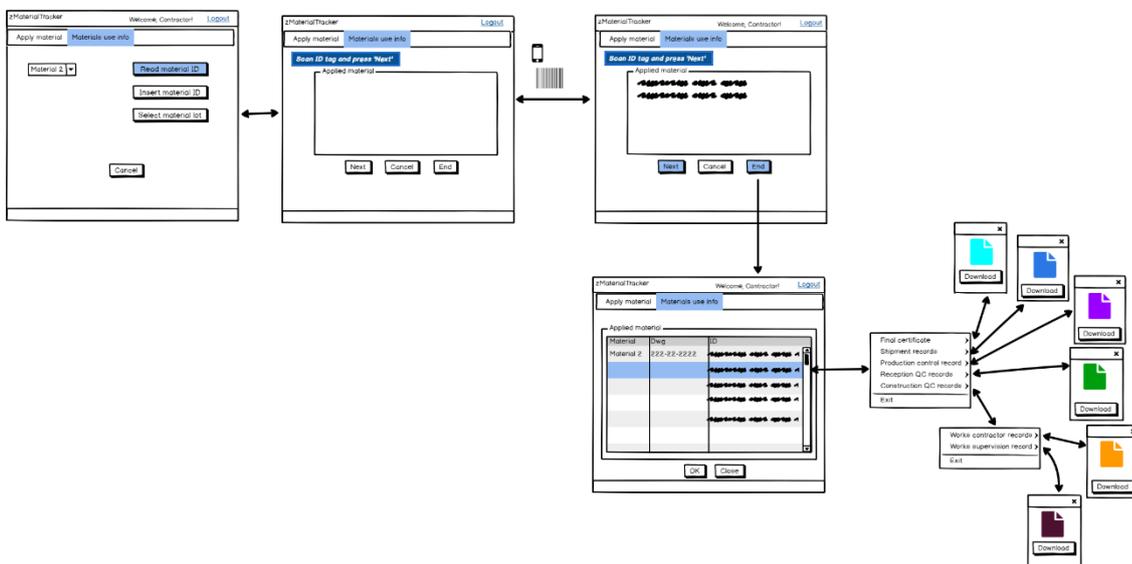


- By selecting the line corresponding to a material identification, the zApp gives access to all the records related to it, both for viewing (by default) and/or downloading

The 'Search by Material' option can be used if a problem can be easily related to a specific material identification



- This option works in a similar way to that explained for the 'Apply Material' section



- If the 'Read Material ID' option is selected, then the defective material identification can be read with a mobile scanning device
- Once the defective materials identification is read (ie press 'End'), the zApp returns a list detailing the identifications and the drawing number corresponding to the area where those parts were used
- Clicking on a line corresponding to a specific use part, the zApp gives access to all the documentation related to that, for viewing (by default) and/or download



- The material part identification can be introduced manually instead of through a mobile scanning device
- The information returned is identical to the first option



- Alternatively, only the lot number is available and used as material identification
- The information returned is identical to the previous options

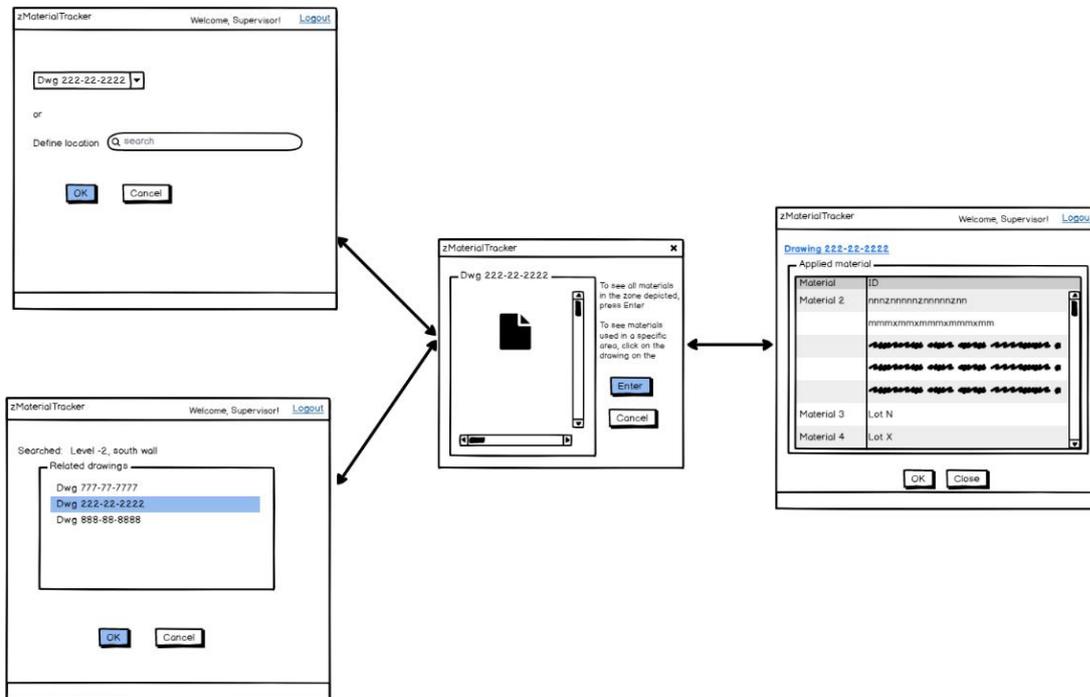
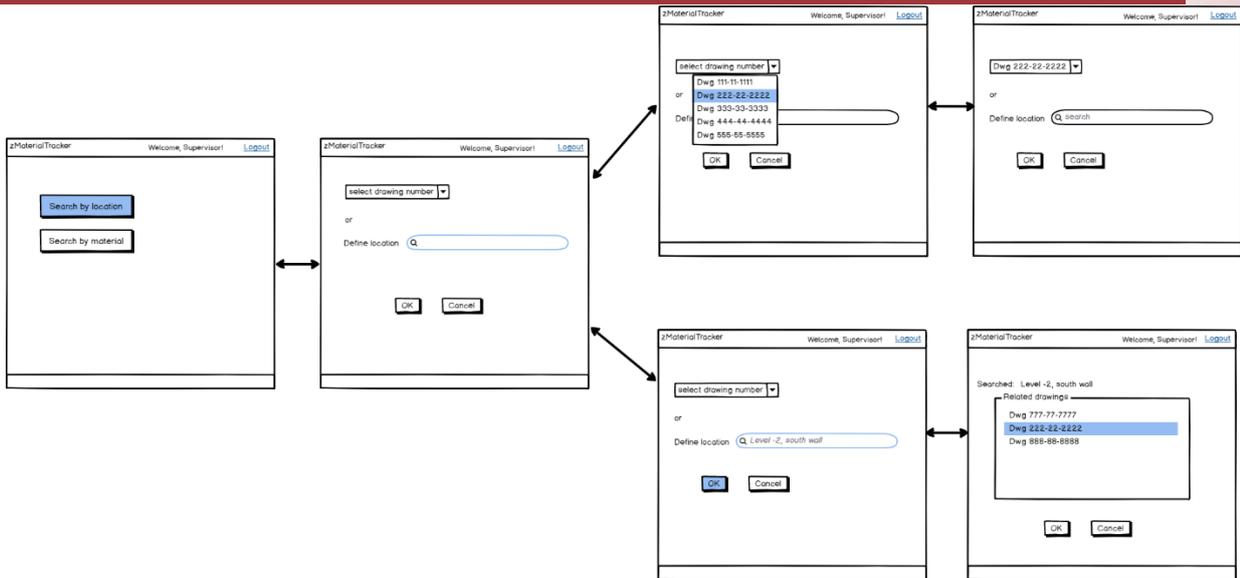
Works Supervisor Workspace

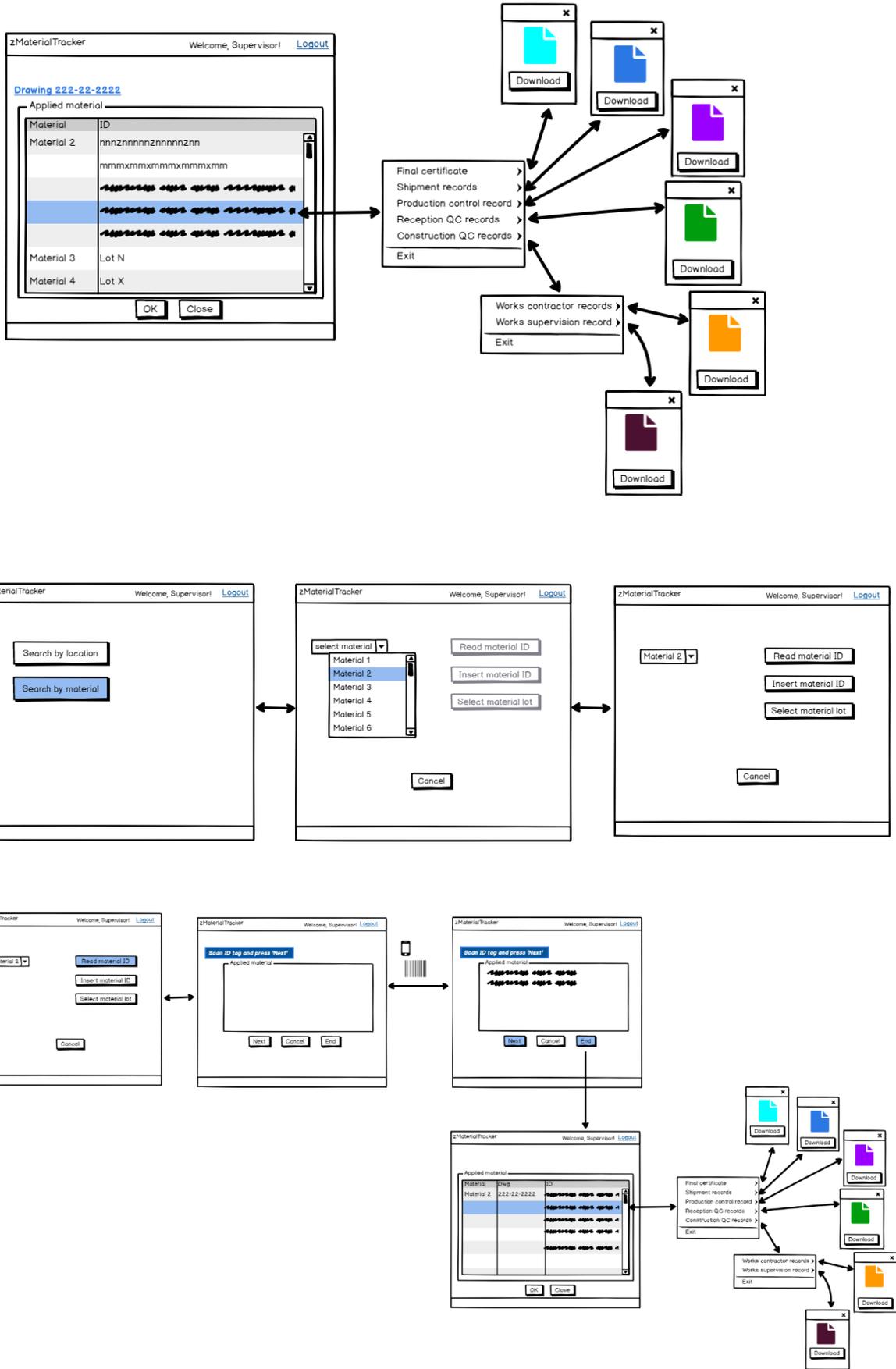
As part of the Works Supervisor duties, the use of this zApp is important during construction, but it is particularly important during the warranty period and during operation.

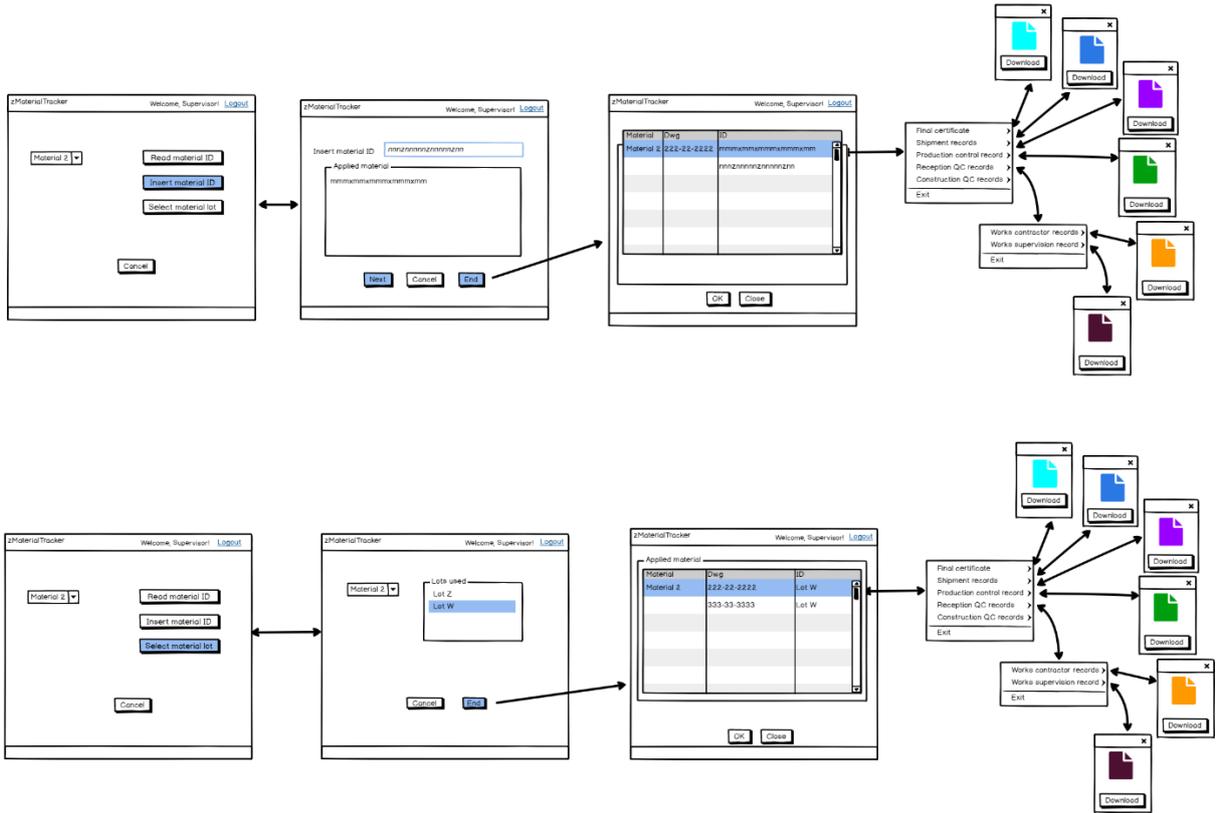
The Works Supervisor does not need to access the Apply Material options. Thus, this workspace only concerns material usage.

It is equal to the 'Material use info' section on the Works Contractor workspace, described above, however accessed by the Works Supervisor.

Interactions with legacy systems for viewing or storing files are with the Works Supervisor's systems.







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