



SPARK

D1.3

FINAL DESIGN
SPECIFICATION FOR
THE
SPARK PLATFORM

Approval Status

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1. EXECUTIVE SUMMARY

The SPARK project aims at realizing a responsive and intuitive ICT platform that exploits the potential of Spatial Augmented Reality (SAR) to show designers and customers real-like solutions in the form of mixed prototypes (partially virtual and partially physical) during co-creative design sessions.

The SPARK platform will allow designers and customers to freely work together within the paradigm of open-innovation to support and foster creative thinking with an enriched flow of ideas in the design process. The platform, by means of adequate content management and real-like interaction with the mixed prototype, will enhance the innovation capabilities of creative industries through the facilitation of idea generation and the early assessment of design solutions in a Co-Design environment. It will enable designers and customers to cooperate since the very beginning in order to create the most suitable solutions according to the prompt evaluation of customers.

The present document aims at defining the functional specification for the platform, to be meant as the different actions the users of the platform can perform in order to prepare and run a creative collaborative design session, as well as gathering the outcomes at its end.

Designers will preferentially be in charge of the use of the SPARK platform, but other co-creative session participants (creative industries' customers, end consumers, as well as others potentially involved stakeholders) will have the chance to carry out some actions in first person, as it will be detailed in the rest of the document.

More precisely the document is structured in sections in order to clarify:

- the meaning of the terms used along the document, as a handy glossary (section 2)
- the purpose of the current document and the flow of information that informed the process of requirements definition (section 3);
- the set of requirements to be addressed, both functional and non-functional (section 4);
- the actors, primary/people and secondary/devices, interacting with the platform to be designed (section 5);
- the use case characterizing the interactions the actors have with the platform to be designed at different degrees of granularity (section 6, 7, 8).

This document represents the final description of requirements as they have been grabbed in terms of needs and expectations from WP1. It is issued at M6 of the project and it reflects the knowledge of the SPARK consortium gained along the activities of WP1. Nevertheless, the design specification will be updated and enriched within the development of the SPARK modules and integrated platform.



2. GLOSSARY

2.1. RATIONALE

This document describes technical specifications for the SPARK platform, which are expressed in UML (see below). In order to clarify the terms used in UML and avoid misunderstandings, we provide a brief glossary for the key terms used.

2.1.1. UML

The Unified Modelling Language is a formalism designed to specify architecture and behavior of systems. According to the UML 2.5 specifications, the objective of UML is to provide system architects, software engineers, and software developers with tools for analysis, design, and implementation of software-based systems as well as for modeling business and similar processes.

It provides a syntax and semantics for the expression of abstract models, represented as human-readable diagrams, and is a standard in software engineering.

2.1.2. System

In the scope of this document, a system is a software, for example, the Spark platform.

2.1.3. Actor

An actor is any entity interacting with the system. It can be a person, an external software or a device. Actors trigger actions in the system, but they can also be controlled by the system (as in the case of devices).

2.1.4. Inheritance

Inheritance is an acquisition of attributes from one entity to another. In the scope of this document, this term is used to describe transfer of privileges between user classes. Inheritance can be multiple and transitive.

The inheritance in UML diagrams is represented by the following icon: 

2.1.5. User

A user is a person interacting directly with the system. In our case, users have an account in the system.

2.1.6. Case study

This term, not part of the UML vocabulary, designates an activity whose aim is to observe practices of clients, identify their needs and desiderata, in order to formulate specifications for a software that aims to address them. It also implies defining metrics according to which the software will be evaluated.



2.1.7. Use Case

According to the UML 2.5 specifications, a Use Case is a specification of behavior. Each Use Case specifies a unit of useful functionality that the subject (in our case the system) provides to its users. Note that the definition of Use Case in this deliverable is different from previous deliverables, where the term "Use Case" designates industrial case studies.

2.1.8. Use case diagram

In UML, a Use Case diagram is one of several types of diagrams, designed to illustrate use cases. It is a graphical representation of users' interactions with a system.



3. DEVELOPMENT OF THE DESIGN SPECIFICATION

This document is a brief description of what the SPARK platform must perform. The different actors involved in the usage of the platform, as well as the main use cases. It is based on results obtained in WP1 (Work Package 1) and it is intended to be used as one of the principal inputs for the WP2 and WP3.

Figure 1 shows the data and information flows along WP1. The main document informing the design specification is D1.2, which reports the analyses of the four case studies (defined in T1.1 and carried out in T1.3/T1.4) and the interviews (T1.5). It supports the refinement of early captured potential end users' needs and demands.

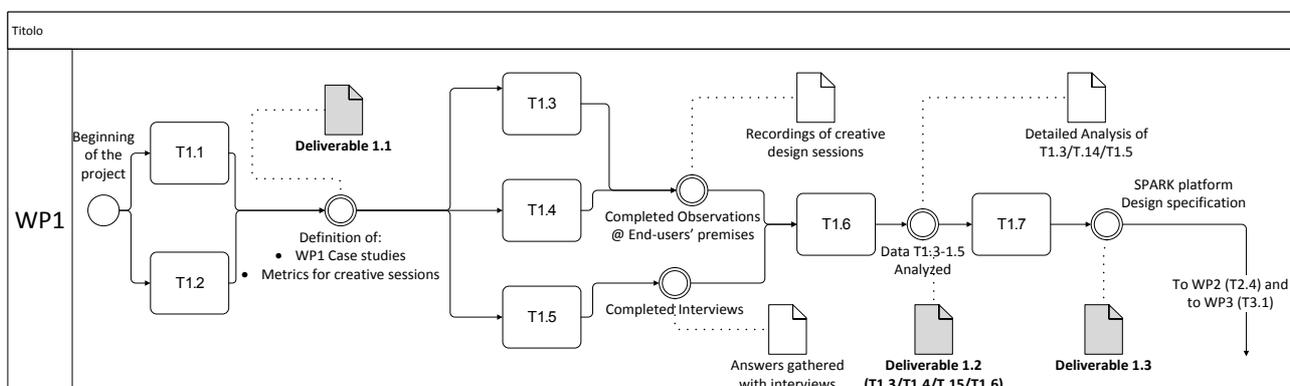


Figure 1 The data and information flow in Work Package 1

Table 1 reports the 4 case studies carried out within T1.3 and T1.4. The case studies are sufficiently representative of the two main scenarios of use foreseen for the SPARK platform so far (packaging and product design). The different nature of the below mentioned case studies ensures a sufficient coverage of different needs and demands of the end users in the working context.

Case Study	End Users' Client	Topic	Context	Goal of the session – Nature of the project
1	Alce Nero	Organic biscuits	Packaging	Definition of visual identity
2	G7	Ice cream	Packaging	Definition of brand identity
3	Viuho	GPS rescue device	Product	Refinement for first generation product, (UI, colour, material and finish)
4	Garth	Barbecue	Product	Idea refinement interaction between barbecues different parts/elements proposals

Table 1: The 4 selected case studies from the list of D1.1, whose observation has been recorded within T1.3 and T1.4

Table 2 summarizes the representativeness of the two case studies with reference to both the SAR technical challenges and the potential user interaction aspects. Despite none of the 4 case studies covered the whole set of characteristics to be mapped by itself, the combination of Alce Nero and Garth allowed to gather a comprehensive understanding of the main interactions the co-designers have among themselves and with the prototype as well as checking the relevance of technical challenges for SAR projections.

		Potential user interface/interaction aspects			
		Consumers response to brand identity	Communication of instructions (on the pack)	User interface design	Design and positioning of UI elements
Technical challenges for SAR	Curved surfaces	<i>Alce Nero (organic biscuits)</i>	<i>Alce Nero (organic biscuits)</i>	<i>Garth (barbecue)</i>	<i>Garth (barbecue)</i>
	Small text	<i>Alce Nero (organic biscuits)</i>	<i>Alce Nero (organic biscuits)</i>		
	Shiny/high gloss surfaces			<i>Garth (barbecue)</i>	<i>Garth (barbecue)</i>
	Small, handheld objects	<i>Alce Nero (organic biscuits)</i>	<i>Alce Nero (organic biscuits)</i>	<i>Garth (barbecue)</i>	<i>Garth (barbecue)</i>
	Very large objects			<i>Garth (barbecue)</i>	<i>Garth (barbecue)</i>

Table 2: The coverage of interaction issues and SAR challenges by the two deeply analysed case studies

The design specification presented hereafter has been developed to drive the selection of the most suitable technologies to address the needs recorded along the observation of the different case studies and to inform the development of the main modules at the core of the ICT platform. This list, moreover, is representative of the greatest amount of the observed interactions the co-designers have with each other and with the prototypes. The Alce Nero case is sufficiently representative of a packaging design scenario, which corresponds to the usage of the platform for small/medium sized objects/prototypes. The analysis of the case study of the barbecue, which differently from the former is characterized by the big size of the whole system, showed that the design of system parts separately from the “whole picture” is more frequent (design of the barbecue top; design of the knob, design of the thermo gage,...). References to the barbecue as a whole system are frequently used to position the design object (sub-system) in place, even if the discussion remains focused on the design object. This means that it is beneficial to be able covering the whole external surface of a barbecue (or whatever

product of such a size) at least from the viewpoint of two people with SAR projections, but for most of the design interaction, smaller volumes of projection can be considered sufficient to proficiently support designing.

Moreover, the observations of the design sessions highlighted that not all the affordances recorded during the interactions with artefacts can be addressed by the SAR technology (e.g.: context setting, which is usually done with slides or paper printed content). However, some other interactions with artefacts allowed for the embedment within the modules of the platform (e.g. sticking notes/comments to concepts).

This document does not describe how the system will be done, but instead what the system must perform. The SPARK platform in this document is described as a black-box system.

As for each development process, the refinement of the requirements (here to be intended as functions, user profiles and use cases) will be required. The requirement list, along the next work packages of the project, will be necessarily updated and detailed with more precise description of requirements. Such requirements will take into consideration the technological choices due to the integration of software modules and hardware solutions that cannot be managed at current stage of the project (M6).



4. DEFINITION OF REQUIREMENTS

4.1. GENERALITIES

This section describes the requirements the application must satisfy. Requirements are subdivided into two main categories:

- “functional”, which describe what the application must provide to the users, and
- “non-functional”: which describe technical and risk requirements.

Beyond what above described, the platform should be also capable of organizing the information according to the following scheme:

- **User:** the user of the SPARK platform is the person that interact directly with the platform. The user could be the designer, the client, the project manager or whatever relevant stakeholder in the value chain of the product to be designed. The SPARK specification deliverable D1.3 details features and functionalities that could be selected according to the profile of the user.
- **Client:** design company have several clients; the system must allow the creation of clients for each company.
- **Project:** the design company handles several projects for the same client; the system must allow the creation of several projects for the same client.
- **Co-creative design session (this corresponds to a brainstorming design session where the participants suggest and evaluate new ideas, regardless of their professional profile):** for each project, there could be several planned design sessions. Each session will have a set of resources

4.2. FUNCTIONAL REQUIREMENTS

This subsection is further subdivided into three thematic descriptions, each of them referring to a specific phase of the co-creative design session. In details:

- Before a co-creative design session (typically a brainstorming-like session)
- During a co-creative design session (as above)
- After the co-creative design session (as above).

This list of actions can be further enriched along the prosecution of the project, consistently with the results to be gathered during lab tests (WP3) and during the field tests (WP4 and WP5).



4.2.1. Before a co-creative design session:

- The system allows the configuration of a space where the participants of the design session can share concepts (textual information, graphical information – see also later) in a graphical/textual form.
- The system allows the creation of users
- The system allows assigning different profile for users (i.e.: session leader, session participant OR designer; client; end-user).
- The system allows the administrator to hide profiles characteristics to the participants of the design sessions.
- The system allows the management (upload/download/delete/...) of files having different extensions (see attached file)
 - a. Texture files
 - b. Font files
 - c. Image files (logos, textures, ...)
 - d. 3D model files
- The system allows the management of information (upload/download/delete/...) structured as notes/post-it and coming from previous sessions within the session space
 - a. The system allows to create connections among the different information in order to clarify the meaning they have with reference to previously shown/generated content discussed in the creative session

4.2.2. During a co-creative design session:

- The system allows the participants to upload content on the fly (according to the file formats the system can manage; for instance new files prepared by the users independently, something changed on personal laptops during the meeting, ...)
- The system allows tracking the position of a prototype
- The system allows projecting structured light within a predefined volume
- The system allows choosing appropriate files for the projection of images from a set of available alternatives stored in (or accessible from) the space prepared for the design session.
- The system allows the management of the files for the projection
 - a. Images (logos, textures, icons,...)
 - b. Textual descriptions/representations
 - c. Pictures
 - d. Colour editing (selection from a palette?)
 - e. Size editing
 - i. Keeping the aspect ratio
 - ii. Modifying the aspect ratio
 - f. Orientation editing



- g. Superimposition of images in different layers
- The system allows recognizing the gestures of the people interacting with the prototype
- The system allows the visualization of the projected content on a screen for the sake of the other participants to the design session.
- The system allows the people handling the prototype to edit the projected images through gestures:
 - a. Move an image from a place to another
 - b. Rotate an image from a place to another
 - c. Resize the image
 - d. Resize the font/textual content
 - e. ...
- The system allows recording the different operations carried out on files (upload, modification, ...)
- The system allows capturing the sequence of actions/activities carried out by the participants of the design session.
- The system allows handling different profile for users (i.e.: session leader, session participant OR designer; client; end-user)

4.2.3. After the co-creative design session

- The system allows producing a report of what happened during the session according to the related time-sequence
 - a. Textual information
 - i. The text written on digital notes, ...
 - b. SAR related content
 - i. Sequence of projected ideas (as superimposed layers of images and text, by who)
 - ii. Updated ideas (what was changed and how in the layers, by who)
 - iii. Discarded ideas (which layers were discarded)

The above subsections (4.2.1-4.2.3) organize functions according to the three main phases of the co-creative design sessions. However, some of the actions to be carried out before the session might also require to be executed during the co-creative design meeting. Some of the actions to be performed before the session can be carried out by different profiles (actors, as detailed in Section 5). The use cases presented in Section 8 will take into account this distinction, so that they will be organized as:

- Before the sessions
 - System Administration (platform user creation and related profiling)
 - Preparation of the design session (creation of a session space, set user role in the session space, graphical resources importing)



- Before and/or during the sessions
 - Tuning of the session (assign content to layers, management of layer orders)
- During the sessions
 - Execution of the design session (starting and concluding the session, content management and prototype interaction)
- After the session
 - Wrap up of the design session (accessing the report of the design session)

4.3. NON-FUNCTIONAL REQUIREMENTS

Differently from the above set of requirements, the following subsections describe the non-functional requirements that the application must have. This section is divided into technical and GUI requirements. Technical requirements are those related to the final platform itself, beyond the actions the users can perform with it, like security, performance, connectivity, etc... GUI requirements, in turn, detail what the graphical user interface should be displaying.

4.3.1. Technical Requirements

- The system must handle simultaneously 12 users.
- In case the system will be used from distance (say 2 locations geographically located far from each other) the data transfer should ensure the security of data and the capability to keep them confidential.
- The system should be able of storing the contents managed and discussed during the design session.
- The system should be able of storing, opening and at least provide simple. modifications to text- and graphics- based files used by creative industries.

4.3.2. GUI requirements

- Platform
 - a. User friendly interface
 - b. Maximum response display time 3 sec
- SAR projection
 - a. User friendly interface
 - b. Low latency (hopefully in the range of tens of milliseconds; the smaller the better)
 - c. Gesture based interaction
 - d. Colour rendering (also as material and finishes) of excellent quality (real-like, as much as achievable with reference to hardware cost)
 - e. Resolution of the projected visual content of high quality (real-like, as much as achievable with reference to hardware cost)
 - f. Ability to track within a limited volume space
 - g. Viewing angle sufficient for 1-2 people to view the prototype from one side



- h. Excellent brightness (without having to darken the room too much, as much as achievable with reference to hardware cost)
- i. The projection should be capable of adapting content to completely cover the external surface of prototypes of small/medium dimensions (i.e. 400x400x400mm max volume).

The setting and the structure for the placement of the SAR-related equipment (projectors, tracking cameras...) in order to cover a large sized object should be further investigated as soon as the technological choices have been done.



5. ACTORS

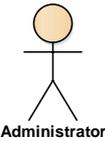
This section describes the actors (roles) involved in the usage of the application. Actors can be human beings or external systems, devices, etc.

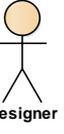
Actors are divided into two groups:

- Primary actors: actors that initiate an interaction with the system. The functions performed by a primary actor can be inherited (check definition sect. 2.1.4) by a different primary actor.
- Secondary actors: actors that will be requested to interact with the system.

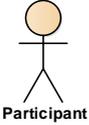
The following subsections are structured accordingly.

5.1.PRIMARY ACTORS

<div data-bbox="172 920 331 1167"> <p>uc Actors</p>  <p>Administrator</p> </div>	<p>Administrator's role (performed functions)</p> <p><u>Before the design session:</u></p> <ul style="list-style-type: none"> • To configure the space for the session • To create users for the session • To assign a profile to users • To hide profile characteristics to other users • Inherits the functions of the Designer <p><u>During the design session:</u></p> <ul style="list-style-type: none"> • To start recording the actions performed during the sessions • To end recording the actions performed during the sessions <p><u>After the design session:</u></p> <ul style="list-style-type: none"> • Inherits the function of the designer
<p>Session Leader (Admin/designer hybrid)</p> <div data-bbox="172 1599 344 1827"> <p>uc Primary Us...</p>  <p>Session leader</p> </div>	<p>Session Leader's role (performed functions)</p> <p><u>Before the design session:</u></p> <ul style="list-style-type: none"> • Inherits the whole set of functions of the Administrator <p><u>During the design session:</u></p> <ul style="list-style-type: none"> • Inherits the set of functions of the Administrator • Inherits the set of functions of the designer <p><u>After the design session:</u></p> <ul style="list-style-type: none"> • Inherits the function from the designer

<p>uc Actors</p>  <p>Designer</p>	<p>Designer role (performed functions)</p> <p><u>Before the design session:</u></p> <ul style="list-style-type: none"> • To Upload/Download/Delete files (images, textures, text/font; 3D models;) • To manage (Upload/Download/Retrieve/Delete) information for the session (as post-its, notes, sketches, ...) • To manage (create/retrieve/delete) connections (or organization in clusters) between the information/notes • To prepare files on personal devices (PC, laptop, tablets) and share them in the session space <p><u>During the design session:</u></p> <ul style="list-style-type: none"> • Inherits the functions from the Participant/Client • To Upload files to the session space (images, textures, text/font; 3D models;) • To include files having textual or graphical content into layers • To choose one or more layers of images to be used for the projection • To superimpose layers with an appropriate order to obtain the desired results for the projection <p><u>After the design session:</u></p> <ul style="list-style-type: none"> • To ask the system for (automatically) gathering the information (textual or graphical) the platform was exposed to and organizing them according to a timeline.
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<p>uc Actors</p>  <p>Participant</p>	<p>Participant role (performed functions)</p> <p><u>Before the design session:</u></p> <ul style="list-style-type: none"> • NONE <p><u>During the design session:</u></p> <ul style="list-style-type: none"> • To move (turn, flip,...) a prototype during the session in order to look at it more carefully • To upload information for the session (as post-its, notes, sketches, ...) To prepare files on personal devices (PC, laptop, tablets) and share them in the session space • To visualize a virtual prototype with structured light projected on it • To interact with the prototype through gestures in order to change one or more of its layers. Expected changes: <ul style="list-style-type: none"> ○ To change its position ○ To change its orientation ○ To change its size (keeping or modifying the aspect ratio) ○ To change number of items on it (adding and removing items) ○ To change the colour of the items on it ○ To change its content (mainly textual) • To visualize on screen (room TV or personal devices as PC, laptop, tablets) what is projected on the prototype <p><u>After the design session:</u></p> <ul style="list-style-type: none"> • NONE
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5.2. SECONDARY ACTORS

Secondary actors are mainly external devices that will interact with the system. They are not part of the system but part of the execution environment; that means the system is capable to interact with those actors, or the actors will be influenced by the usage of the system.

Projecting device	Projectors are devices that will render textures into the physical object. One co-creative design environment can be composed by several projectors. The system will interact with each of the projector to send the correct image to project.
Tracking device	Devices for tracking identify the spatial position of the physical object. This position information is sent to the system and will be used to calculate the correct images and position to send to each of the projector devices.



Additional displaying device	A screen connected to the camera will show the physical object with the rendered images provided by the projector. The screen could be a connected TV or a computer located in the same room where the co-creative design session is performed.
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6. SYSTEM DEFINITION

6.1.SCOPE

The system is composed by several functional modules, each of them concurring to perform the functions described in Section 3.1.

One module manages the contents for Spatial Augmented Reality (called SAR module). It manages the interaction with the projecting device(s) and receives the information coming from the tracking devices. This includes both the position of the prototypes and, in case, the hands of the person that is interacting with it (prototype handling and gestures).

The other module (called Information System –IS- module) is in charge of storing resources and the manipulation history made during the co-creative design session.

Potentially the SAR module can work as a standalone application running in the same place where the co-creative design session is placed, while the IS module is a web application that can be accessed anywhere using valid account credentials.

The consortium members working on the development of the modules will carefully evaluate the different opportunities of the integration and communication among them with the purpose of having a non-intrusive platform that effectively support collaborative design

6.2.GRANULARITY

This document presents uses cases at level 0 and at level 1 using UML use case representation.



7. STATIC CONTEXT

The following scheme (Figure 2) shows the system and the interaction with the actors in a static context. The static context is the platform presented as a black box system and permits to see its boundaries by describing the flow exchange between the system and the actors. For the development of the platform, it is important to have a big picture of the application to produce, the boundaries of the system, the kind of users (actors), as well as the kind of information that will transit through the actors (primary and secondary) and the platform.

As shown in Figure 2, the "session leader" will not be detailed as a single actor in the use cases, but the platform should allow the creation of a hybrid profile that integrates the function of the administrator and of the designer, as they can be the same user.

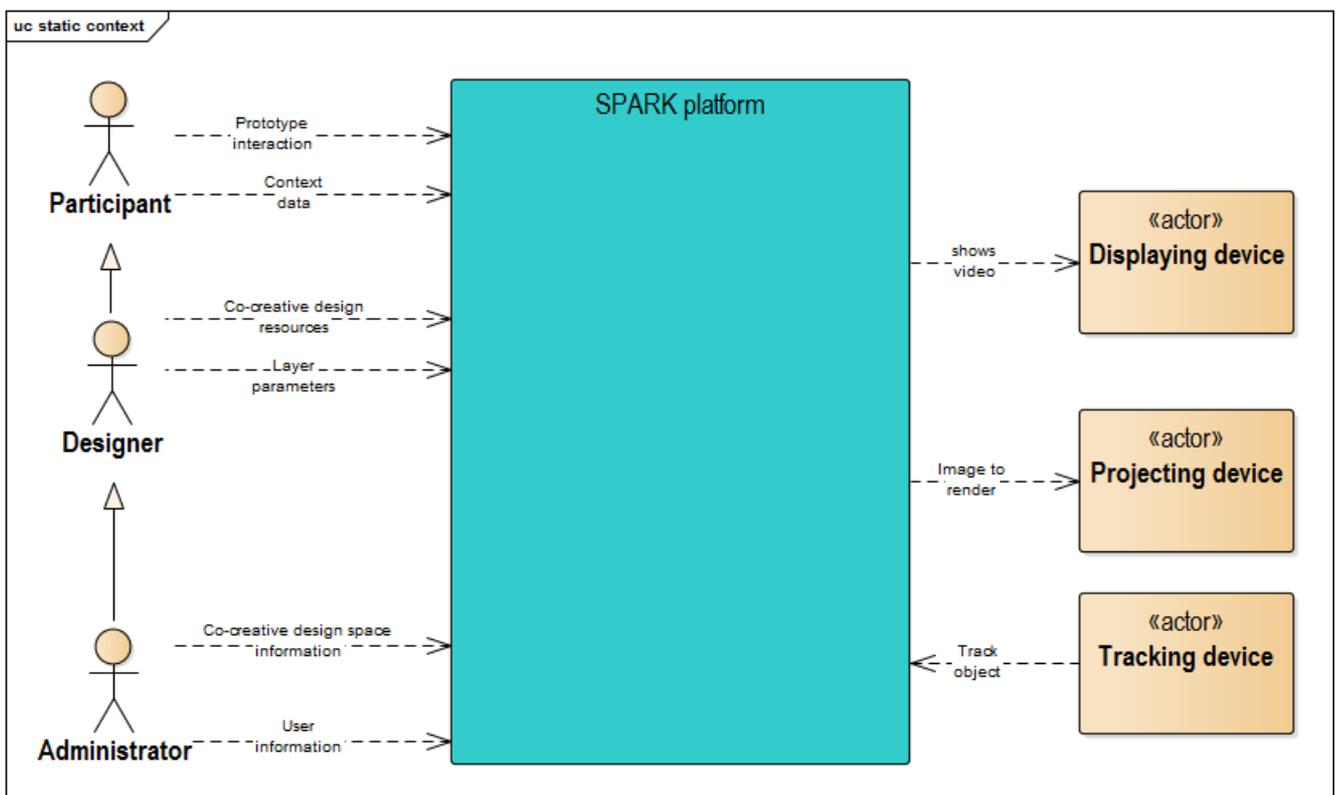


Figure 2 The SPARK platform seen as a black box in a static context

8. USE CASE DESCRIPTION

The functional description of the platform (in terms of the interactions it should allow) is proposed hereafter, consistently with the requirements, the system and the actors previously defined.

This section describes the different functions the application must deliver through “use cases”.

In the hereafter, the description of use case may also refer to a generic “user”. This has to be meant as the generic user, whatever its profile as primary actor is.

8.1. USE CASE DIAGRAM

The following scheme (Figure 3) is the use case diagram - level 0. This shows the overall functionality the system must perform. In the following subsections, each of the use case is presented with a deeper degree of granularity.

It is possible that some of the represented actors will not be mentioned in the tables describing the use cases because of the logic of inheritance. For instance, if a “Participant” carries out specific action in a use case, it means that also the other actors inheriting the “Participant”'s functions are allowed to carry them out. This applies also for the other primary actors according to inheritance relationships mentioned in section 5.



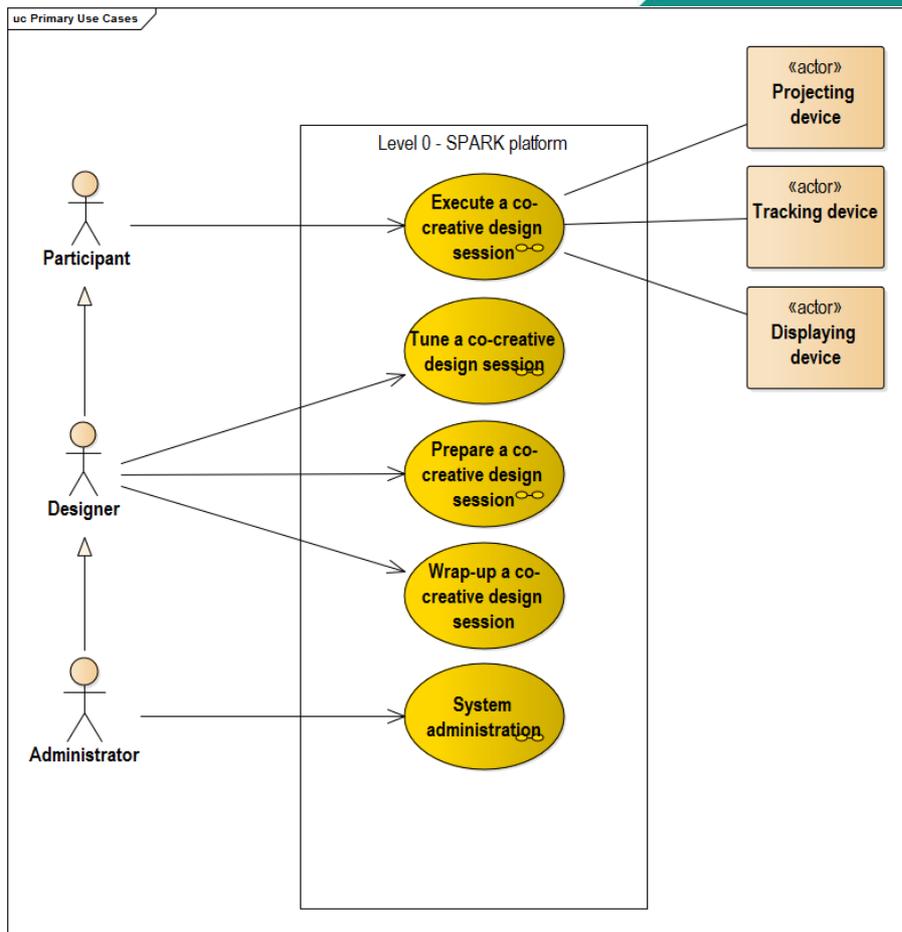


Figure 3 Use case diagram level 0



8.1.1. Use case diagram level 1 – System Administration

Name	Diagram: System administration
Primary Actor	Administrator
Summary	Uses cases in this diagram allows the management of user of the platform

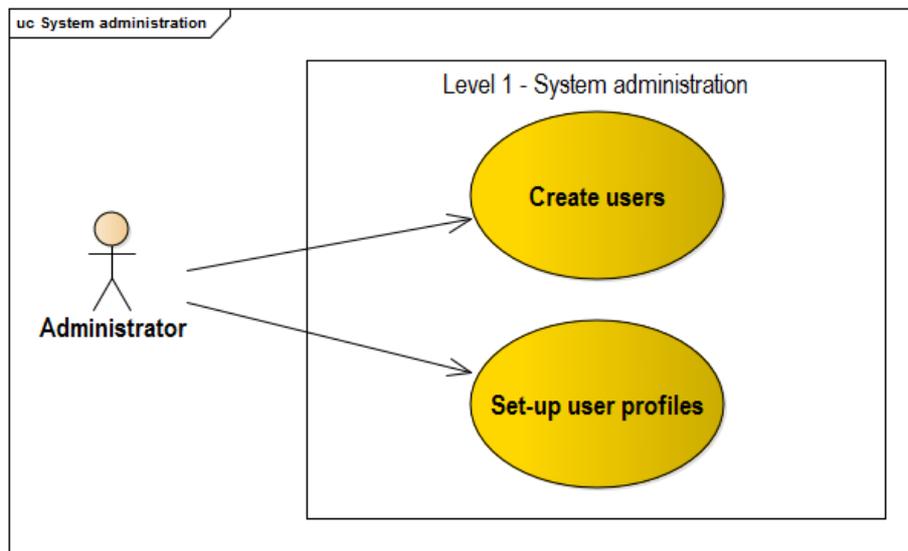


Figure 4 Use case diagram for system administration

Creation of users

Name of the use case	Creation of users
Primary Actor	Administrator
Pre-conditions	The user must be authenticated.
Invariants	
Post-conditions	New user will be added to the platform
Summary	The administrator creates new users to allow them to connect on the platform

Main Scenario for the Creation of Users

STEP	Primary Actor	System	Secondary Actors
1	The administrator select the create new user option		
2		The system shows the user the "create new user" page	
3	The administrator fills the user information (login, password, email, etc.)		

4		The system saves the new user information into the platform	
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Use case: Set-up user profile

Name of the use case	Assign the user a profile
Primary Actor	Administrator
Pre-conditions	The user must be authenticated
Invariants	
Post-conditions	User will have new profile in the system
Summary	The administrator manage the profile of the users

Main scenario for the "Set-up user profile"

STEP	Primary Actor	System	Secondary Actors
1	The administrator go to the user management option in the system		
2		The system shows the user the "management page"	
3	The administrator select a user to modify its profile		
4		The system shows the existing user profile	
5	The administrator assign or revoke a profile for the user		
6		The system saves the user profile	



8.1.2. Use case diagram: Level 1- Preparation of a design session

Name	Diagram: Preparation of a design session
Primary Actor	Designer
Summary	Uses cases in this diagram are performed before the execution of a co-creative design session

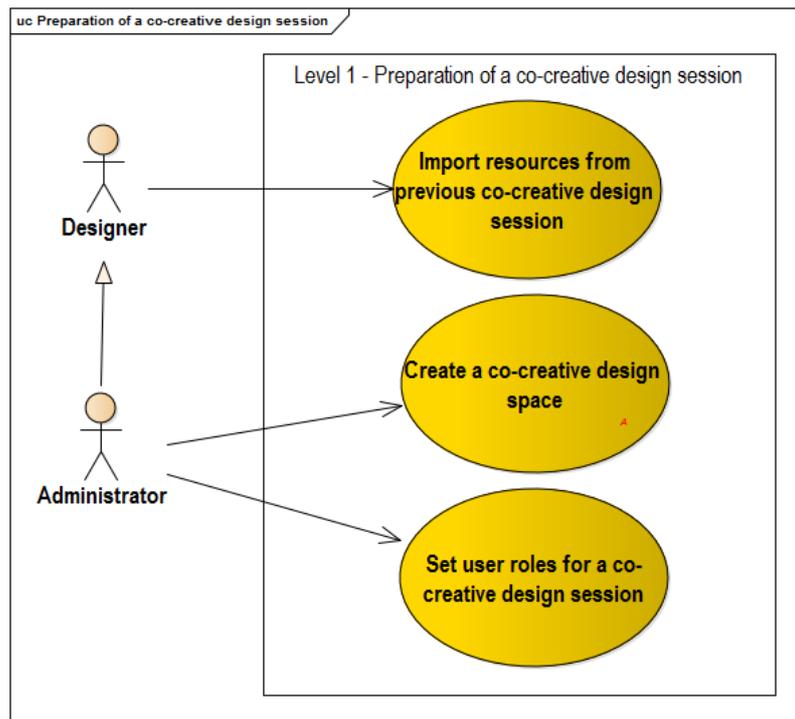


Figure 5 Use case diagram for preparation of a co-creative design session

Use case: Import resources

Name	Import resources from previous co-creative design session
Primary Actor	Designer
Pre-conditions	The user must be authenticated. The session must not be initialized. The user must have permission to access to the design session Contents for the co-creative design session are available from computer folders or other design session spaces
Invariants	
Post-conditions	The design session will contain a copy of resources prepared in advance

Summary	The designer import resources from existing session
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Main scenario for import resources – 1

STEP	Primary Actor	System	Secondary Actors
1	The designer selects the design session space		
2		The system shows the design session page	
3	The designer select existing contents available in computer folders and moves them to the design session page.		
4		The system copies the selected/moved resources into the new design session space	

Main scenario for importing resources - 2

STEP	Primary Actor	System	Secondary Actors
1	The designer selects the design session		
2		The system shows the design session page	
3	The designer select an existing design session space containing the resources to be copied in the new one		
4		The system copies existing resources to be used in the new design session	



Use case: Creation of a co-creative design session

Name	Creation of a co-creative design session
Primary Actor	Administrator
Pre-conditions	The user must be authenticated.
Invariants	
Post-conditions	A new design session is created
Summary	The administrator creates a new design session

Main scenario for creating a co-creative design session

STEP	Primary Actor	System	Secondary Actors
1	The administrator selects the "create new co-creative design session" option in the system GUI		
2		The system displays the design session creation page	
3	The administrator fills the needed fields for the design session		
4		The system saves the new design session	

Use case: Set user roles for a co-creative design session

Name	Set user roles for a design session
Primary Actor	Administrator
Pre-conditions	The user must be authenticated.
Invariants	
Post-conditions	Users roles will be modified for a design session
Summary	The administrator gives access to users to a design session

Main scenario for setting user's role

STEP	Primary Actor	System	Secondary Actors
1	The administrator select an existing design session		
2		The system sends to the design session page	
3	The administrator select the users who will have access to the session and its role		
4		The system saves the user roles for the session	



8.1.3. Use case diagram: Level 1- Tuning co-creative design session

Name	Diagram: Tuning design session
Primary Actor	Designer
Summary	Uses cases in this diagram could be performed during the preparation of a co-creative design session or while the session is executed.

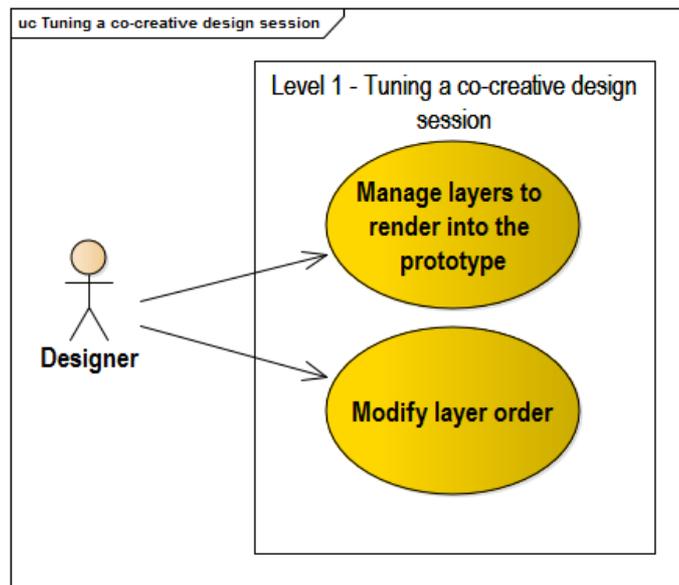


Figure 6 Use case diagram for tuning co-creative design session

Use case: Manage layers to render into the prototype

Name	Manage layers to render into the prototype
Primary Actor	Designer
Pre-conditions	The user must be authenticated. The user must have permission to access to the design session
Invariants	The status of a design session will not change, it remains running or not running.
Post-conditions	The resources to render on the design session will be modified
Summary	The designer add, remove or update layers to be applied to the prototype. If the session is running, the modifications must be applied instantly on the prototype.

Main scenario for layer management-1 - (Co-creative design session not running)

STEP	Primary Actor	System	Secondary Actors
1	The designer selects the co-creative design session		
2		The system displays the design session page	
3	The designer manage layers (in terms of size, position, color, ...) [refer to parameters described in section 3]		
4		The system stores layer information	

Main scenario for layer management – 2 - (Co-creative design session running)

STEP	Primary Actor	System	Secondary Actors
1	The designer selects the co-creative session		
2		The system sends the session page	
3	The designer manage layers		
4		The system stores layer information	
5		The system creates new images to render on the prototype	

Use Case: Modify layer order

Name	Modify layer order
Primary Actor	Designer
Pre-conditions	The user must be authenticated. The user must have permission to access to the co-creative design session
Invariants	The status of a co-creative design session will not change, it remains running or not running.
Post-conditions	The order of layer will be modified and saved in the system
Summary	The designer change the order of the existing layers to render on the prototype



Main scenario for layer order modification – 1 - (Co-creative design session not running)

STEP	Primary Actor	System	Secondary Actors
1	The designer selects the co-creative design session		
2		The system displays the session page	
3	The designer updates layer order		
4		The system stores layer order information	

Main scenario for layer order modification-2 – (Co-creative design session running)

STEP	Primary Actor	System	Secondary Actors
1	The designer selects the co-creative design session		
2		The system displays the session page	
3	The designer manage layers		
4		The system stores information about the order of layers	
5		The system superimposes layers as new content to be rendered on the prototype	



8.1.4. Use case diagram: Level 1 - Execution of a co-creative design session

Name	Execution of a co-creative design session
Primary Actor	Participant, Administrator, Designer
Secondary Actors	Projector device

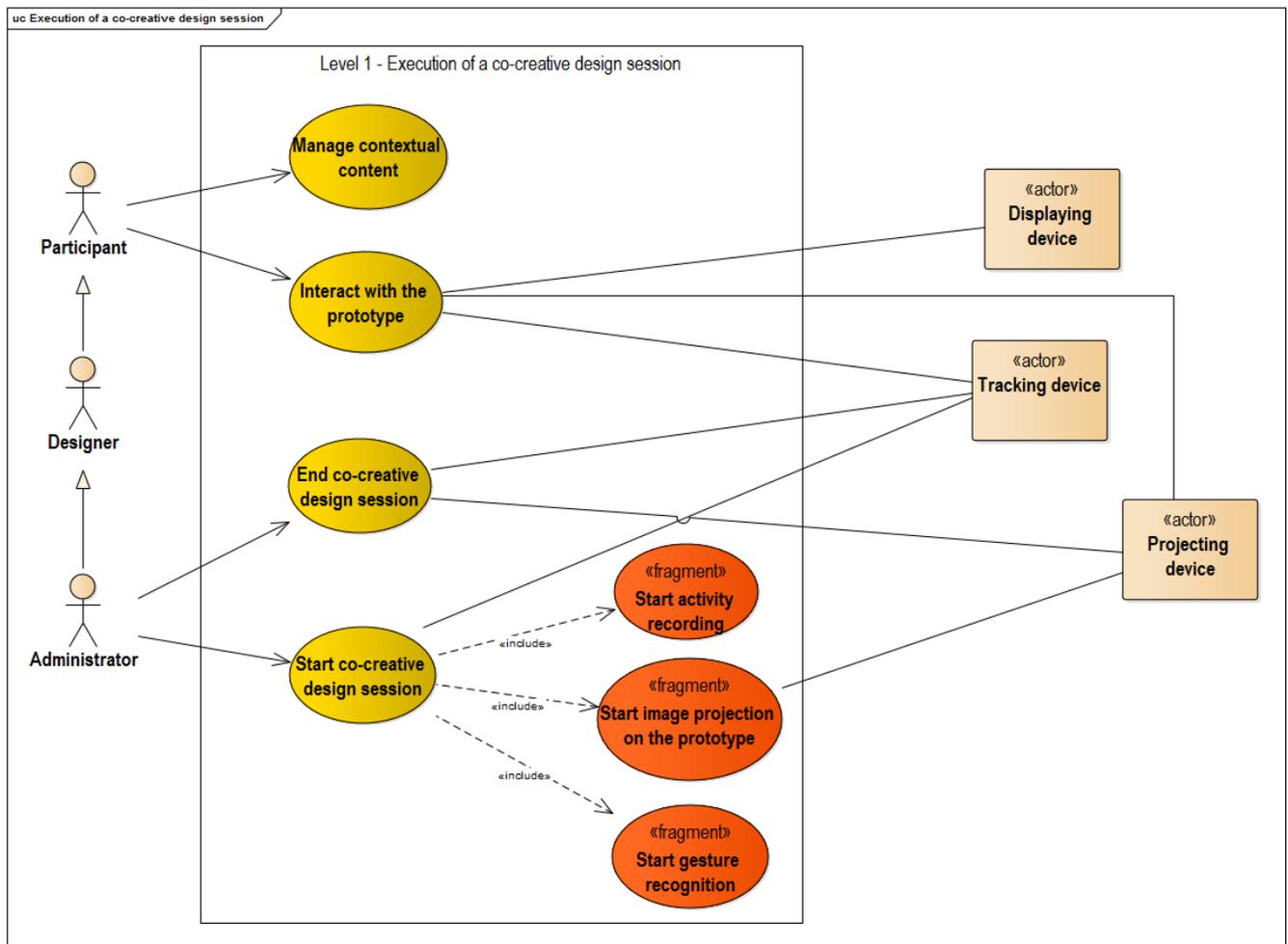


Figure 7 Use case diagram for execution of a co-creative design session

Manage contextual content

Name	Manage contextual content
Primary Actor	Participant
Pre-conditions	User must be authenticated in the platform The user must have permission to access to the co-creative design session
Invariants	What will not change in the system



Post-conditions	The system will contains new or updated contextual resource associated to a design session
Summary	The participant can upload information for the session (as post-its, notes, sketches,...) and share them in the session space

Main scenario for the management of contextual content

STEP	Primary Actor	System	Secondary Actors
1	The participant connects to a co-creative design session space		
2		The system send the page of the desired session	
3	The participant upload content for the session		
4		The system stores the content and leaves the option to share it with other participants	
5	The participant chooses to share the uploaded content with the other participants		
		The system, if the participant chose it, shows the uploaded content to the other participants in the co-creative design session space	



Use case: Interact with the prototype

Name	Interact with the prototype
Primary Actor	Participant
Pre-conditions	Is not mandatory to be authenticated into the platform The co-creative design session must be initialized The user must have permission to access to the co-creative design session
Invariants	The session remains initialized
Post-conditions	The interactions performed by the participant will be recorded as activities in the system for further reporting The recognized gestures will impact the rendered image on the prototype.
Summary	The participant can manipulate the prototype by performing gestures Expected changes to be done to prototype layers: <ul style="list-style-type: none"> • To change its position • To change its orientation • To change its size (keeping or modifying the aspect ratio) • To change number of items on it (adding and removing items) • To change the colour of the items on it • To change its content (mainly textual)



Main scenario for interacting with the prototype

STEP	Primary Actor	System	Secondary Actors
1	The participant perform recognizable gestures		
2			The tracking device(s) recognizes what the participant does with the prototype (it acquires prototype position and the participant gestures to modify content on it)
3		The system interprets the information of the tracking device and sends the information to the projecting device and the displaying device	
4			The projecting device renders the image on the prototype
5			The displaying device allows the other participant to visualize the projected content on separate devices (tablets, TV screen, ...)



Use case: Start co-creative design session

Name	Start co-creative design session
Primary Actor	Administrator
Pre-conditions	The user must be authenticated. The co-creative design session space must be created.
Invariants	
Post-conditions	The start activity use case must be initialized The start image projection on prototype use case must be initialized. The start gesture recognition use case must be initialized
Summary	The administrator/session leader selects a design session and initialize it in order to track prototype position, gesture recognition and record events.

Main scenario for starting a co-creative session

STEP	Primary Actor	System	Secondary Actors
1	The administrator selects the co-creative design session		
2		The system displays the session page	
3	The administrator initializes the session		
4		The system starts to track prototype, recognizes gestures (exchanges information with the tracking devices(s)) and records activities.	



5			The tracking device collects information about the prototype position, orientation and shape and exchanges it iteratively with the system
6		The co-creative design session status becomes running	

Use case: End co-creative design session

Name	End co-creative design session
Primary Actor	Administrator
Pre-conditions	The user must be authenticated. The co-creative design session must be initialized.
Invariants	
Post-conditions	The system stops to record activities, stops to perform gesture recognition and stops to render image on the prototype
Summary	The administrator stops the execution of a co-creative design session.

Main scenario for ending a co-creative design session

STEP	Primary Actor	System	Secondary Actors
1	The administrator selects the co-creative design session		
2		The system sends the session page	
3	The administrator stops the session		
4		The system stops to track prototype, stops to recognize gestures and stops to record activities	



5			The tracking device stops acquiring information about the prototype and exchanging it with the system
6			The projecting device stops managing information about the prototype to be rendered and stops projecting visual content
7			The displaying device(s) stops showing the visual content to the participants
8		The status of the design session becomes finalized	

Use case: Start activity recording

Name	Start activity recording
Primary Actor	Administrator, triggered by "Start co-creative design session" use case
Pre-conditions	The user must be authenticated
Invariants	
Post-conditions	Each modification to the model will be stored in the system for further use or reporting
Summary	The system starts recording events coming from the gesture recognition, the interaction with the prototype, and from the use case of tuning the co-creative design session



Main scenario for recording the session's activities

STEP	Primary Actor	System	Secondary Actors
1	The trigger initializes the recording of the co-creative design session		
2		The system in background store activities performed during the session	

Use case: Start image projection on the prototype

Name	Start image projection on the prototype
Primary Actor	Administrator, triggered by "Start co-creative design session" use case
Pre-conditions	The user must be authenticated.
Invariants	
Post-conditions	The new calculated images will be rendered on the prototype
Summary	Each modification performed to the prototype or the layer and/or resources will be analysed by the system in order to produce new images to render on the prototype

Main scenario for image projection

STEP	Primary Actor	System	Secondary Actors
1	The trigger initializes rendering of image on the prototype		
2		The system in background analyses the state of the prototype model in order to generate images	
4		The system sends images to the projector devices	
3			The projector device renders images on the prototype



Use case: Start gesture recognition

Name	Start gesture recognition
Primary Actor	Administrator, triggered by "Start co-creative session" use case
Pre-conditions	The user must be authenticated.
Invariants	
Post-conditions	Detected gestures modifies the images to render on the prototype
Summary	Gesture recognition is the interpretation of user movements manipulating the prototype with the aim of recognizing modifications or new images to render on the prototype.

Main scenario for gesture recognition

STEP	Primary Actor	System	Secondary Actors
1	The trigger initializes rendering of image on the prototype		
2			The tracking device captures information about the prototype position and the participants gestures to modify its visual content (what to be projected)
3		The system interprets the information from the tracking device as gestures made by users	
4		The system produces new images based on recognized gestures and sends them to the projecting device	



		for visualization (then UC for projection of images applies)	
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8.1.5. Use case description: Level 1 - Wrap-up of the co-creative design session

Name	Wrap-up of the co-creative design session
Primary Actor	Designer
Pre-conditions	The user must be authenticated
Invariants	
Post-conditions	
Summary	The user sees record activities of the co-creative design session

Main scenario

STEP	Primary Actor	System	Secondary Actors
1	The designer selects the co-creative design session		
2		The system displays the session page	
3	The designer selects the report option		
4		The system retrieves the record activities for the chosen co-creative design session	
5		The system formats the recorded activities as a report	
6	The designer sees and print (if he wants) the report or saves it to a log file.		



9. CONCLUSION

The present document summarizes the main functional requirements of the SPARK platform and its modules. This content has been generated after the observations carried out in WP1 for capturing end users' needs and expectations.

Requirements are described and distinguished between functional and non-functional. For each of the functional requirements, at least one actor is considered in charge of carrying out that function by interacting with the system. For these interactions, specific use cases have been detailed with the purpose of harmonizing the understanding of what is required to be developed by the involved partners of the project consortium.

This document, hence, aims to steer the activities of the Work Packages concerning the development of the SPARK modules (WP2) and the platform as a whole (WP3).

Along with the development of the project, the consortium expects that the collected list of requirements will be refined and further detailed after M6 (date of issue of this document). The updated design specification will be refined according to the technological choices to be carried out in WP2 and WP3 regarding the integration of software modules, hardware solutions and their harmonization.

