

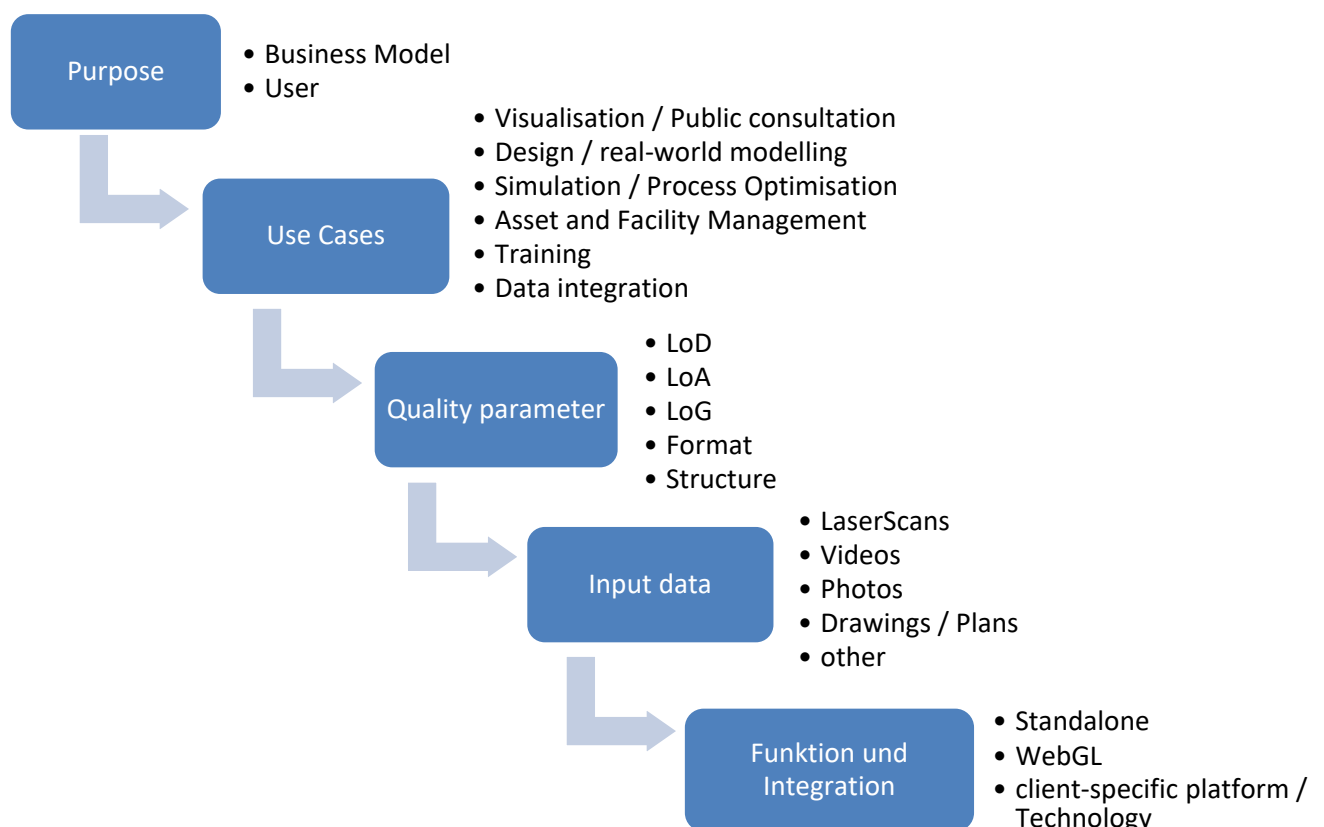
Gathering requirements for a digital twin of LocLab

Introduction

LocLab specializes in creating three-dimensional, digital images of existing or planned buildings, plants, machines or geographic spaces that are true to life and optimized for specific applications. In doing so, we specifically use technologies and processes that aim to achieve the greatest possible cost reduction, in line with the motto: as little as possible, but as much as necessary.

It is important to note that not all 3D models are the same. There are even very big differences in the quality and thus the suitability of 3D models for certain applications. Therefore, we first try to understand the intended use and the desired use cases for the digital twin. The use case largely determines the required quality parameters. From these parameters, in turn, it depends on which input data can be considered or is required. In order to achieve an optimal end result, the question of integration into the system and data landscape of the end customer is also important, i.e. whether a web or cloud-based technology is used or whether full system integration is desired.

The dependencies are illustrated in the diagram below.



Quality parameters

The following standardized parameters are used to describe the quality of the 3D model to be created:

- a) The level of detail of the modeled objects (LoD)
- b) The Level of Accuracy (LoA)
- c) The Level of Generalisation (LoG)
- d) Format or formats to be transferred (e.g. FBX, IFC, DGN, Player, WebGL, etc.)
- e) If necessary, customer-specific object structure

The quality parameters are explained in the appendix with examples.

Requirements capture

The following questionnaire is intended to make it easier for you and us to record your requirements and to ensure that the product meets your needs.

1) Purpose

In which area of the organization should the digital twin be used?

Who are the users of the Digital Twin?

Are there different user authorizations, e.g. trainer and trainee?

- no
- yes:

Do you require training on the use of the Digital Twin?

- no
- yes

2) Areas of application

What are the main application areas of the Digital Twin?

- Visualization / Public Relations
- As-is and Inventory Modeling / Planning / Planning Optimization
- Simulation / Process Optimization
- Asset Management / Facility Management
- Training
- Data integration
- Other

What kind of project is it basically?

- The basis is a digitization of the as-is situation
- A pure planning project without existing inventory
- Digitization of the as-is with planning integration
- Other

3) Model requirements

What should be modeled?

- Route or corridor (e.g. railway line, road, energy line, etc.)
- City or district
- Building
 - number of floors
 - m² per floor
 - m² total
 - inside
 - outside
 - furnished
 - unfurnished
- Production hall / workshop
- Production plants / machines
- Other

Please provide images, an outline of the area to be modeled, or other information that will give us an idea of the size and complexity of the area to be modeled. This could be, for example, a screenshot from Google Earth or Google Maps showing the area to be modelled. Of interior spaces, please provide some sample images.

Level of Detail - LoD (see attachment)

Our recommendation:

- LoD 9 (recommended for outdoor view)
- LoD 10 (recommended for indoor view)
- LoD 11 Exterior view (no explosion model, recommended for machinery and equipment in an exterior view).
- LoD 11 interior view (explosion model and hidden element modeling).
- Other:

Do certain objects or areas require a higher LoD?

- No
- Yes

Level of Accuracy - LoA (see attachment)

- very high
- high
- medium
- low
- Other:

Level of Generalisation - LoG (see attachment)

- very strong
- strongly
- medium
- low
- Other:

Object structure

Should we follow a given object hierarchy and model structure when modeling?

- No, please use the standard LocLab model structure
- Yes, please provide the following model structure (e.g. IFC 4.0):

4) Input data

Can input data be made available to us?

No, no data can be provided

Yes, the following data can be provided

- 3D laser scan
- Videos recorded according to instructions from LocLab
- Videos recorded without guidance from LocLab
- Digital photos
- Reference dimensions
- 2D planning as PDF
- 2D planning in a native format
- 3D model
- Cadastre (MasterMap) or comparable
- Digital terrain model
- Orthophotos
- GIS data (e.g. MasterMap)
- CityGML
- Other

Should data be recorded by LocLab?

- No
- Yes, please observe the following safety or other requirements:

5) Function and integration

Which applications / data formats are to be transferred?

- Standalone Viewer
- Unity Package
- Unity Workspace
- WebGL
- VR/AR
- Mobile devices / App
- editable, native CAD format (surface model):
 - FBX
 - OBJ
 - IFC
 - DWG
 - DGN
- Other:

Player functions

By default, the following functionalities & tools are included in the license-free basic version of the player:

- Navigation in real time
- Camera settings orbit, flight or pedestrian with gravity
- Switching between existing and planning variants, if available

Which of the following additional functionalities should be activated (see attachment)?

- Screenshot tool
- Commenting tool
- Mini-Map (for better navigation and location in the model)
- Weather system
- Daylight system
- Camera jump position
- Camera path tool
- Focal length setting (viewing angle view can be changed)
- On-screen navigation aid

- "Sandbox" functionality (insert, delete and move objects)
- Other:

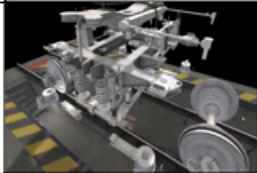




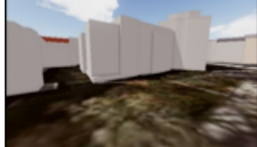
Is there any other information you would like us to consider when submitting a bid?

- No
- Yes,

Please save the form and after filling it out send it by mail to:
info@loclab-consulting.com

Appendix: Description of the quality parameters

LoD Overview Table

LocLab LoD (Level of Detail)	Design Standard LoD ¹	City GML LoD ²	Description	Use Case Examples	Picture	UK LoD ³
11	500	-	At least objects and components of larger objects that are larger than 1 cm in all three dimensions (length, width, height) are modelled. Smaller objects are either represented in the form of a texture or omitted.	Explosion models, construction models, e.g. of production plants, machines, tools, etc.		7
10	-	4	At least objects and components of larger objects that are larger than 5 cm in all three dimensions (length, width, height) are modelled. Smaller objects are either represented in the form of a texture or omitted.	Interior modelling, e.g. for office buildings, railway stations, airports, etc. Ideal for asset management, visualisations, process optimisation, data integration, training		6
9	400	-	At least objects and components of larger objects that are larger than 10 cm in all three dimensions (length, width, height) are modelled. Smaller objects are either represented in the form of a texture or omitted.	Outdoor space modelling, e.g. for route corridors, cities or geographical spaces. Ideal for as-built modelling, visualisation, planning optimisation, simulation, asset management.		5
8	300	3	LoD 8 has a medium modelling level and represents details only on a purely visual level as a texture.	LoD 8 is suitable for completing the visual scene with secondary environmental elements and transition to the background. Well suited for very large scenes, e.g. overhead lines.		4
7	200	2	LoD 7 has a coarse modelling level with simple generic texture without details. Houses are represented with roof shapes and roof materials, but without balconies, bay windows or other protrusions.	LoD 7 is suitable for completing the visual scene in the background.		3
6	100	2	LoD 6 contains only a terrain model textured with orthophotos and extruded building footprints. It is only suitable for the representation of content at a great distance.	LoD 6 is suitable for rough completion of the visual scene or for extremely large scenes to be displayed via web-based technologies due to the low data load.		2

LoA Overview table

LoA	Very high	High	Medium	Low
Maximum deviation	1-10 mm	1-10 cm	10-50 cm	>50 cm

In principle, LocLab models can achieve the same positional accuracy as the input data to be used.

LoG overview table

LoG	Very strongly generalized	Highly generalized	moderately generalized	Low generalized
Polygoncount (file size)	Low / small	Medium / medium	High / large	Very high / very large
Geometric accuracy	Low	Medium	High	Very high

The degree of generalization is influenced by operations such as simplification, generalization, or tessellation, which are the number and size of polygons used to represent a surface. The LoG has a direct influence on the file size and renderability of the 3D model.

Input data and admission procedure

The most important input data as a basis for modelling in the LocLab method are listed below with their respective advantages and disadvantages as well as the areas of application.

	Features	Suitability / areas of application
<i>3D laser scan</i>	<ul style="list-style-type: none"> - very high geometric accuracy - manifold applications - Can be combined with other methods (photogrammetry) - high data volume (often TB!) - high hardware costs - high personnel costs at admission - complex processing 	<ul style="list-style-type: none"> - Indoor and outdoor spaces - all applications requiring very high to high positional accuracy
<i>Videogrammetry</i>	<ul style="list-style-type: none"> - low hardware costs - versatile application possibilities and coupling with recording methods possible (stationary, mobile, terrestrial, air-borne) - fast pick-up procedure, can be done from the side (no safety risk on roads or railways) - Georeferencing through metadata of the recording device - High degree of automation for processing in the LocLab process - great differences in the suitability of hardware - not suitable for complex interiors - susceptible to errors in difficult lighting conditions (strong shadows, one-sided light source) - always requires reference data for calibration 	<ul style="list-style-type: none"> - Indoor and outdoor spaces - all applications requiring high to medium positional accuracy
<i>Photogrammetry</i>	<ul style="list-style-type: none"> - low hardware costs versatile application possibilities and coupling with recording methods possible (stationary, mobile, terrestrial, air-borne) - fast pick-up procedure, can be done from the side (no safety risk on roads or railways) - Processing method at LocLab replaced by videogrammetry, hardly used anymore 	<ul style="list-style-type: none"> - Indoor and outdoor spaces - all applications requiring high to medium positional accuracy
<i>Geodata</i>	<ul style="list-style-type: none"> - good availability - obtainable in part free of charge - can only provide supplementary information - do not replace project-specific input data 	<ul style="list-style-type: none"> - Outdoor spaces - All applications requiring low positional accuracy
<i>Planning data</i>	<ul style="list-style-type: none"> - Usability varies depending on the format (PDF, 2D CAD, 3D CAD) - show future state - high manual effort, if only available as PDF - Information content lower than in the digital twin, therefore corrections are almost always necessary 	<ul style="list-style-type: none"> - All applications that show a future state

Additional functionalities 3D Rocket Player

Screenshot



The "Screenshot Tool" allows the automated storage of the current screen content as an image file in a predefined folder. By pressing the "p" key, this screenshot is automatically created via shortcut. All created screenshots can be displayed in a selection window in the player.

Comment



With the "Annotate" tool, comments or notes can be located in the scene, similar to a "Post-It" note. The system saves the point including the comment as well as the camera position when the point was set. In addition, a screenshot is stored in the system from this very position.

For a detailed description of how to use the "Comment" tool, please refer to the separate description.

Mini-map / overview map



The mini-map shows an overview of the 3D scene and your own location as well as the viewing direction. The scale of the mini-map can be changed individually. A standard version of the Mini-Map is available, as well as a version with a connection to various map and aerial photo services, such as Google Maps, Arc GIS from Esri, MapQuest and Virtual Earth.

Weather system



The weather system allows the simulation of realistic weather conditions. The following settings are available:

- A. Clear sky
- B. Cloudy 1
- C. Cloudy 2
- D. Cloudy 3
- E. Cloudy 4
- F. Rain
- G. Snowfall
- H. Thunderstorm
- I. Light rain
- J. Light snow
- K. Heavy rain
- L. Heavy snowfall

Please refer to the separate description for a detailed description of how to use the "weather system".

Daytime system



In addition to the weather system, there is also a daytime system. This is mainly used to simulate the time of day with realistic shadows. Besides the use of the system time, a virtual time as well as a virtual date can be set.

Jump position



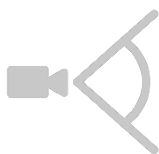
Jump positions are fixed camera positions with a predefined viewing direction. These jump positions are displayed either on a map or as a selection box in the viewer. By clicking on the respective jump position, the camera is teleported to the specific position.

Kamerapfad



With the "camera path" tool a camera flight can be created in the viewer, which can be flown repeatedly at different speeds. For a detailed description of how to use the "Create Camera Path" tool, please refer to the separate description.

Focal length



By changing the slider, the focal length of the camera can be changed. The focal length defines the wide angle of the camera. If required, you can vary between a full view and a view with depth of field.

On-Screen Navigation Aid



In the "On-Screen Navigation Help" a window is displayed which shows an overview of the most important keyboard commands. The user can choose whether the help is shown every time the viewer is started.

Editor



The editor mode offers the possibility to change the contents of the scene in the viewer. After activation all objects are selectable. When clicking on an object, a transformation symbol with three different axes appears. The objects can be moved via the individual axes.

In addition to moving, there are also options to rotate, scale or delete the objects.

An object panel offers the user a selection of objects that can be placed in the scene. It is possible to load further objects into the panel via the corresponding icon and a selection in the file browser. The object is then added to the panel and can be placed in the 3D scene.

Changed 3D scenes can be saved under the item save.

