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| --- | --- | --- | --- | --- |
| ID | Name | Description | Verification | Pr. |
| A.01 |  |  |  |  |
| A.02 |  |  |  |  |
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1. introduction

a. Purpose (of the document)

This chapter provides the specification of the project. It will be defined what is needed to be done to complete the project.

b. Scope (of the software product)

The first task is to establish the MES Software to work with the learning factory. The second task is to explain how to make the KI-Campus factory Software work with the factory in the laboratory.

c. Explanation of terms and / or abbreviations

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| ID | Is the identification number of a specification. |
| Pr. | Is the priority of a specification. It specifies whether a goal has to be achieved or not.  A: Has to be fulfilled (Verification needed).  B: Should be fulfilled  C: Can be fulfilled |
| MES | Manufacturing execution system |

d. References to other resources or sources

e. Overview (How is the document structured?)

In the following chapter a general description of the project will be done. It will give an overview of the tasks. In the second part specific requirements will be clarified.

2. general description (of the system)

a. Product functions (a summary and overview)

For the first part of the project a MES software is used. It is used to digitalize manufacturing processes. For worker of the manufactory it should provide instructions. Therefore a workflow for the whole production process will be implemented. Customers should be supplied with information about the state of the production. The information provided to the costumers shall be of such a nature to help them classify when the product will be ready. A person that oversees the production should have a dashboard with collected data sets.

For the KI-Campus learning factory a set of explanations will be created. This will include a user manual and a workshop in which the functions will be gone through. Furthermore, it will be discussed how to implement the Software to the factory.

b. Product perspective

The factory is shown on an exhibition table. The results of the implementation of the MES Software can be accessed via a PC and a screen. For show purposes it is advised to locate the screen right next to the factory.

The KI-Campus factory learning material will be given digitally. The workshop will be held face to face.

c. User characteristics (information about expected users, e.g., education, experience,

expertise)

The expected users of the MES software divide into three groups: Worker, Customer and Manager.

The workers expertise will be to use the PLC software. He has expertise for all the steps of the factory. He will need to learn how to follow instructions of the MES workflow. He probably has no higher education and won’t be able to implement any changes to the software.

The manager will have higher education. He has experiences with complex software. He needs to overview that the MES software is running correctly. He also needs expertise on how to interpret data as he will need to have a look onto the data sets of the dashboard.

The customer is a coworker of a other company that works in the department of purchase and sells. He has experiences in using ordering software. He need to apply these expertise to access the data provided to him.

d. Design constraints (for the developers)

Not all parts needed for KI-Campus factory are available. This could hinder the connection between the KI applications and the factory.

e. Assumptions and dependencies (factors that influence but do not hinder development, e.g.,

choice of operating system)

f. Division of requirements (features that cannot be realized and features that are postponed

to later versions)

3. specific requirements

a. functional requirements

i. MES software

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| --- | --- | --- | --- | --- |
| ID | Name | Description | Verification | Pr. |
| A.01 | Workflow | With arc.ops a workflow has to be created for the hole factoring process. | Ended workflow | A |
| A.02 | Workflow | Further processes can be implemented for product personalization | - | C |
| A.03 | Data collection | With arc.quire data of the factory must be demanded | Software verifies connection | A |
| A.04 | Database | A database needs to be created, that is capable to store all important data. | Load data into database | A |
| A.05 | Database | Data from the factory must be stored into the database. | Request list of database. | A |
| A.06 | Flow | A flow needs to be created with arc.flow | Finished Flow | A |
| A.07 | Flow | Data has to be processed and analyzed. Important sensor values will have an allocated meaning. | Understable data | A |
| A.08 | Dashboard | Data need to be put into a dashboard. Important information about the manufactory need to be shown. | Reviewing dashboard on screen | A |

ii. external interfaces

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| ID | Name | Description | Verification | Pr. |
| B.01 | Screen | To access the MES software a display is required. | Plug in display | A |
| B.02 | Connection | All systems need to connect to the UTHM network | Confirmation of established connection | A |
| B.03 | Connection | The factory data needs to be transmitted to the UTHM server | Access data | A |
| B.04 | Connection | The arc.quire software needs to connect with the UTHM server. | Data can be loaded | A |
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iii. Output

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| ID | Name | Description | Verification | Pr. |
| C.01 | Dashboard | Factory information is provided | Dashboard review |  |
| C.02 | Workflow | The coworker is provided with information about the next production steps he needs to execute. | Coworker view review |  |

iv. KI learning factory

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| ID | Name | Description | Verification | Pr. |
| D.01 | Information gathering | Course of KI learning factory needs to be attended | 100% attendance | A |
| D.02 | Doing tasks | Task during the course should be done, within the possibilities of equipment. | - | B |
| D.03 | Manual | Creating an manual for the use of the KI factory software. | Report finished | A |
| D.04 | Workshop | Prepare lessons in which interactively the information is provided | Finished workshop | A |
| D.05 | Connection | Data of the factory should be loaded into the database. | - | B |
| D.06 | Data | Transferred data should be analyzed using KI software | - | B |
| D.07 | Connection | A connection to the controller of the factory can be established | - | C |
| D.08 | Controlling | The factory may be controlled by the KI software | - | C |

iv. Environmental conditions

b. non-functional requirements

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| ID | Name | Description | Verification | Pr. |
| F.01 | Software | Usage of arcstone arc.ops | All PCs need to be controlled to always use the latest version of the software | A |
| F.02 | Software | Usage of arcstone arc.quire | A |
| F.03 | Software | Usage of arcstone arc.flow | A |
| F.04 | Software | Usage of Microsoft SQL database manager | A |
| F.05 | Software | Anaconda for python | B |
| F.06 | Server | UTHM server is to be used |  | A |

i. Performance requirements

ii. Usability

iii. Maintainability

iv. Modifiability/Scalability

c. Quality requirements

d. System Security

e. Data management and security

f. Other requirements

i. Policies and regulations

ii. Packaging, handling, shipping and transportation

4. verification