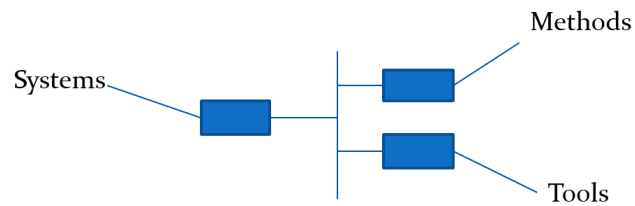

System Specification

System of interest

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Syscience

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Reference: Syscience R001, V1



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1 Introduction

1.1 Object of the document

This document describes the system of interest as a black box, using graphical model views. It defines the requirements that the system of interest shall satisfy.

1.2 System mission

The mission of the system of interest consists in providing a service or a product to main users. The mission is characterized in detail by models and requirements which are identified in the following paragraphs.

1.3 Lifecycle

The system lifecycle is defined according to standard [IEEE15288]. It can be described by the following state machine :

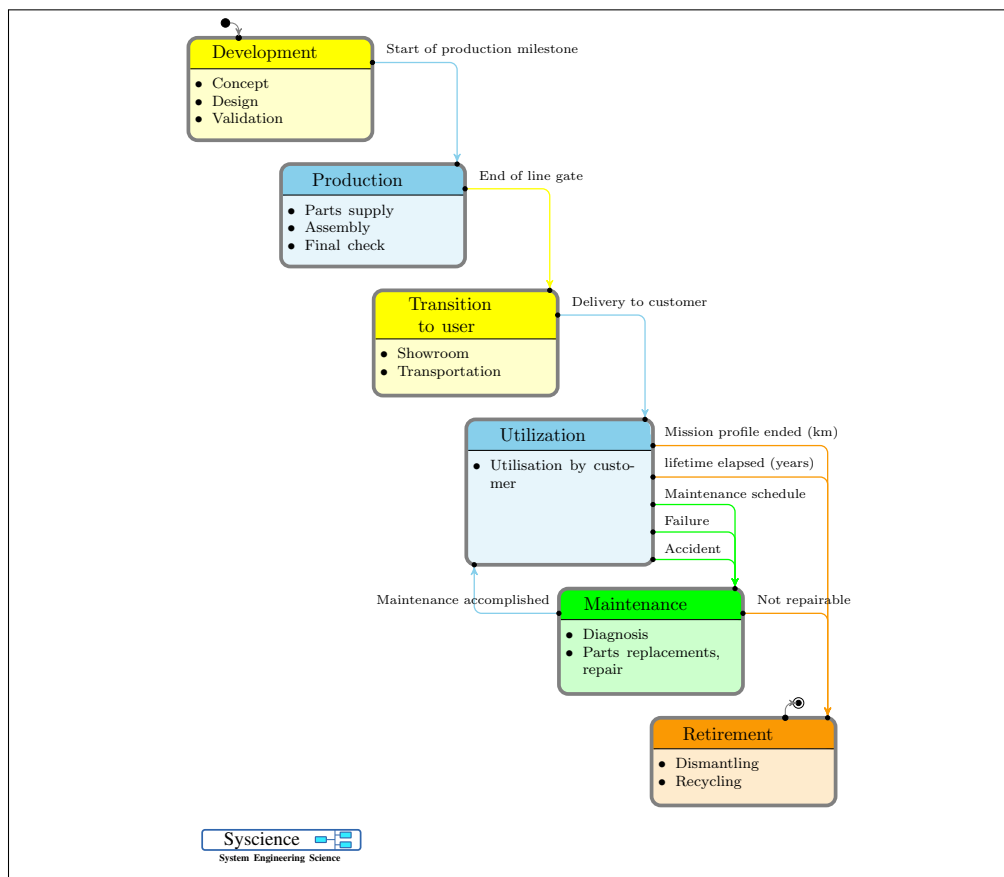


Figure 1: **State_LifeCycle:** The system lifecycle

1.4 References

- IEEE1220 : IEEE Standard for Application and Management of the Systems Engineering Process
- IEEE15288 : Systems Engineering - System Life Cycle Processes
- IEEE1471 : IEEE Recommended Practice for Architectural Description of Software-Intensive Systems

1.5 Terminology

1.5.1 Terms

- Stakeholder : entity, person or organization having needs, expectations or constraints concerning the system of interest
- Lifecycle : succession of phases through which the system passes between the elaboration of the concept and its end of life.

- Lifecycle phase : phase identified in the lifecycle.
- Diagram : graphical representation of a view of a system

1.5.2 Acronyms definitions

- MBSE : Model Based System Engineering
- RBSE : Requirement Based System Engineering
- COTS : Commercial off the shelf
- SOI : System of interest
- MOP : Measure of performance
- KME : Key measures of effectiveness
- TPM : Technical performance measure

2 Stakeholders needs

Stakeholders are individuals, organizations or enterprise departments who have expectations, needs and constraints for the SOI.

Stakeholders are drawn on a context diagram, associated with the collected documents [IEEE1220] §6.1.1, §6.1.2, §6.1.3).

2.1 Stakeholder context diagram

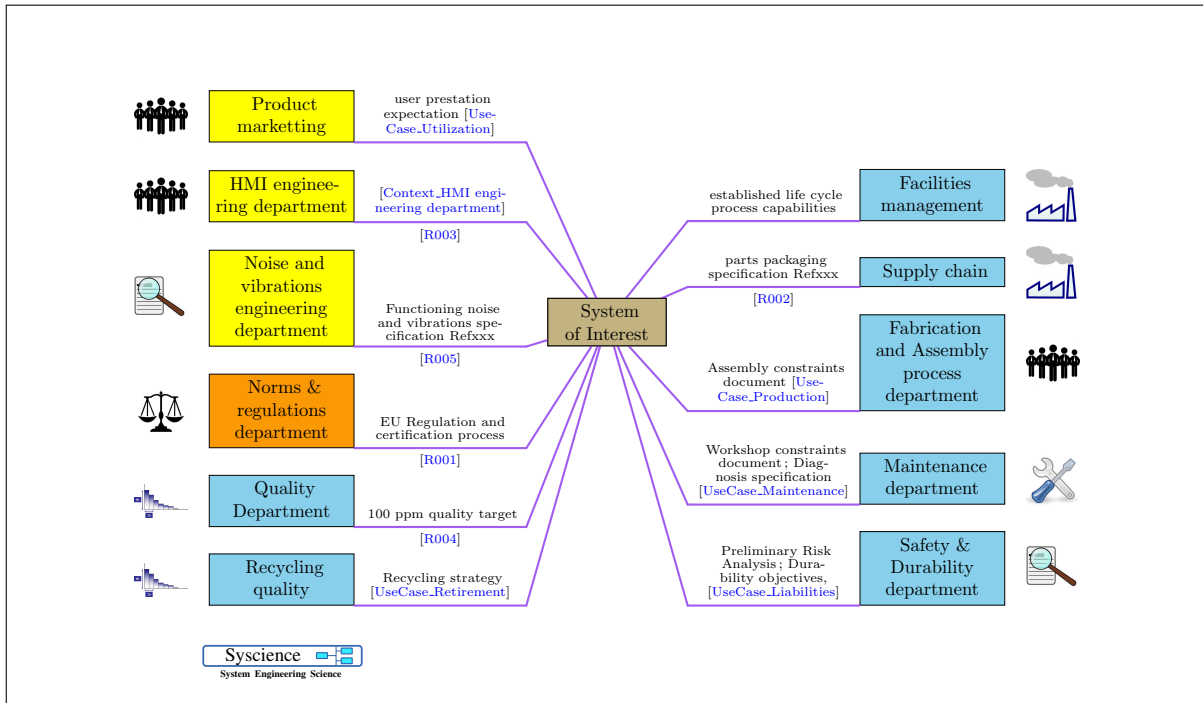


Figure 2: **Context_Stakeholders**: Context diagram representing the system of interest surrounded by stakeholders. Documents transmitted by stakeholders are indicated on the link between stakeholder and system.

Requirement identifier	R003
Requirement Text	In order to satisfy HMI engineering department, the System of Interest shall comply with [Context_HMI engineering department].
Diagram	Context_Stakeholders

Table 1: **R003**, cited in the figure [Context.HMI engineering department](#), and [Context_Stakeholders](#)

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Requirement identifier	R005
Requirement Text	In order to satisfy Noise and vibrations engineering department, the System of Interest shall comply with Functioning noise and vibrations specification Refxxx.
Diagram	Context_Stakeholders

Table 2: **R005**, cited in the figure [Context.HMI engineering department](#), and [Context_Stakeholders](#)

Requirement identifier	R001
Requirement Text	In order to satisfy Norms & regulations department, the System of Interest shall comply with EU Regulation and certification process.
Diagram	Context_Stakeholders

Table 3: **R001**, cited in the figure [Context.HMI engineering department](#), and [Context_Stakeholders](#)

Requirement identifier	R004
Requirement Text	In order to satisfy Quality Department, the System of Interest shall comply with 100 ppm quality target.
Diagram	Context_Stakeholders

Table 4: **R004**, cited in the figure [Context.HMI engineering department](#), and [Context_Stakeholders](#)

Requirement identifier	R002
Requirement Text	In order to satisfy Supply chain, the System of Interest shall comply with parts packaging specification Refxxx.
Diagram	Context_Stakeholders

Table 5: **R002**, cited in the figure [Context.HMI engineering department](#), and [Context_Stakeholders](#)

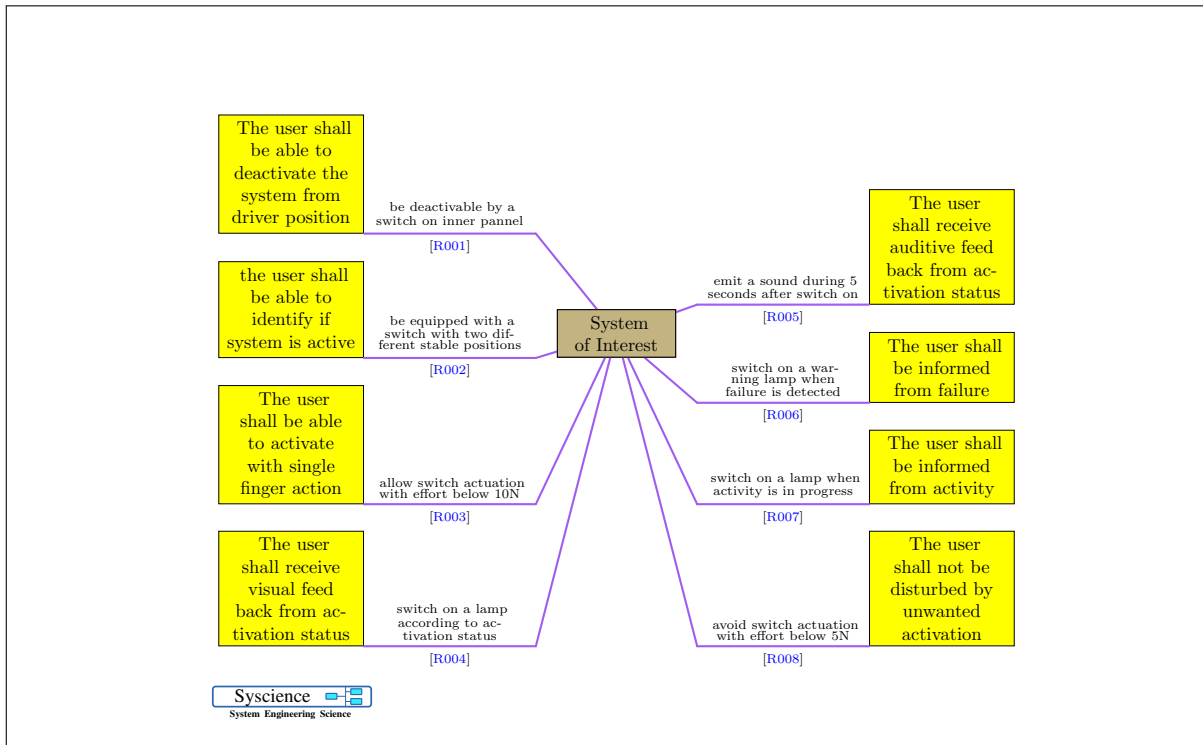


Figure 3: **Context_HMI engineering department:** Details concerning HMI needs, cited in [Context_Stakeholders](#)

Requirement identifier	R001
Requirement Text	In order to satisfy HMI engineering department, the System of Interest shall be deactivable by a switch on inner panel.
Diagram	Context_HMI engineering department

Table 6: **R001**, cited in the figure [Context_HMI engineering department](#), and [Context_Stakeholders](#)

Requirement identifier	R002
Requirement Text	In order to satisfy HMI engineering department, the System of Interest shall be equipped with a switch with two different stable positions.
Diagram	Context_HMI engineering department

Table 7: **R002**, cited in the figure [Context_HMI engineering department](#), and [Context_Stakeholders](#)

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Requirement identifier	R003
Requirement Text	In order to satisfy HMI engineering department, the System of Interest shall allow switch actuation with effort below 10N.
Diagram	Context_HMI engineering department

Table 8: **R003**, cited in the figure [Context_HMI engineering department](#), and [Context_Stakeholders](#)

Requirement identifier	R004
Requirement Text	In order to satisfy HMI engineering department, the System of Interest shall switch on a lamp according to activation status.
Diagram	Context_HMI engineering department

Table 9: **R004**, cited in the figure [Context_HMI engineering department](#), and [Context_Stakeholders](#)

Requirement identifier	R005
Requirement Text	In order to satisfy HMI engineering department, the System of Interest shall emit a sound during 5 seconds after switch on .
Diagram	Context_HMI engineering department

Table 10: **R005**, cited in the figure [Context_HMI engineering department](#), and [Context_Stakeholders](#)

Requirement identifier	R006
Requirement Text	In order to satisfy HMI engineering department, the System of Interest shall switch on a warning lamp when failure is detected.
Diagram	Context_HMI engineering department

Table 11: **R006**, cited in the figure [Context_HMI engineering department](#)

Requirement identifier	R007
Requirement Text	In order to satisfy HMI engineering department, the System of Interest shall switch on a lamp when activity is in progress.
Diagram	Context_HMI engineering department

Table 12: **R007**, cited in the figure [Context_HMI engineering department](#)

Requirement identifier	R008
Requirement Text	In order to satisfy HMI engineering department, the System of Interest shall avoid switch actuation with effort below 5N.
Diagram	Context_HMI engineering department

Table 13: **R008**, cited in the figure [Context_HMI engineering department](#)

2.2 Measures of effectiveness

Key measures of effectiveness (KMEs) reflect overall satisfaction level of stakeholder expectations [IEEE1220] §6.1.5.

- Performance (TPM)
- Safety (TPM)
- Operability (KME)
- usability (KME)
- reliability (TPM)
- maintainability (KME)
- time and cost to train (TPM)
- workload (KME)
- human performance requirements (KME)

3 Environment analysis

Use cases can be identified by a systematical analysis of relations of the system of interest with external people, physical environment or collaborating systems in each lifecycle phase [IEEE1220] §6.1.6.

3.1 Production use cases

3.1.1 Diagram

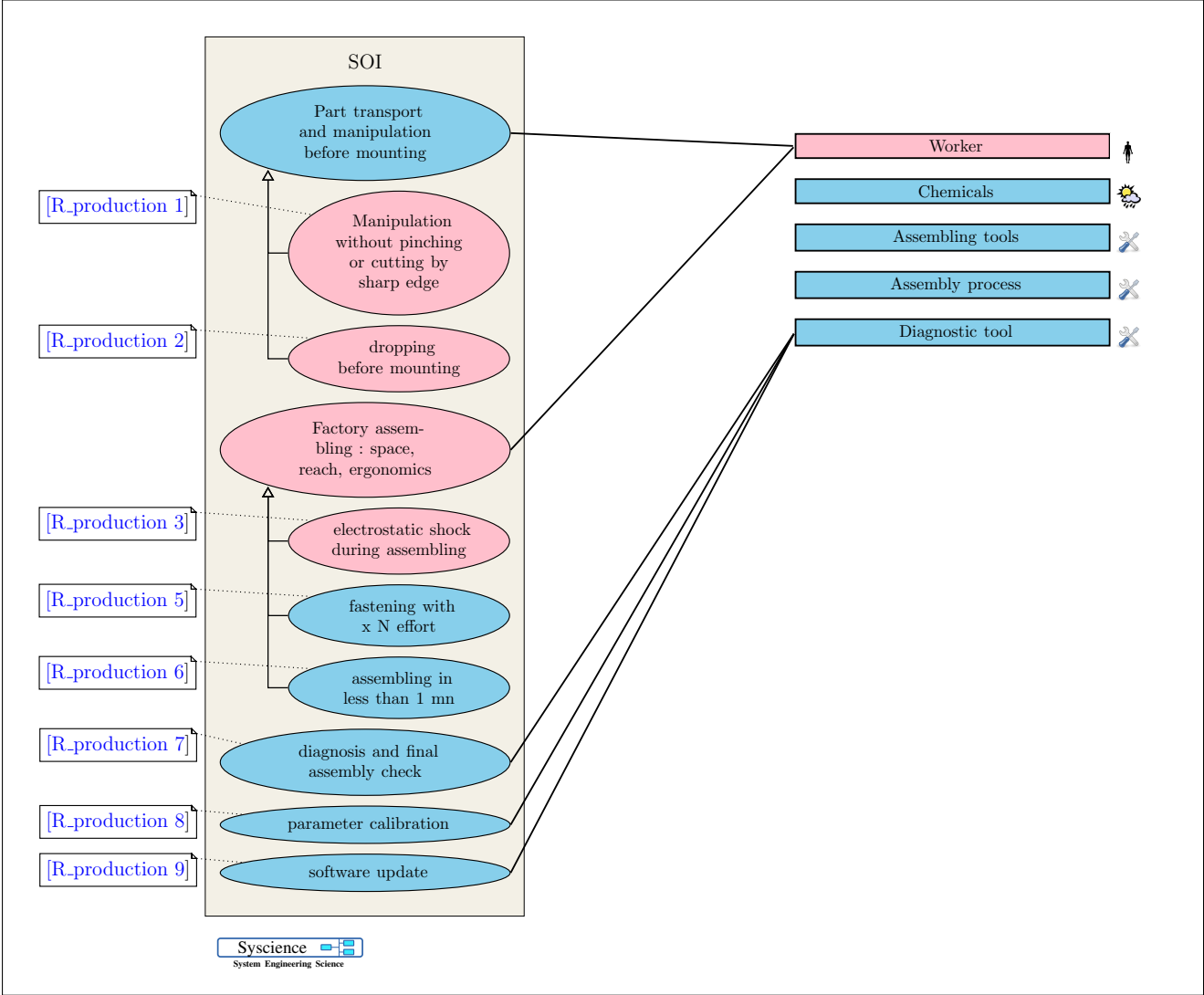


Figure 4: UseCase_Production: UseCase.Production, cited in Context_Stakeholders

3.1.2 Requirements

Requirement identifier	R_production 1
Requirement Text	The system SOI shall enable Manipulation without pinching or cutting by sharp edge in relation with "Worker"
Diagram	UseCase_Production

Table 14: **R_production 1**, cited in the figure [UseCase_Production](#)

Requirement identifier	R_production 2
Requirement Text	The system SOI shall enable dropping before mounting in relation with "Worker"
Diagram	UseCase_Production

Table 15: **R_production 2**, cited in the figure [UseCase_Production](#)

Requirement identifier	R_production 3
Requirement Text	The system SOI shall enable electrostatic shock during assembling in relation with "Worker", and "Assembling tools"
Diagram	UseCase_Production

Table 16: **R_production 3**, cited in the figure [UseCase_Production](#)

Requirement identifier	R_production 5
Requirement Text	The system SOI shall enable fastening with x N effort in relation with "Assembling tools"
Diagram	UseCase_Production

Table 17: **R_production 5**, cited in the figure [UseCase_Production](#)

Requirement identifier	R_production 6
Requirement Text	The system SOI shall enable assembling in less than 1 mn in relation with "Assembly process"
Diagram	UseCase_Production

Table 18: **R_production 6**, cited in the figure [UseCase_Production](#)

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Requirement identifier	R_production 7
Requirement Text	The system SOI shall enable diagnosis and final assembly check in relation with "Diagnostic tool"
Diagram	UseCase_Production

Table 19: **R_production 7**, cited in the figure [UseCase_Production](#)

Requirement identifier	R_production 8
Requirement Text	The system SOI shall enable parameter calibration in relation with "Diagnostic tool"
Diagram	UseCase_Production

Table 20: **R_production 8**, cited in the figure [UseCase_Production](#)

Requirement identifier	R_production 9
Requirement Text	The system SOI shall enable software update in relation with "Diagnostic tool"
Diagram	UseCase_Production

Table 21: **R_production 9**, cited in the figure [UseCase_Production](#)

3.2 Utilization use cases

3.2.1 Diagrams

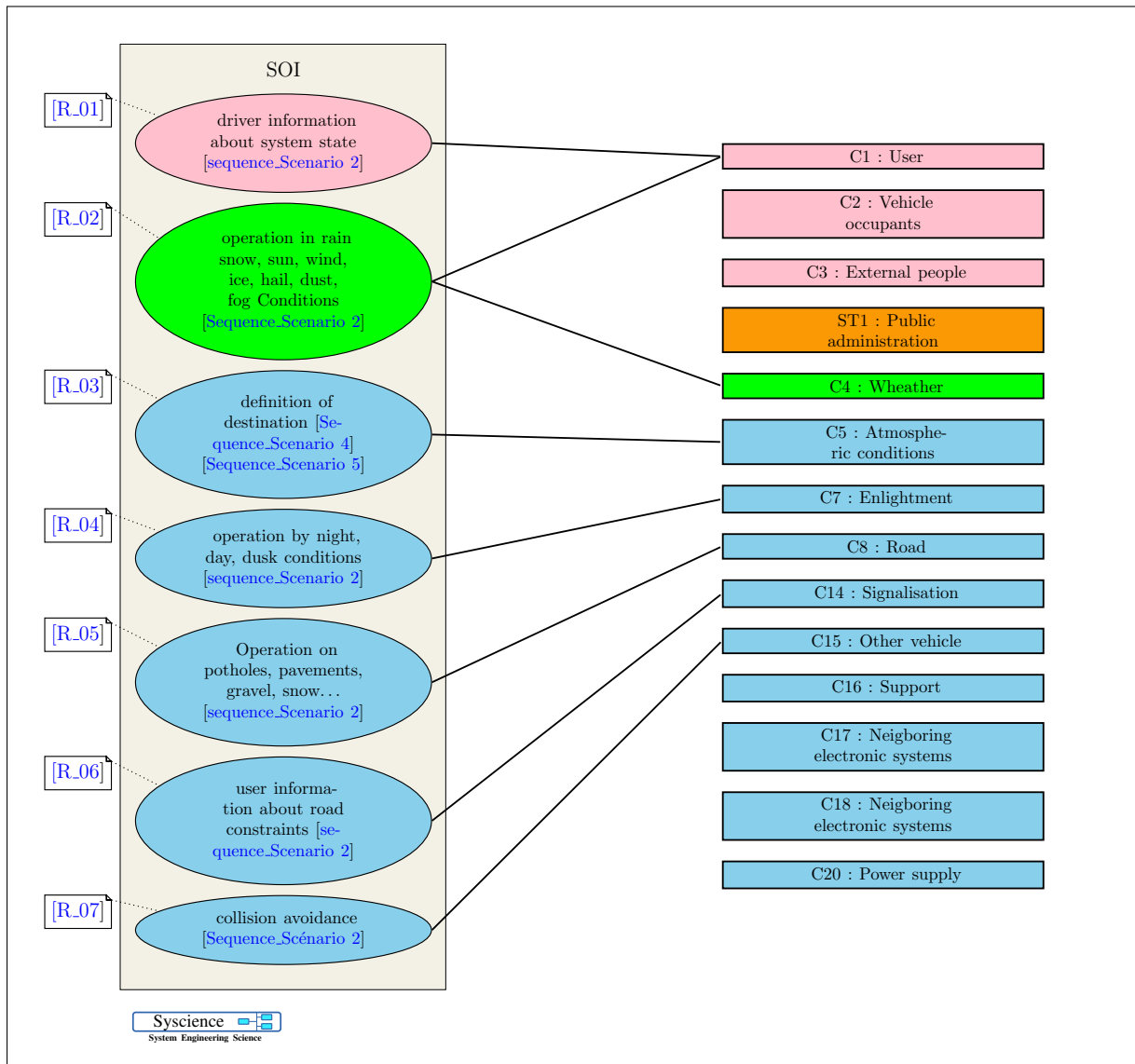


Figure 5: **UseCase_Utilization:** UseCase_Utilization, cited in [Context_Stakeholders](#)

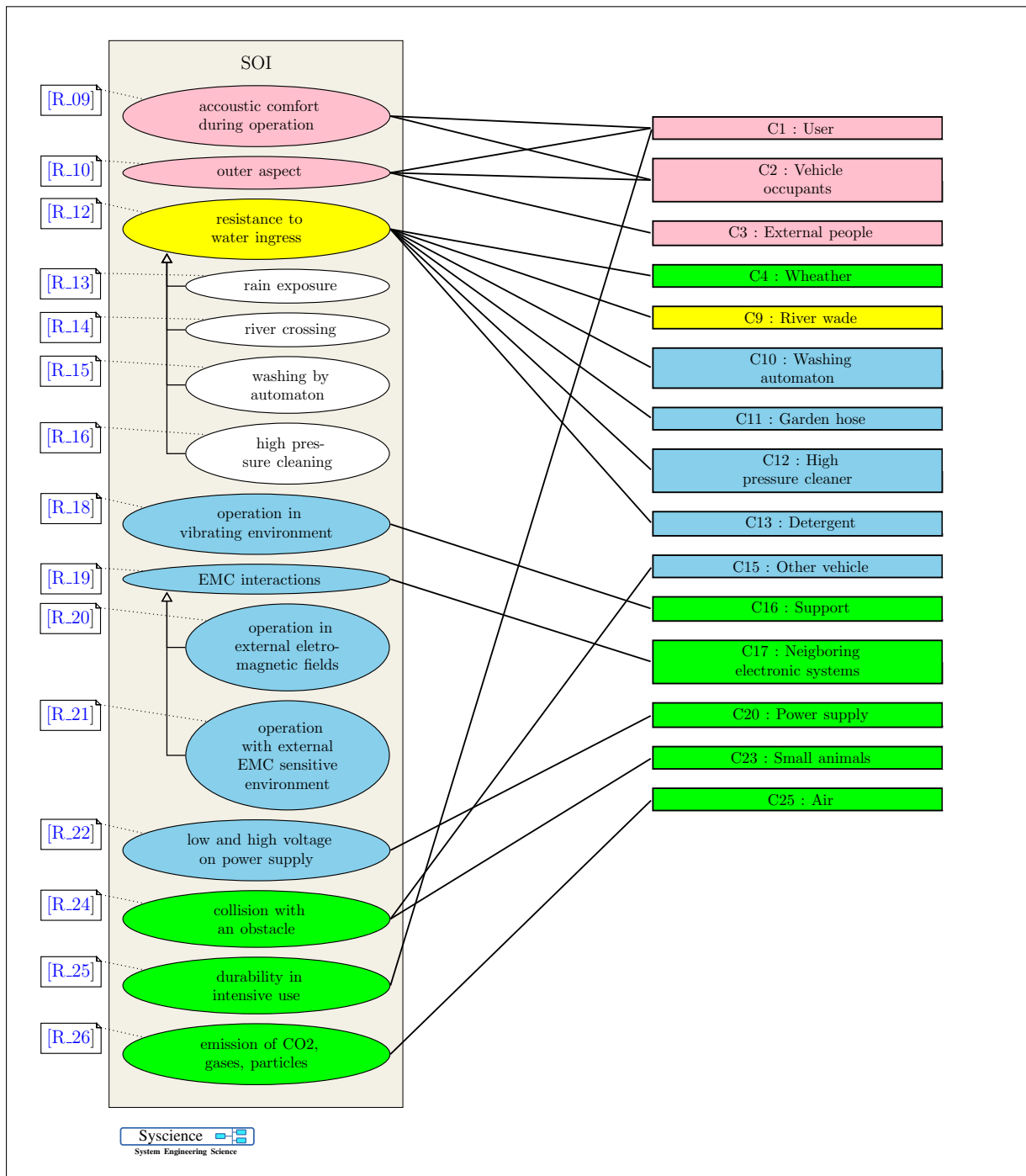


Figure 6: **UseCase_Liabilities:** UseCase_Liabilities, cited in [Context_Stakeholders](#)

3.2.2 Requirements

Requirement identifier	R_01
Requirement Text	The system "SOI" shall enable use case "driver information about system state [sequence_Scenario 2]" in relation with actor(s) "C1 : User"
Diagram	UseCase_Utilization

Table 22: **R_01**, cited in the figure [UseCase_Utilization](#)

Requirement identifier	R_02
Requirement Text	The system "SOI" shall enable use case "operation in rain snow, sun, wind, ice, hail, dust, fog Conditions [Sequence-Scenario 2]" in relation with actor(s) "C1 : User", and "C4 : Wheather"
Diagram	UseCase_Utilization

Table 23: **R_02**, cited in the figure [UseCase_Utilization](#)

Requirement identifier	R_03
Requirement Text	The system "SOI" shall enable use case "definition of destination [Sequence_Scenario 4][Sequence_Scenario 5]" in relation with actor(s) "C5 : Atmospheric conditions"
Diagram	UseCase_Utilization

Table 24: **R_03**, cited in the figure [UseCase_Utilization](#)

Requirement identifier	R_04
Requirement Text	The system "SOI" shall enable use case "operation by night, day, dusk conditions [sequence_Scenario 2]" in relation with actor(s) "C7 : Enlightenment"
Diagram	UseCase_Utilization

Table 25: **R_04**, cited in the figure [UseCase_Utilization](#)

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Requirement identifier	R_05
Requirement Text	The system "SOI" shall enable use case "Operation on potholes, pavements, gravel, snow... [sequence_Scenario 2]" in relation with actor(s) "C8 : Road "
Diagram	UseCase_Utilization

Table 26: **R_05**, cited in the figure [UseCase_Utilization](#)

Requirement identifier	R_06
Requirement Text	The system "SOI" shall enable use case "user information about road constraints [sequence_Scenario 2]" in relation with actor(s) "C14 : Signalisation"
Diagram	UseCase_Utilization

Table 27: **R_06**, cited in the figure [UseCase_Utilization](#)

Requirement identifier	R_07
Requirement Text	The system "SOI" shall enable use case "collision avoidance [Sequence_Scénario 2]" in relation with actor(s) "C15 : Other vehicle"
Diagram	UseCase_Utilization

Table 28: **R_07**, cited in the figure [UseCase_Utilization](#)

Requirement identifier	R_09
Requirement Text	The system "SOI" shall enable use case "acoustic comfort during operation" in relation with actor(s) "C1 : User", and "C2 : Vehicle occupants"
Diagram	UseCase_Liabilities

Table 29: **R_09**, cited in the figure [UseCase_Liabilities](#)

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Requirement identifier	R_10
Requirement Text	The system "SOI" shall enable use case "outer aspect" in relation with actor(s) "C1 : User", "C2 : Vehicle occupants", and "C3 : External people"
Diagram	UseCase_Liabilities

Table 30: **R_10**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_12
Requirement Text	The system "SOI" shall enable use case "resistance to water ingress" in relation with actor(s) "C4 : Wheather", "C9 : River wade", "C10 : Washing automaton", "C11 : Garden hose", "C12 : High pressure cleaner", and "C13 : Detergent"
Diagram	UseCase_Liabilities

Table 31: **R_12**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_13
Requirement Text	The system "SOI" shall enable use case "rain exposure" in relation with actor(s) "C4 : Wheather"
Diagram	UseCase_Liabilities

Table 32: **R_13**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_14
Requirement Text	The system "SOI" shall enable use case "river crossing" in relation with actor(s) "C9 : River wade"
Diagram	UseCase_Liabilities

Table 33: **R_14**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_15
Requirement Text	The system "SOI" shall enable use case "washing by automaton" in relation with actor(s) "C10 : Washing automaton", and "C13 : Detergent"
Diagram	UseCase_Liabilities

Table 34: **R_15**, cited in the figure [UseCase_Liabilities](#)

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Requirement identifier	R_16
Requirement Text	The system "SOI" shall enable use case "high pressure cleaning" in relation with actor(s) "C12 : High pressure cleaner", and "C13 : Detergent"
Diagram	UseCase_Liabilities

Table 35: **R_16**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_18
Requirement Text	The system "SOI" shall enable use case "operation in vibrating environment" in relation with actor(s) "C16 : Support"
Diagram	UseCase_Liabilities

Table 36: **R_18**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_19
Requirement Text	The system "SOI" shall enable use case "EMC interactions" in relation with actor(s) "C17 : Neighboring electronic systems"
Diagram	UseCase_Liabilities

Table 37: **R_19**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_20
Requirement Text	The system "SOI" shall enable use case "operation in external eletromagnetic fields" in relation with actor(s) "C17 : Neighboring electronic systems"
Diagram	UseCase_Liabilities

Table 38: **R_20**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_21
Requirement Text	The system "SOI" shall enable use case "operation with external EMC sensitive environment" in relation with actor(s) "C17 : Neighboring electronic systems"
Diagram	UseCase_Liabilities

Table 39: **R_21**, cited in the figure [UseCase_Liabilities](#)

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Requirement identifier	R_22
Requirement Text	The system "SOI" shall enable use case "low and high voltage on power supply" in relation with actor(s) "C20 : Power supply"
Diagram	UseCase_Liabilities

Table 40: **R_22**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_24
Requirement Text	The system "SOI" shall enable use case "collision with an obstacle" in relation with actor(s) "C15 : Other vehicle", and "C23 : Small animals"
Diagram	UseCase_Liabilities

Table 41: **R_24**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_25
Requirement Text	The system "SOI" shall enable use case "durability in intensive use" in relation with actor(s) "C1 : User"
Diagram	UseCase_Liabilities

Table 42: **R_25**, cited in the figure [UseCase_Liabilities](#)

Requirement identifier	R_26
Requirement Text	The system "SOI" shall enable use case "emission of CO ₂ , gases, particles" in relation with actor(s) "C25 : Air"
Diagram	UseCase_Liabilities

Table 43: **R_26**, cited in the figure [UseCase_Liabilities](#)

3.3 Maintenance use cases

3.3.1 Diagrams

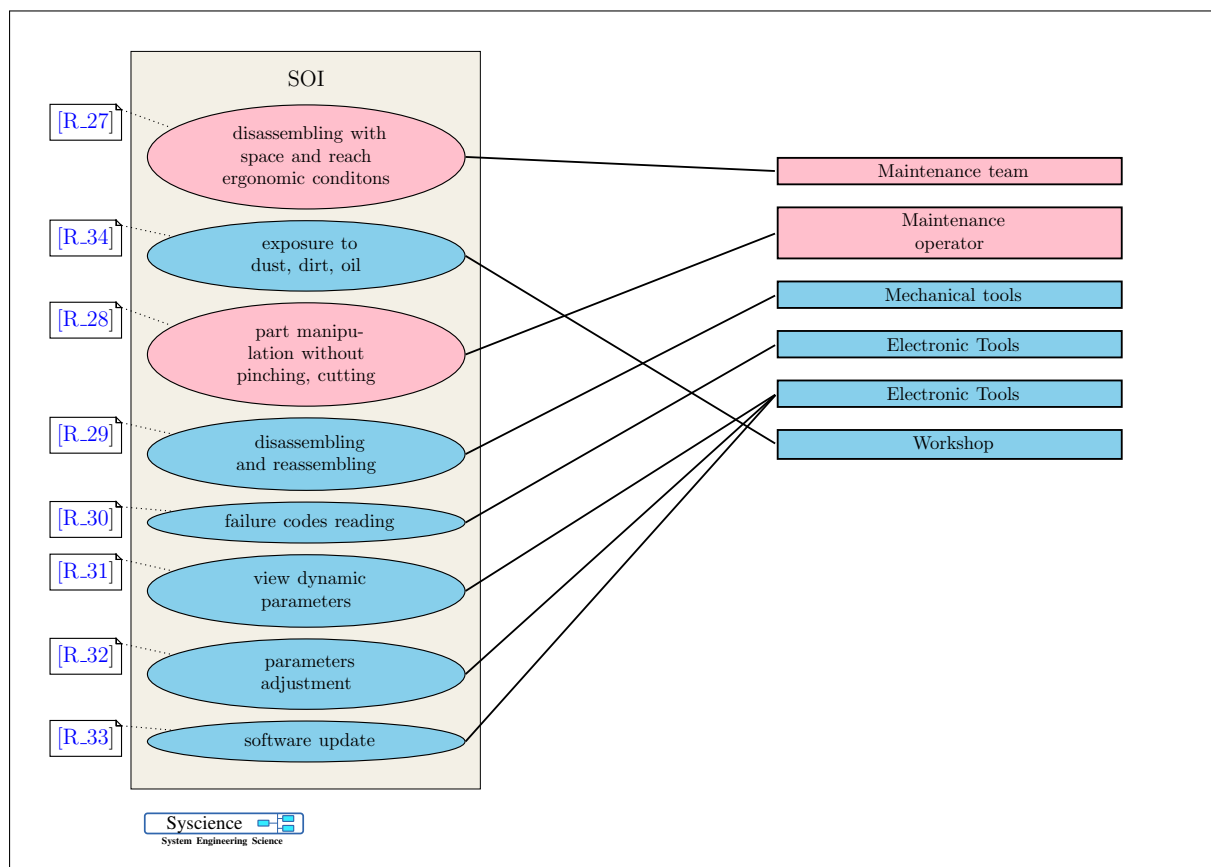


Figure 7: UseCase_Maintenance: UseCase_Maintenance, cited in Context_Stakeholders

3.3.2 Requirements

Requirement identifier	R_27
Requirement Text	The system "SOI" shall enable use case "disassembling with space and reach ergonomic conditons" in relation with actor(s) "Maintenance team"
Diagram	UseCase_Maintenance

Table 44: R_27, cited in the figure UseCase_Maintenance

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Requirement identifier	R_34
Requirement Text	The system "SOI" shall enable use case "exposure to dust, dirt, oil" in relation with actor(s) "Workshop"
Diagram	UseCase_Maintenance

Table 45: **R_34**, cited in the figure [UseCase_Maintenance](#)

Requirement identifier	R_28
Requirement Text	The system "SOI" shall enable use case "part manipulation without pinching, cutting" in relation with actor(s) "Maintenance operator"
Diagram	UseCase_Maintenance

Table 46: **R_28**, cited in the figure [UseCase_Maintenance](#)

Requirement identifier	R_29
Requirement Text	The system "SOI" shall enable use case "disassembling and reassembling" in relation with actor(s) "Mechanical tools"
Diagram	UseCase_Maintenance

Table 47: **R_29**, cited in the figure [UseCase_Maintenance](#)

Requirement identifier	R_30
Requirement Text	The system "SOI" shall enable use case "failure codes reading" in relation with actor(s) "Electronic Tools"
Diagram	UseCase_Maintenance

Table 48: **R_30**, cited in the figure [UseCase_Maintenance](#)

Requirement identifier	R_31
Requirement Text	The system "SOI" shall enable use case "view dynamic parameters" in relation with actor(s) "Electronic Tools"
Diagram	UseCase_Maintenance

Table 49: **R_31**, cited in the figure [UseCase_Maintenance](#)

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Requirement identifier	R_32
Requirement Text	The system "SOI" shall enable use case "parameters adjustment" in relation with actor(s) "Electronic Tools"
Diagram	UseCase_Maintenance

Table 50: **R_32**, cited in the figure [UseCase_Maintenance](#)

Requirement identifier	R_33
Requirement Text	The system "SOI" shall enable use case "software update" in relation with actor(s) "Electronic Tools"
Diagram	UseCase_Maintenance

Table 51: **R_33**, cited in the figure [UseCase_Maintenance](#)

3.4 Retirement use cases

3.4.1 Diagrams

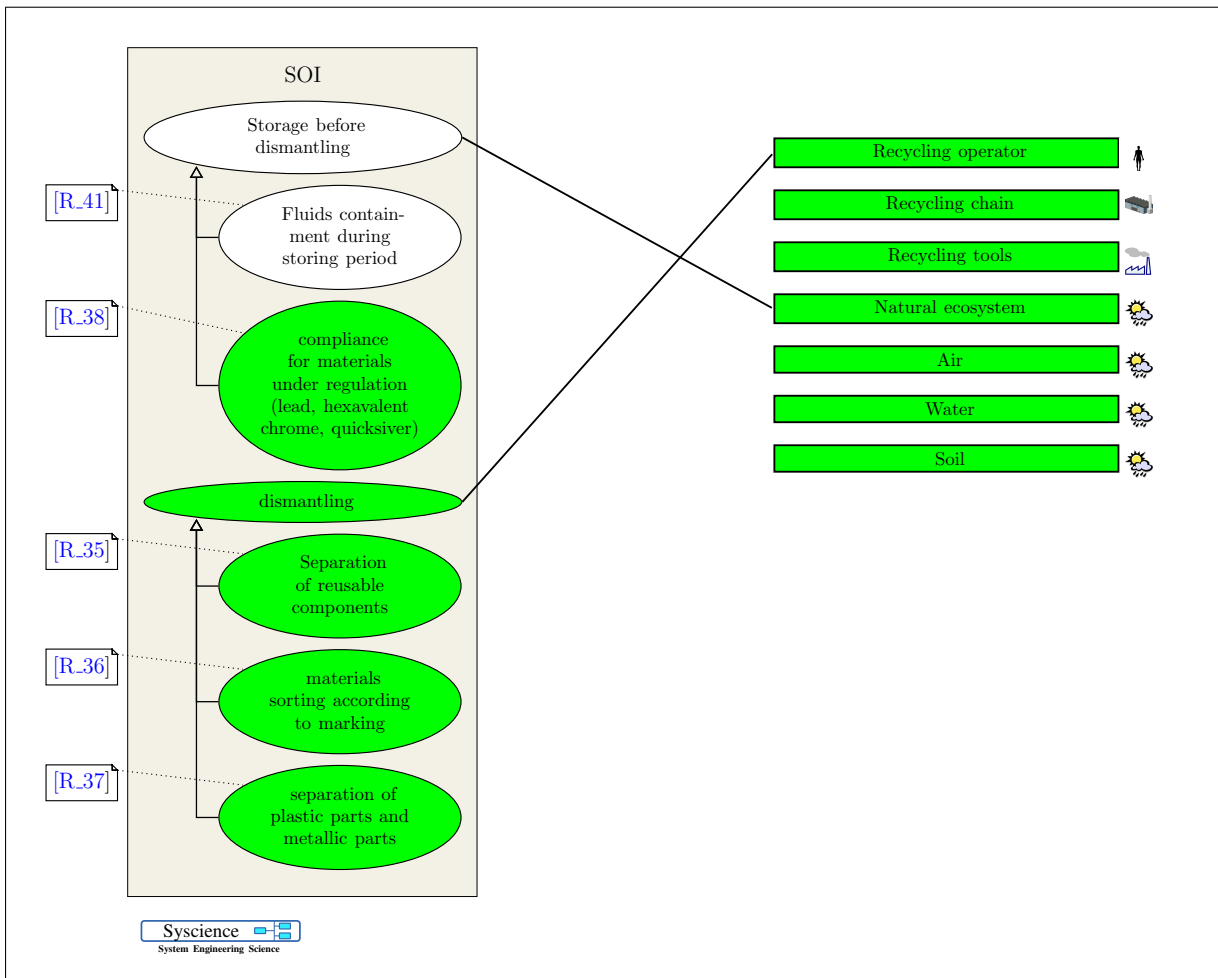


Figure 8: **UseCase_Retirement:** UseCase_Retirement, cited in [Context_Stakeholders](#)

3.4.2 Requirements

Requirement identifier	R_41
Requirement Text	The system "SOI" shall enable use case "Fluids containment during storing period" in relation with actor(s) "Water", and "Soil"
Diagram	UseCase_Retirement

Table 52: **R_41**, cited in the figure [UseCase_Retirement](#)

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Requirement identifier	R_38
Requirement Text	The system "SOI" shall enable use case "compliance for materials under regulation (lead, hexavalent chrome, quicksilver)" in relation with actor(s) "Natural ecosystem"
Diagram	UseCase_Retirement

Table 53: **R_38**, cited in the figure [UseCase_Retirement](#)

Requirement identifier	R_35
Requirement Text	The system "SOI" shall enable use case "Separation of reusable components" in relation with actor(s) "Recycling operator", and "Recycling tools"
Diagram	UseCase_Retirement

Table 54: **R_35**, cited in the figure [UseCase_Retirement](#)

Requirement identifier	R_36
Requirement Text	The system "SOI" shall enable use case "materials sorting according to marking" in relation with actor(s) "Recycling chain"
Diagram	UseCase_Retirement

Table 55: **R_36**, cited in the figure [UseCase_Retirement](#)

Requirement identifier	R_37
Requirement Text	The system "SOI" shall enable use case "separation of plastic parts and metallic parts" in relation with actor(s) "Recycling tools"
Diagram	UseCase_Retirement

Table 56: **R_37**, cited in the figure [UseCase_Retirement](#)

4 Operational scenarios

Operational scenarios are identified by the analysis of stakeholder documents [IEEE1220] §6.1.4. Activities are represented by rectangle boxes centered on the lifeline associated to each actor. The following diagrams describe operational scenarios for the system of interest.

4.1 Collision avoidance scenario

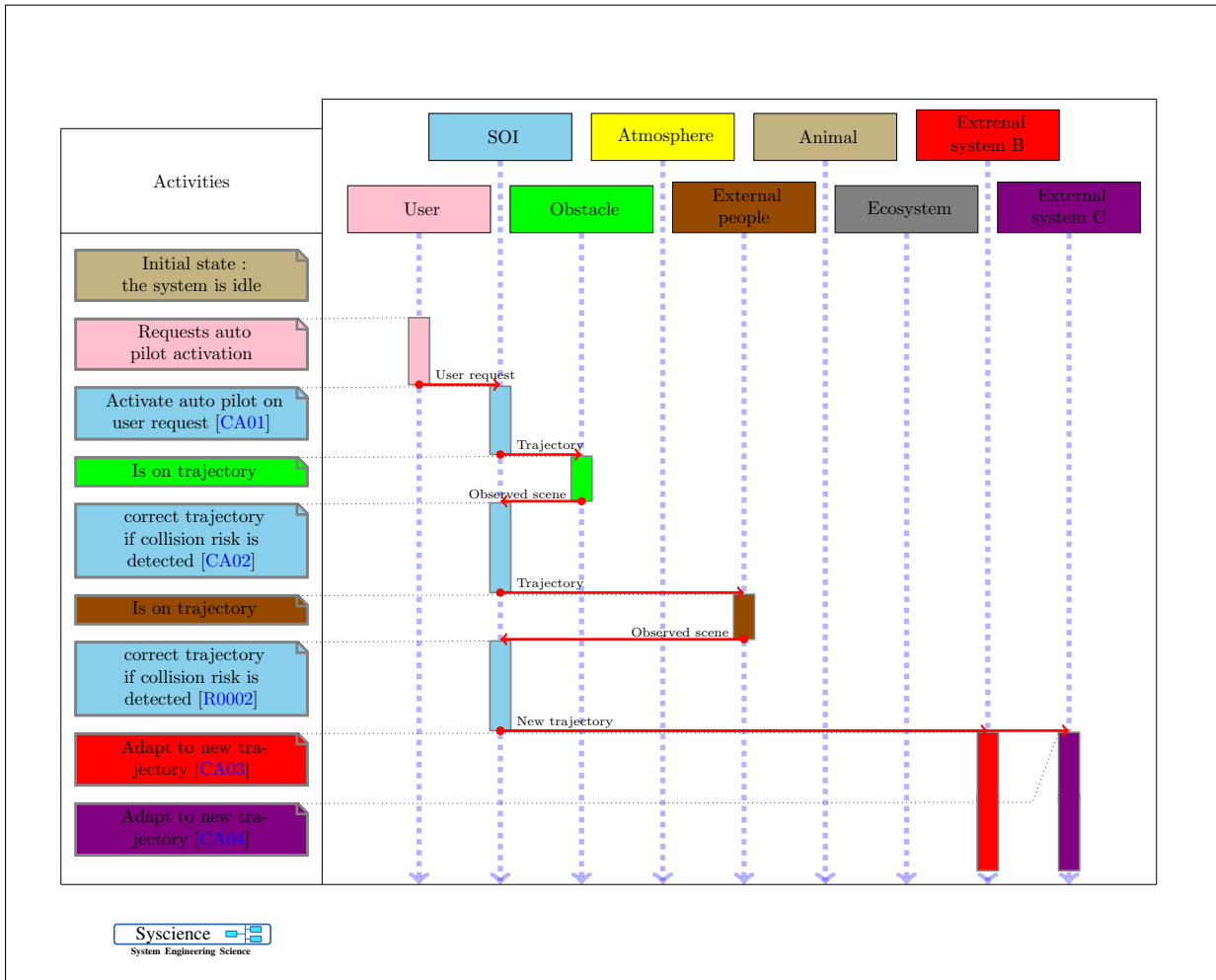


Figure 9: **Sequence_Collision Avoidance:** Operational scenario for the system of interest

Requirement identifier	CA01
Requirement Text	The system "SOI" shall "Activate auto pilot on user request" when receiving "User request"
Diagram	Sequence_Collision Avoidance

Table 57: **CA01**, cited in the figure [Sequence_Collision Avoidance](#)

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Requirement identifier	CA02
Requirement Text	The system "SOI" shall "correct trajectory if collision risk is detected" when receiving "Observed scene"
Diagram	Sequence_Collision Avoidance

Table 58: **CA02**, cited in the figure [Sequence_Collision Avoidance](#)

Requirement identifier	CA03
Requirement Text	The system "Extrenal system B" shall "Adapt to new trajectory" when receiving "New trajectory"
Diagram	Sequence_Collision Avoidance

Table 59: **CA03**, cited in the figure [Sequence_Collision Avoidance](#)

Requirement identifier	CA04
Requirement Text	The system "External system C" shall "Adapt to new trajectory" when receiving "New trajectory"
Diagram	Sequence_Collision Avoidance

Table 60: **CA04**, cited in the figure [Sequence_Collision Avoidance](#)

4.2 New Destination scenario

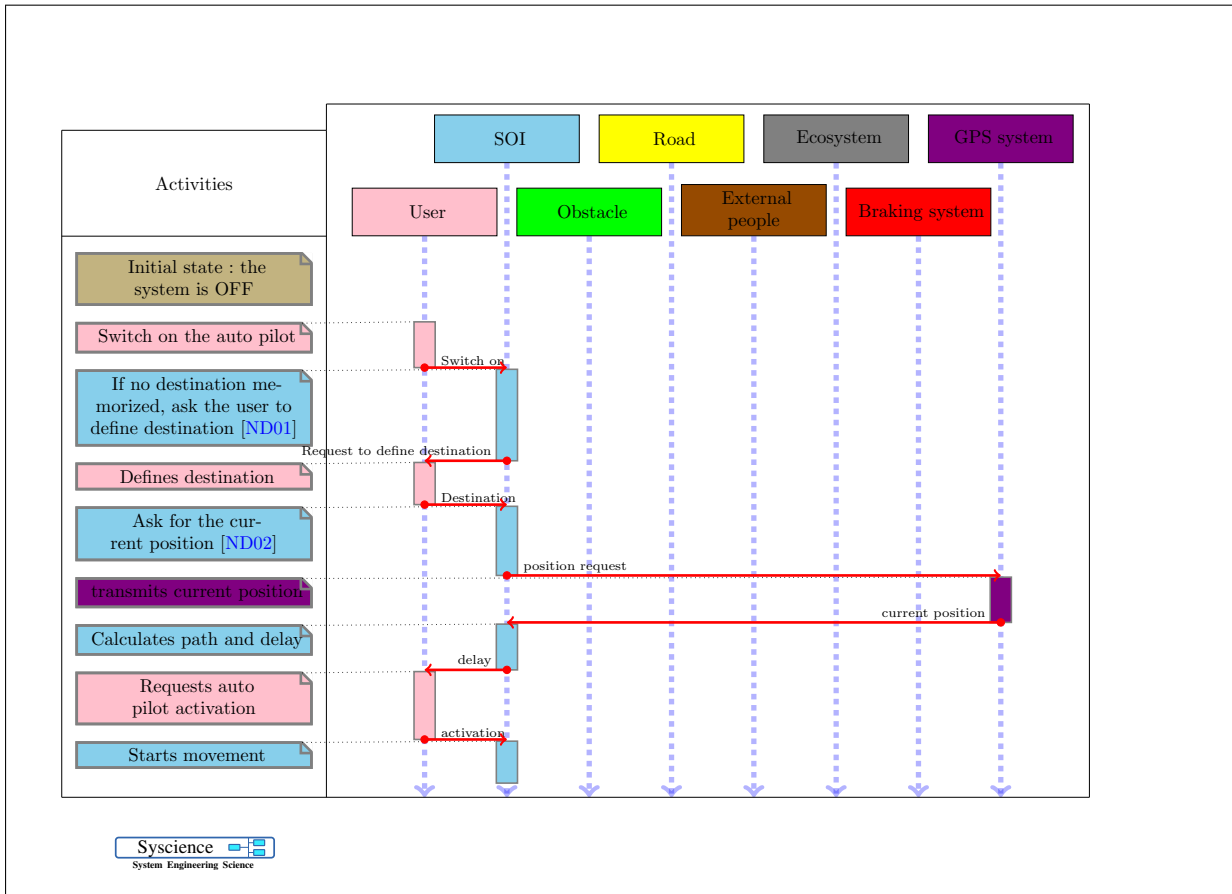


Figure 10: **Sequence_New Destination:** Operational scenario for the system of interest

Requirement identifier	ND01
Requirement Text	The system "SOI" shall "If no destination memorized, ask the user to define destination" when receiving "Switch on"
Diagram	Sequence_New Destination

Table 61: **ND01**, cited in the figure [Sequence_New Destination](#)

Requirement identifier	ND02
Requirement Text	The system "SOI" shall "Ask for the current position" when receiving "Destination"
Diagram	Sequence_New Destination

Table 62: ND02, cited in the figure [Sequence_New Destination](#)

4.3 Resume Destination scenario

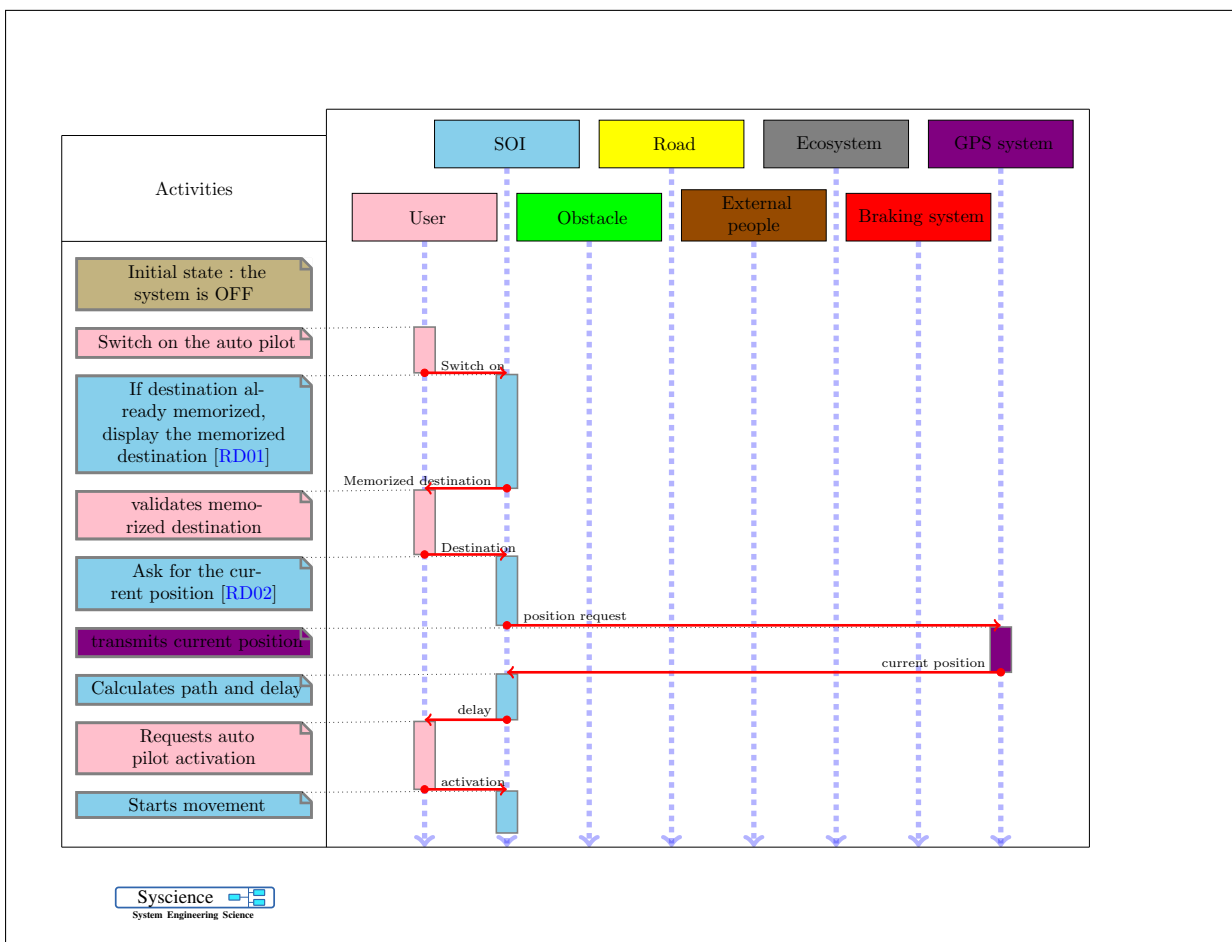


Figure 11: **Sequence_Resume Destination:** Operational scenario for the system of interest

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Requirement identifier	RD01
Requirement Text	The system "SOI" shall "If destination already memorized, display the memorized destination" when receiving "Switch on"
Diagram	Sequence.Resume Destination

Table 63: **RD01**, cited in the figure [Sequence.Resume Destination](#)

Requirement identifier	RD02
Requirement Text	The system "SOI" shall "Ask for the current position" when receiving "Destination"
Diagram	Sequence.Resume Destination

Table 64: **RD02**, cited in the figure [Sequence.Resume Destination](#)