# Exemplar

*Required

1. Authors (e.g, name1 surname1, name2 surname2) *

2. Affiliations (e.g., University 1, University 2) *

3. Emails (e.g., author1@mail.com, author2@mail.com) *

4. Name of the exemplar (e.g., Vital Signs Monitoring)

5. Description (the textual description of the robotic mission)

## Exemplar Information

6. Source

*Tick all that apply.*

- [ ] Academia
- [ ] Industry
- [ ] Other: _____

## 7. Domain

*Tick all that apply.*

- [ ] Medical
- [ ] Emergency
- [ ] Logistics
- [ ] Education
- [ ] Household
- [ ] Food supply

Other: [ ] _____

## 8. Multirobot

*Tick all that apply.*

- [ ] Single-robot
- [ ] Multi-robot swarms (all the robots exhibit the same behaviour)
- [ ] Multi-robot teams (some of the robots have distinct behaviours)

9. Robot Features

*Tick all that apply.*

- [ ] Parameter adaptability (whether the robots can adapt their behaviour by changing some parameters, e.g., their speed)
- [ ] Component adaptability (whether the robots can adapt their behaviour by adding or removing components)
- [ ] Mechatronics configurability (whether the robots can adapt their behaviour by changing their Mechatronics configuration)
- [ ] Other: _____

10. If any robot feature was checked, please explain why it was checked.

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## 11. Technical Capabilities

*Tick all that apply.*

- [ ] Robot capabilities (e.g., perception and interpretive, robot task abilities, actions and envisioning capabilities)
- [ ] Interaction capabilities (e.g., physical interaction with the environment, social interaction, cognitive interaction with other information systems)
- [ ] Intelligence (e.g., physical morphological intelligence - visual-spatial skills, cognitive intelligence - such as learning or logical-mathematical skills, social intelligence, such as emotional behaviuor skills or musical skills, collective intelligence, such as collaboration or cooperative skills.

## 12. If any technical capability was checked, please explain why it was checked.

## 13. Operational Capabilities

*Tick all that apply.*

- [ ] Cost (whether the robotic mission contains some ``notion'' of cost such that the energy consumed by robots)
- [ ] Duration (whether the robotic mission contains some ``notion'' of time, e.g., the robots should complete a task within two minutes)
- [ ] Safety (whether the mission specifies that the robot should prevent collisions, crushing, and injuries from mechanical parts or other safety properties)
- [ ] Security (whether the robots are employed to secure areas, buildings, or other sensible assets)
- [ ] Testing (whether the robots are employed to testing other devices)
- [ ] Training (whether the robots are trained during or before their operation)
- [ ] Acceptance (whether user acceptance is a primary requirement of the mission)
- [ ] Usability (whether usability or usability requirements are specified within the mission)
- [ ] Re-usability (whether robots should be reusable to perform different missions, e.g., depending on the context)
- [ ] Reliability (whether reliability, i.e., the ability of the robot to function without failure, is part of the mission)
- [ ] Versatility (whether the versatility of the robotic application, i.e., the ability the robots to reprogram them-self for the necessary tasks, is part of the mission)
- [ ] Robustness (the ability of the robotic application to cope with errors during the mission execution)

Other: [ ] _____

14. If you check any operational capability please explain why it was checked

Model or State Uncertainties.

The representation of information or knowledge that the robot employs may be incomplete, contradictory, overly complex or incorrect; a typical example is a discrepancy between the cyber-physical environment and its perceived model by the robot.

15. Abstraction (Caused by omitting certain details and information from models).

16. Incompleteness (Caused by lack of knowledge about parts of the internal robot or external environment state).

17. Model Drift (Caused by discrepancy between the state of models maintained by the robot and the actual represented cyber-physical system).

18. Different Sources of information (Caused by differences between representations of information provided by different sources (e.g., camera vs presence sensor)).

19. Complex Models (Caused by complexity of runtime models representing the managed cyber-physical system).

20. Sensing (Caused by robotic sensors which are inherently imperfect).

21. Actuation (Caused by robotic actuators of which the effects may not be completely deterministic).

Adaptation Functions Uncertainties.

Those capture uncertainties inherent in the variability space, decision making and coordination functions that adaptation must handle.

22. Variability Space (Caused by the size of the variability space that adaption functions need to handle).

23. Automatic learning (Caused by machine learning techniques employed of which the effects may not be completely predictable).

24. Decentralization & Coordination (Caused by decision making by robots in teams or swarms, of which the effects may not be predictable).

Mission Uncertainties.

The intended behavior of the robotic application may be not adequately specified, may change, or become outdated.

25. Mission Specification (Caused by potential changes in the mission that could not be completely anticipated).

26. Future Mission Changes (Caused by lack of deterministic and precise specification of mission).

27. OutdatedMission (Caused by overlooking that the mission is outdated).

Environment Uncertainties.

The variability of the overall context where the robot operates at runtime, including unpredicable interaction with humans.

28. Execution Context (Caused by the inherent unpredictability of execution contexts, exacerbated by the complexity of the cyber-physical environment).

29. Human in the Loop (Caused by the inherent unpredictability of human behavior interacting with the robot).

Capabilities Uncertainties

Robots have individual features that they employ to achieve their mission, including technical and operational capabilities. However those are not static; they may be changed, removed or new ones may be available to the robot.

30. New or defunct capabilities (Caused by new availability or no longer existing or functioning robotic capabilities).

31. Changing capabilities (Caused by dynamicity of capabilities in the robotic system).

## Adaptation

## 32. Types of adaptation (self* properties)

*Tick all that apply.*

- [ ] self-management (if the system has at least one self* property)
- [ ] self-stabilization (starting from an arbitrary initial configuration it recovers to a legal configuration, and then remains in that configuration)
- [ ] self-healing (given a set of actions, the occurrence of one of these actions causes a violation of a property)
- [ ] self-organization (if it maintains, improves or restores a safety property following certain actions)
- [ ] self-protection (if it continuously maintains a safety property)
- [ ] self-optimization (if starting from an initial configuration it improves the value of an objective function)
- [ ] self-configuration (if it is able to change its configuration to restore or improve some property)
- [ ] self-scaling (if it maintains or improves a property during the occurrence of a set of actions)
- [ ] Other: _____

33. If you check any adaptation type please explain why it was checked

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34. Adaptation concerns, constraints and other factors

*Tick all that apply.*

- [ ] Timing constraints
- [ ] Performance
- [ ] Utility
- [ ] Cost
- [ ] Trade-offs

Other: [ ] _____

35. If you check any adaptation concern, constraint, or other factors please explain why it was checked

36. Source and further resources (e.g., hyperlinks, relevant papers, technical reports)

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