ROBAFIS™ 2019

Specifications applicable to URBAN'SYS

Edition	Nature of evolution	State	Date
V01	Creation	Feasibility	190901
VD1	Launching	Diffusion for application	190930

Auteurs: Jean-Cl aude TUCOULOU — Thérèse RENARD — David GOUYON — Eric BONJOUR

Contents

1. OBJECT

This document describes the requirements to be met by all the material and human resources provided by a engineering team to prepare for and participate in a mission provided by URBAN'SYS, a system providing a transport by means of an autonomous AUTO'RA.M train and a MONITOR control station .

2. Scope

The present Specifications are applicable to the production of a copy of all the components of URBAN'SYS intended for the realization of free trials and a comparative evaluation campaign between several solutions competitors.

URBAN'SYS is a so-called complex system, because it incorporates, once realized. a set of technological products, services and a human organization for its exploitation.

This Specification is also applicable to the material and human resources and to the documentation necessary for the verification of conformity of URBAN'SYS carried out during the configuration audit, its use and its maintenance during free practice and during the evaluation campaign.

3. LIMIT OF SUPPLY

The supply includes :

- The development file, deliverable result of the development engineering of URBAN'SYS.

- A functional copy of URBAN'SYS including all hardware, software. human resources and services and organizational requirements for participation in the evaluation campaign:

    - The AUTO'RAM train;

    - the MONITOR control and safety station which integrates:
        - the REGUL HMI used by the control operator;
        - the SECUR HMI used by the safety officer;
        - Remote monitoring and remote control software from AUTO'RAM :

    - the link infrastructure enabling remote transmission of control data between AUTO'RAM and MONITOR:

    - the MAINT'SYS support system required for the use and maintenance of AUTO'RAM and MONITOR:

    - the regulator, the safety officer and the maintenance agent trained in the implementation of the URBAN'SYS.

For free practice and operational evaluation, the environment conforms to the specifications of the Specifications of its annexes 1-1 and 1-2 is made and made available by the organization of ROBAFIS 2019.
For the development, tbe environment is carried out by each team according to the specifications of its annexes 1-1 and 1-2. The organization of ROBAFIS 2019 provides the printed layout of the urban transport network.

4. MISSION

AUTO'RAM operates autonomously on a line A or B of an urban transport network and ensures the services of stations of the line. URBAN'SYS will be designed to serve either line A or line B indifferently.
Two AUTO'RAM systems operate simultaneously, each on one of the two lines of this network. Each system is operated by a separate operating team using its own MONITOR.

The mission consists of two round trips (4 journeys) made by crossing the line between the terminals I and 2. terminals are stations.
The travel time between 2 stations is set between 10s and 20s (indicative). The stop at each station is set between 15s and 20s (indicative). AUTO'RAM stops in the middle of the length of the wharf materialized by a green pellet.
The regularity of the traffic imposes that the time of a journey, from the terminal of departure to the terminal of arrival, time included in this destination terminal, between 75s and 120s.

The mission is initialized by the control operator, who launches AUTO'RAM located at terminal I of the line. The operation of AUTO'RAM then autonomous except obligatory intervention of one of the three operators. The stop at the end Mission is automatic and AUTO'RAM goes to sleep after a time of 15s to 20s.
The regulator supervises the smooth running of the mission, from HMI REGUL
The applicable rail safety code imposes strict compliance with the priority on the right.
Whenever traffic regulation on both lanes makes it necessary, the safety officer temporarily takes the manual control of the train, from HMI SECUR until autonomous operation is restored.
In case of immobilization of AUTO'RAM on the track without the possibility of remote control or in the event of a lane departure, the safety officer may ask the maintenance agent to intervene directly in order to restore the functioning autonomous.
Preventive maintenance operations are carried out only between 2 missions, by the maintenance agent, with authorization of the head of the organization ROBAFIS 2019.

5. CHARACTERISTICS OF URBAN'SYS

AUTO'RAM is implemented in its environment by being monitored remotely using MONITOR
MONITOR allows operators:
- to visualize the correct execution of the mission during all its duration by means of HMI REGUL and HMI SECUR:
- in case of remote intervention obligation use the commands of HMI REGUL and HMI SECUR. A tele manipulation interface can be connected to MONITOR : mouse. joystick, etc.
MONITOR has a video output in VGA or DVl or HDMl format that allows the copying of the computer screen, in order to project HMI REGUL and HMI SECUR in the site of progress of the operational evaluation.
AUTO'RAM is composed of:
- a bare platform providing the chassis function of the rolling base:
- all the components mounted on / in the platform, necessary for the operation of AUTO'RAM, all from of the kit provided by AFIS.

The bare platform is made of material, or product with low ecological footprint, reused or recycled.
At the end of life, the bare platform must be easily recyclable.
No addition or modification of any component of the kit is allowed for the realization of AUTO'RAM, except for the bare platform. The constitution of the kit is given in annex 3. The only additional components required are the energy storage elements and embedded software embedded in AUTO'RAM.

AUTO'RAM is integrated (which includes embedded software and power reserve) and the control software is loaded in MONITOR, before the arrival on the site of the final ROBAFIS.
MONITOR uses a laptop; any other type of terminal is excluded. The remote connection between MONITOR and AUTO'RAM is imperatively of type Bluetooth.
The maximum length of AUTO'RAM, in running order, shall not exceed 200 mm. The maximum width of AUTO'RAM. in running order, should not be greater than 180 mm.
The maximum mass of AUTO'RAM in running order, may not exceed 1200 g.
AVTO'RAM is testable and maintainable. AUTO'RAM is designed to perform a mission without preventive maintenance during this one. At the end of each mission, the on-board energy reserve can be replaced in AUTO'RAM.

6. CHARACTERIZATION OF THE USE ENVIRONMENT

The missions are carried out in an organized environment as characterized in annexes 1.1 and 1.2.
The current climatic conditions in the evolution zone are as follows:

- Ambient temperature in the range of 10 • C to 32 • C.
- Atmospheric pressure between I000 and I030 mb.
- Hygrometry between 40 and 75 percent.

MONITOR is placed on a desk with a height of 700 nun+/. 100 mm.

7 VERIFICATION OF CONFORMITY

Tbe compliance check acts as a configuration audit.
The presentation concerns all components of URBAN'SYS.
The compliance audit includes:
- the weighing of the AUTO'RAM vehicle;
- measurement of the dimensions (width - height - length) of the AUTO'RAM vehicle and verification of compliance with maximum dimensions allowed;
- the configuration of the software installed in MONITOR

8. OPERATIONAL QUALIFICATION

The operational qualification consists in carrying out 3 missions over a period of 4 hours. Each mission

consents to evaluate:

- The ability to service the line characterized by:
  - o The regularity of schedules (time to make each trip).
  - o The absence of unexpected interruption of the service.
  - o The absence of a technical incident that could affect the integrity of AUTO'RAM.
  - o The absence of collision with a person who may be accidentally present on the line.
- The effectiveness of the cooperation between the operator of the line and the safety officer and possibly with the agent maintenance if it has to intervene.

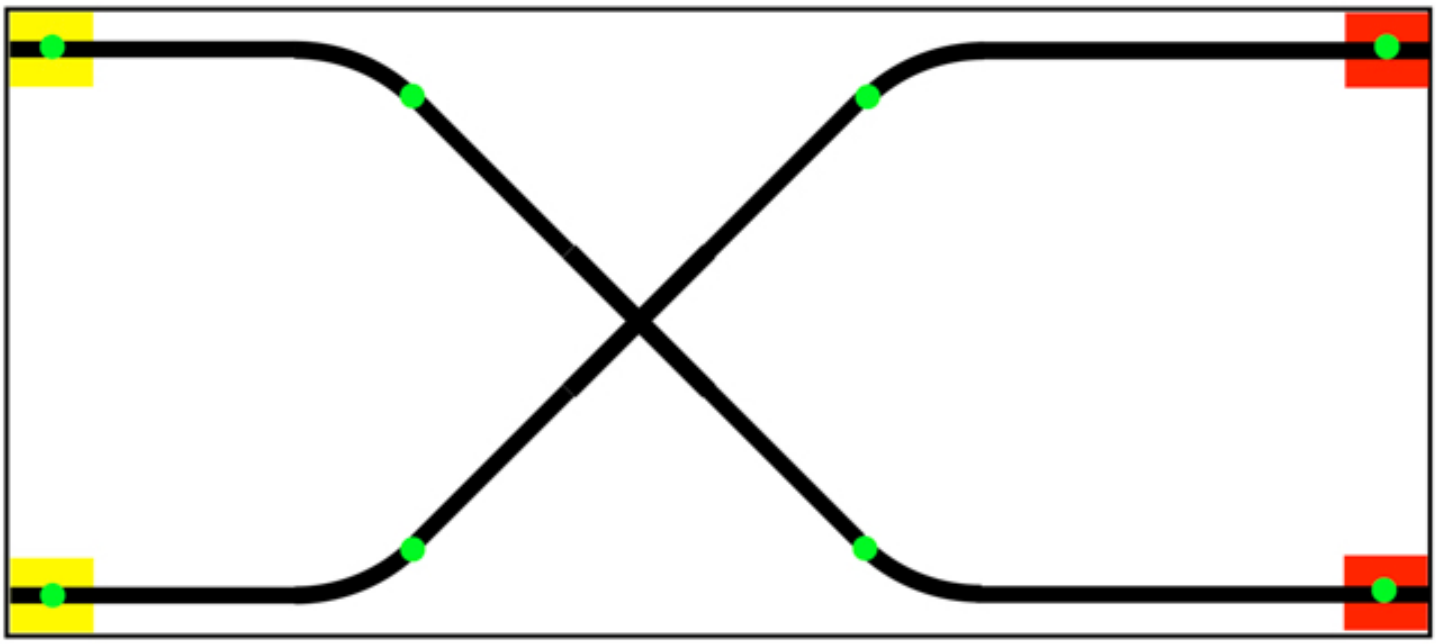
The scale of points for a mission is as follows:

- 4 completed trips: 20 points
- 3 completed trips: 15 points
- 2 completed trips: 10 points
- 1 completed trip: 5 points
- Penalty for non-respec1 of travel 1ime: I point per journey (too slow)
- Penalty for non-respect of travel time: 2 points per trip (too fast)
- Penalty for manual control by the security officer via HMI S£CUR : - I point in case of restoration of autonomous operation to continue and complete the mission.
- Penalty for manual control by the security ofiicer via HMI SECUR : - 2 points in case of no restoration of autonomous functioning until the end of the mission.
- Penalty for intervention of the maintenance agent on the track: - 2 points.
- Penalty for manual intervention of the maintenance agent between 2 missions: • 1 point.
- Penalty in case of collision of AUTO'RAM with AUTO'RAM traveling on the other line: - 4 points for the author of the accident / 0 point for the AUTO'RAM accident.
- Penalty in case of collision of AUTO'RAM with a person accidentally on the track: - 4 points.

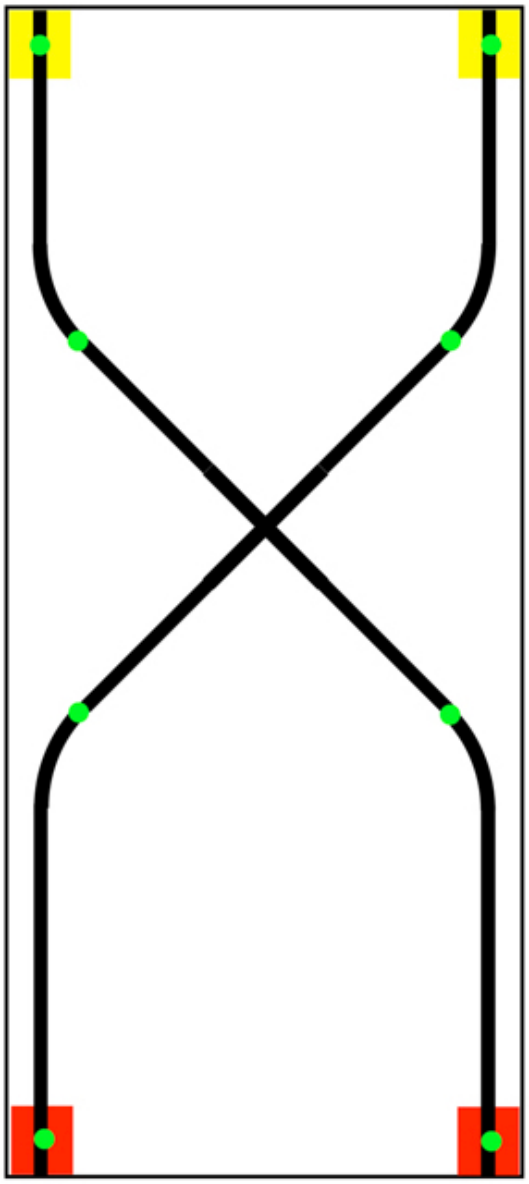
ANNEX 1-1: CHARACTERIZATION OF THE EVOLUTION AREA

Dimensions of the area of evolution: 3400 mm x 1500 mm - tolerance +/- 20 mm.
Border of the evolution zone: width 5 mm - tolerance +/- 1 mm.
Width of the track: 40 mm + / - 2mm.
Technical dimensions: 200 mm long x 180 mm wide
Access to the evolution area: on incident. only authorized to the security operator under the specified conditions.
The ground of tbe evolution zone is of white color reference 476147.
The evolution area is lit homogeneously, except for the shadows produced by the objects present in the zone of evolution. The luminous intensity in this zone is between 100 and 300 Lumen/ m2.

The terminal 1 is yellow. The terminal 2 is red. Station stops are identified by a green pellet of diameter 80 mm +/- 2 mm correspooding to the middle of the length of the quay.



ANNEX 1-2: AREA OF EVOLUTION A D ACCESSIBILITY
Maintenance operator workshops: 750 mm x 1000 mm - tolerance+/- 100 mm.
Access: maintenance operator exclusively.
Prohibited area 1: 750 mm x 1000 mm - tolerance +/- 100 mm. No access to anyone.
Prohibited area 2: 3500 mm x 750 mm - 1olerance +/- 100 nun. No access to anyone.
Operating room (implementation of MONITOR: 3500 mm x 750 mm-tolerance +/- 100 mm. Access: Regulatory Operator and Security Agent exclusively.

<table>
<tr><td>Agent Workshop maintenance line A</td><td>Agent Workshop maintenance line B</td><td>Prohibited area I</td><td>Prohibited area 1</td></tr>
<tr><td colspan="2">  </td><td>Prohibited area 2</td><td>Operating room lines A and B</td></tr>
</table>

ANNEX 2: DEFINITION OF THE KIT

With the exception of the bare platform, AUTO'RAM uses only kit components provided to each team by the ROBAFIS organization

-Ultimate 2.0-10-in-l Robot Kit: hnps: store.makeblock.com/buy/ultunate-2-0-IO·in-l-robot-kit

-Electronic Add-on Pack for Starter Robot Kit: https·//store makeblock.com/electronic-add-oo-pack-for-starter-robot·kit

AUTO'RAM will be driven by software that can be developed with the programming tool provided with the KIT. or with any ocher language or programming application based for example on C or Java languages.