ExFacLab Documentation

SDVUNx: SDV-Map-Viewer

Table of Contents

The *SDV-Map-Viewer* web application was designed with the idea of being able to send positioning commands to the *ExFabLab* SDVUNx robots through a robust interface, based on the design principles of the *Angular Material* library and adding functionality with the *Covalent* library from *Teradata*. The application seeks to be easy to use, requiring little configuration for use with *SDV* robots and focused on teleoperation.

This application is autonomous: it can work by itself, requiring an http server and the *sdv-nav-service* service as a data source for the robots (*backend*). However, from the outset, *SDV-Map-Viewer* was designed to be integrated into the *PRIA-UN-Webapp* application as a module of said application. Both the development *framework* (*Angular*) and the libraries used in this project are compatible with those used in the *PRIA-UN-Webapp* web application.

SDV-Map-Viewer extends the capabilities of the *PRIA-UN-Webapp/Node-RED* duo: it does not seek to replace the functions that these two programs already provide for the use of *PRIA*, but to add teleoperation functionalities and monitoring, absent in the mentioned tools.

Figure 72 contains a sample view of the web app.

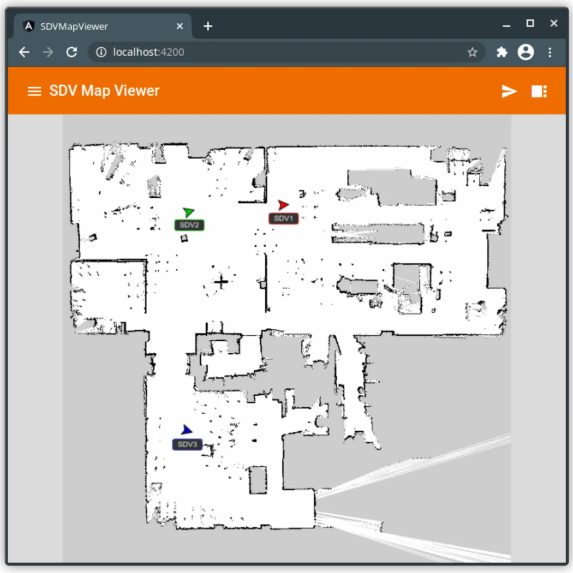


Fig. 72 A view of main map with three SDVUNx mobile robots.

Interface elements

The main elements of the application interface are:

- Toolbar
- Map
- Map Icons
- Right side panel

Each of these elements is detailed below.

Toolbar

The toolbar contains, from right to left:

- Button *general menu*: Displays a side panel on the left. In this panel there are links to other sections such as *Help* or *About*.
- Title: Name of the application
- Quick operation buttons. To the left end of the bar. These buttons are:
  - Stop all SDVUNx: Sends all SDVUNx an immediate stop command.
  - Send Objectives: Send the objectives defined on the map to the active *SDV*.
  - Help: Displays a menu with the help contents.
  - Show/Hide right panel: Shows or hides the right side panel, which contains extra information and configuration options.

The Figure 73 shows the previously detailed elements of the task bar.

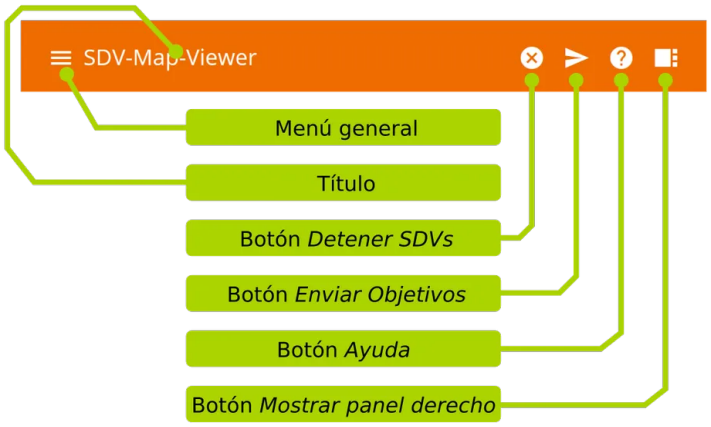


Fig. 73 Toolbar

Map

The map is the main component of interaction with the user, since it shows the current and new position, orientation, route and objective data of the *SDV* robots, by means of colored icons and lines that allow differentiating the different robots that are active in the ExFacLab. It also allows you to select or deselect SDVUNx and define new targets for each SDVUNx. The map and the way the user interacts with this map is configurable.

Map icons

The *map icons* are a set of shapes (lines, arrows, labels) that represent the information of the SDVUNx. Only icons of SDVUNx robots that are active in the lab are displayed.

The set of icons for each SDVUNx is drawn on the map, with a unique color for each robot:

- SDVUN1: red
- SDVUN2: green
- SDVUN3: blue
- SDVUN4: purple

The Figure 74 shows an example of the icons of the SDVUN3 robot:

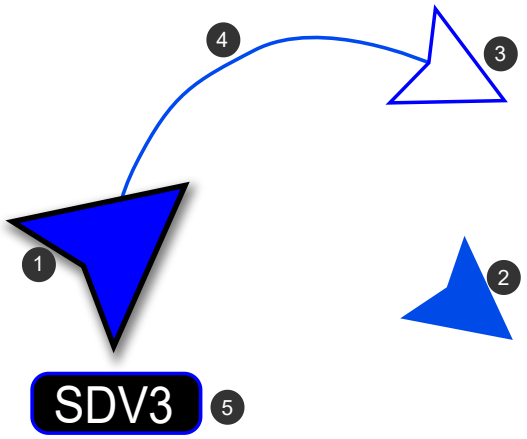


Fig. 74 Icons for SDVUN3 in SDV-Map-Viewer

The items listed are:

1. SDVUNx in current pose: Arrow that represents the position and orientation of the SDVUNx in the laboratory. It is the largest arrow for the set of SDVUNx icons and, when said robot is selected, it increases in size and casts a shadow to be distinguished from the others. Only one SDVUNx can be selected at a time.
2. Objective defined within the map: Arrow that represents the new objective defined by the user. This arrow is smaller in size and lighter in tone. It has no borders and casts no shadows.
3. Target currently tracked by the SDVUNx: This arrow is shown on the map only if the SDVUNx is moving. Its padding is white and the border is the distinctive color of the SDVUNx.
4. SDVUNx generated path to current target: The path is generated by the SDVUNx robot and is constantly changing as the robot moves around the lab. This line is displayed only if the SDVUNx robot is moving towards a target.
5. SDVUNx Name Tag: Only displayed under the current pose icon and contains the short name of the SDVUNx robot.

Right side panel

The right side panel contains additional SDVUNx information and display options that modify the map view. By default, the right side panel is always displayed when the application is loaded, but it can be hidden using the *Show right panel* button on the toolbar to make it easier to view the map on narrow screens or windows (on narrow screens, such as the one in a mobile device, the right side panel remains hidden by default).

The right panel groups the sections that make it up into cards. There are two types of card:

- Robot information card: generated dynamically when data is received from the server.
- Configuration cards: They contain options for configuring the application.

The content of these cards is detailed below.

Robot Information Card

The information fields contained in this card are:

- Stop button: Sends an immediate stop command only to the SDVUNx robot to which said card belongs.
- New Objective: Values of the objective defined by the user on the map.
- Robot pose: Position of the robot measured in meters with respect to the common origin of the SDVUNx and orientation of the robot with respect to the *x* axis measured in sexagesimal degrees.
- Status: Indicates if the robot can communicate with the server.
- Navigation: Status of the *Navigation Stack* of the SDVUNx robot.
- Image: Photograph of the SDVUNx robot, used as a reference.

The following figure shows the SDVUN1 robot card. You can see the stop button and a set of collapsible panels, which are:

- Target
- More information

The content is separated into these collapsible panels to save space in the right panel. The user can easily expand them by clicking on them. See Figure 75.

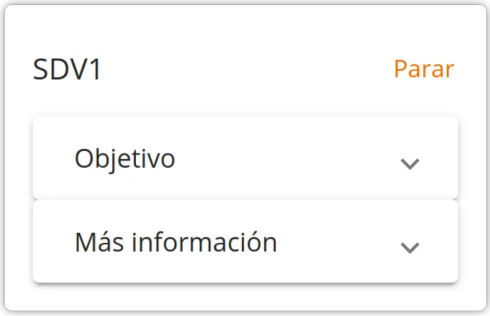


Fig. 75 SDVUN card

The figure below shows the content of the *Objective* collapsible panel, in the case in which the user has not defined any objective for the SDVUNx. See Figure 76.

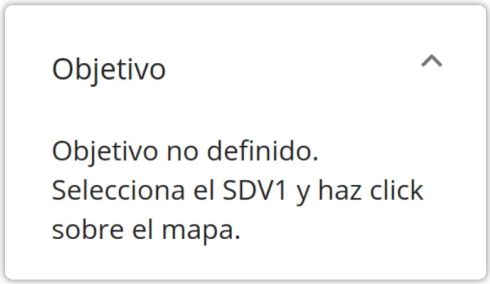


Fig. 76 SDVUN card without objective

The figure below shows the *Objective* collapsible panel in the case where the user already has an objective defined. In this panel you can see the position and orientation data defined by the user when creating a new objective on the map. A button allows you to clean this data in case you want to remove the target. See Figure 77.

Fig. 77 SDVUN card with objective panel

The following figure shows the content of the collapsible panel *More information*. This panel displays the current position and orientation data of the SDVUNx robot, the status of the connection to the server, and the status of the robot's *Navigation Stack*. See Figure 78.

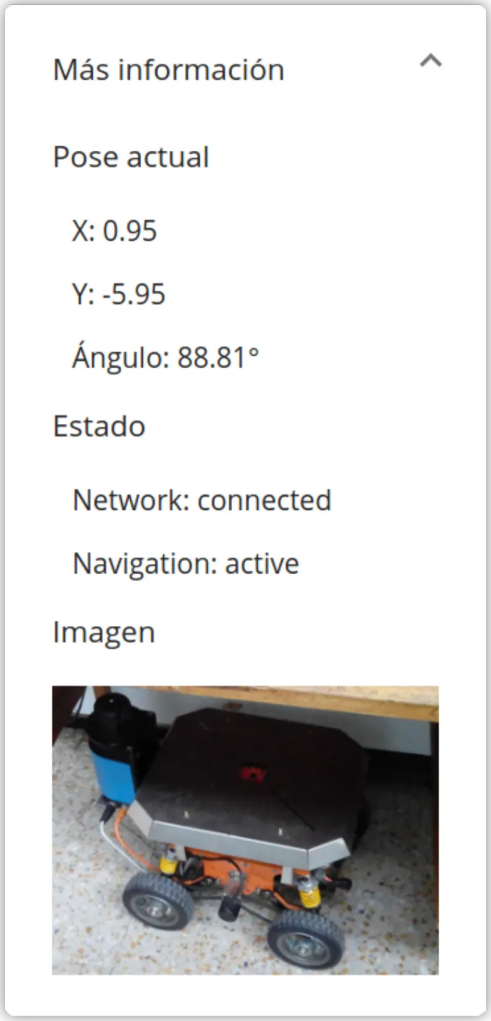


Fig. 78 SDVUN card: More information panel

Map Settings Card

The *Map Options* configuration card allows you to configure the map view and how you interact with the map component. The available options are:

- Show Grid: Enables a grid superimposed on the map. The grid lines are one meter apart. The red and green lines represent the *x* and *y* axes: their intersection corresponds to the *home* of the SDVUNx.
- Show SDVUNx labels: Enables the labels that are placed on the SDVUNx icons.
- Allow overlapping: Enables the possibility that the new target is located on another SDVUNx.
- Allow Overlay: Enables the possibility that the new target is located on the same SDVUNx. Useful for reorienting the SDVUNx keeping the same position.
- Enable keyboard shortcuts: Keyboard shortcuts allow you to quickly select SDVUNx.

See Figure 79 for an example.

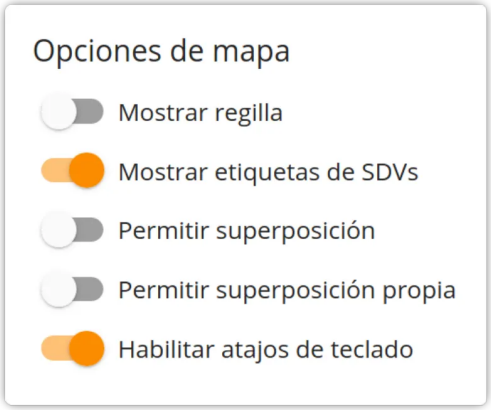


Fig. 79 Map configuration panel

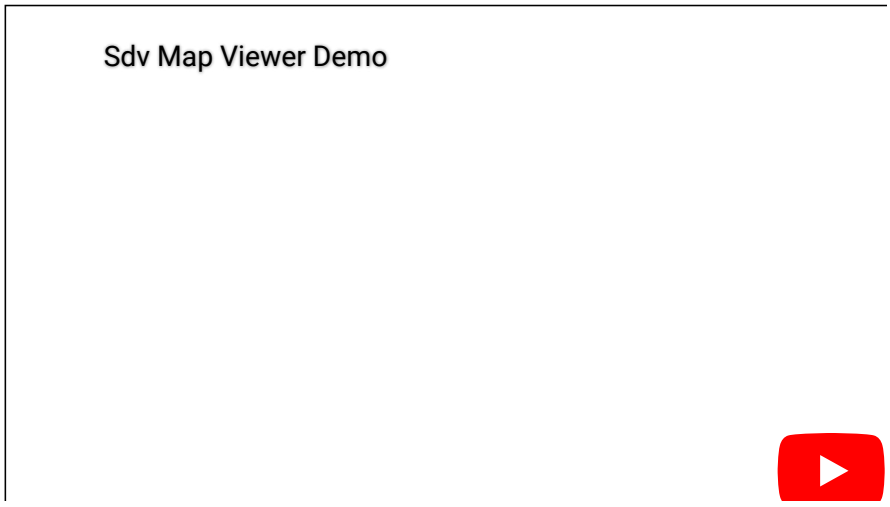
Using SDV-Map-Viewer

Define target for an SDV

The steps to define the target of an SDVUNx are as follows:

1. Click on an active SDVUNx or press the keyboard shortcut for that SDVUNx
2. Click on the area of the map where you want the SDVUNx to move. Remember: the SDVUNx will not move if there are obstacles on the static map or if it finds one on the way that prevents it from reaching the objective.
3. If you want to set an orientation, in step 2, when you click on the map, don't release the mouse button: move the mouse around the starting point to reorient the target arrow.
4. You can deselect the SDVUNx by clicking on it again or by pressing the *Escape* key.
5. You can change the target of any active SDVUNx by repeating the procedure from step 1.

You can see these steps in the next video tutorial.



Send targets to SDVs

To send the target(s) defined on the map, press the *Send Targets* button on the toolbar. The Figure 80 indicates which is the *Send Targets* button on the toolbar.

Fig. 80 Send button in toolbar

Warning: Avoid that the SDVUNx cross each other or remain in very close stopping points. The application prevents a target from being defined on an SDVUNx (function that can be deactivated under risk of collision).

Cancel operation

You can cancel the move of all SDVUNx by pressing the *Stop SDVs* button located on the toolbar. You can also stop a specific SDVUNx by accessing its corresponding detailed information panel. The Figure 81 shows the location of the general stop button.

Fig. 81 General Stop Button in the app toolbar

Warning: to send a stop command, any queued task inside the SDV will be stopped. This can affect the operation of any process loaded from *PRIA*.

Warning: Although the stop buttons quickly send commands to the server, if the lab's wireless network is congested, commands may take time to reach the robots. If the robot is at risk of an imminent collision and the robot does not respond to immediate stop commands, it is recommended to turn off the switch on the drivers.

Obtain information from SDVs

Each SDVUNx robot connected to the server is represented by an information card on the right side panel. This panel provides information on the current status of the robot.

Display options

The map can display a reference grid with *x* and *y* axes. You can also hide the *SDV* labels or modify the way the map allows you to insert new targets on top of the other SDVUNx.