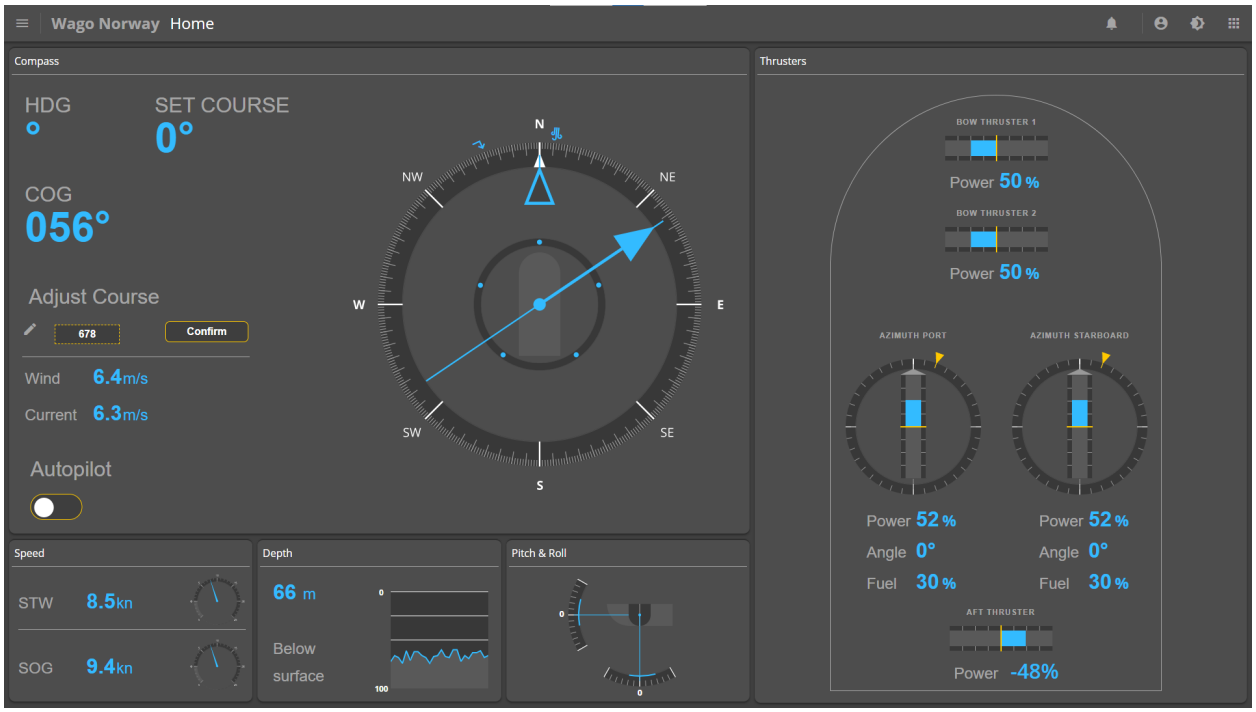
HMI User Manual

HMI for a simulated ship-control-system with MTP and OpenBridge based graphics



A bachelor project in collaboration with WAGO Norway AS.

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HMI Setup

Wiring the TP600, PFC200 and the power supply

Connect an ethernet cable from your router to the TP 600, and one ground wiring and live wiring as shown in figure 1 below. Wire the screen to the power supply and plug in the adapter. Figure 2 gives a better view of the setup.

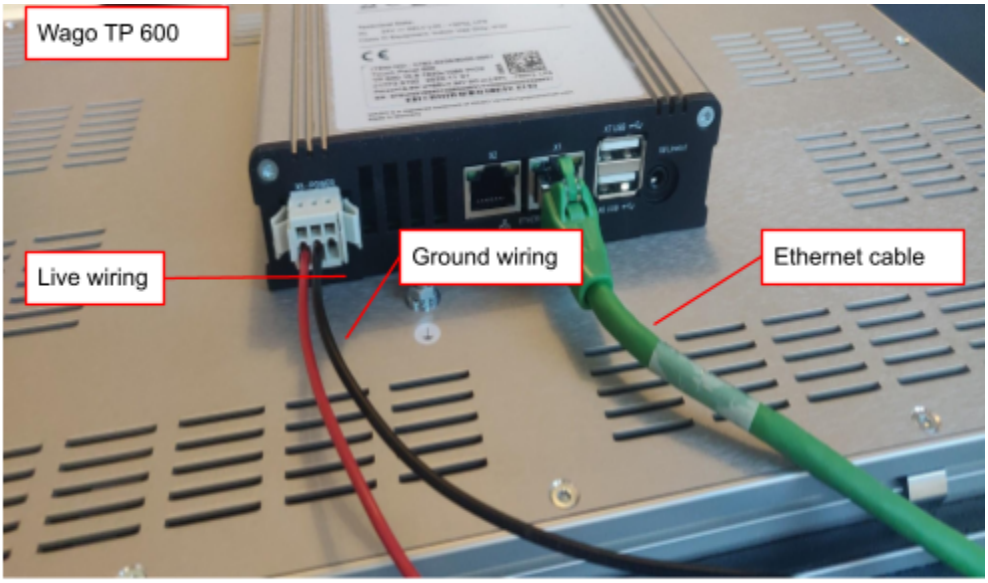

Figure 1

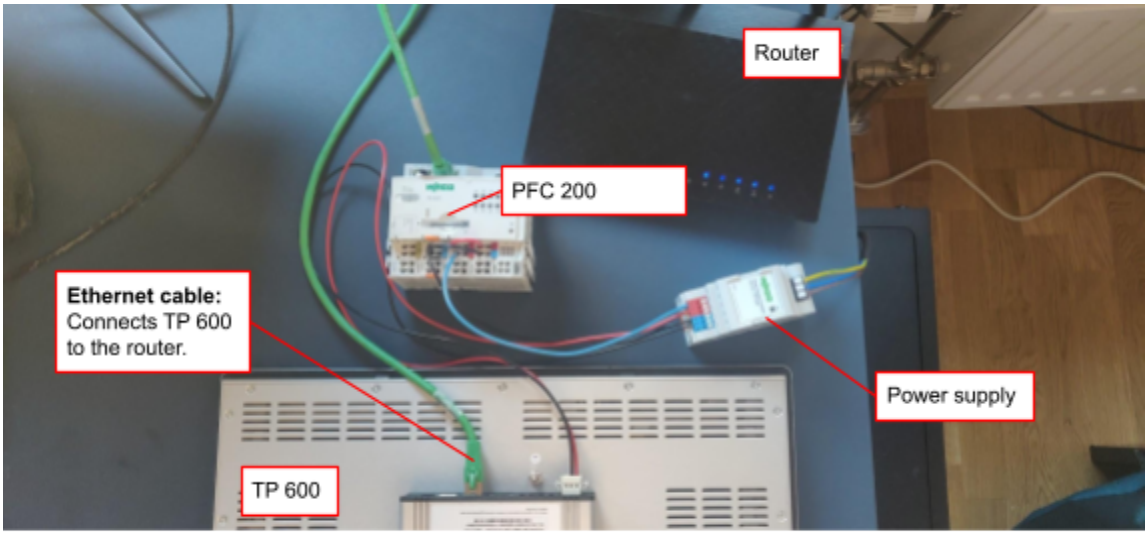

Figure 2

Access the Wago TP600 using an SSH Client

To access the Touch panels command promt, an SSH Client must be used to connect to the TP's ip. The example in figure 3 shows how this is done using the PuTTY client.

TP 600 ip address: 192.168.1.136

When the ip address of the touch panel is entered, click on "Open". Then you need to enter "**root**" as your username, and "**admin**" as your password.

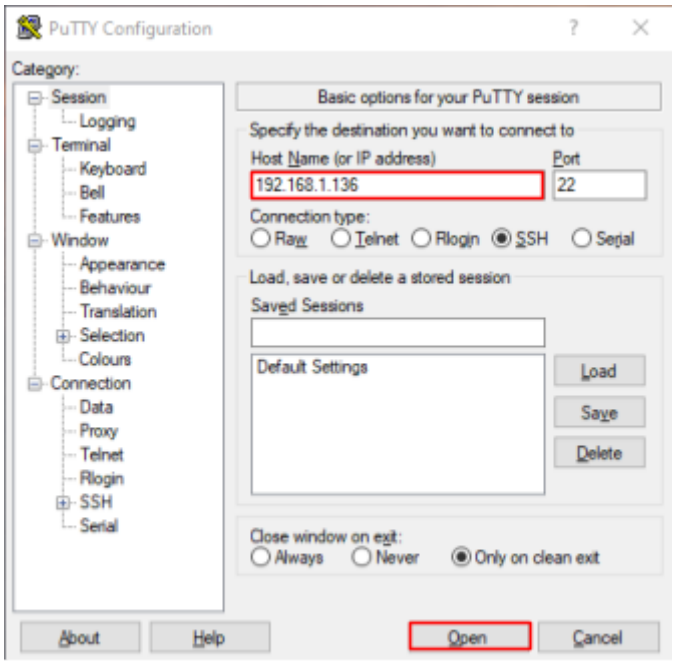

Figure 3

When signed in, run the website by typing: "**docker start hmi**", as shown in figure 4.

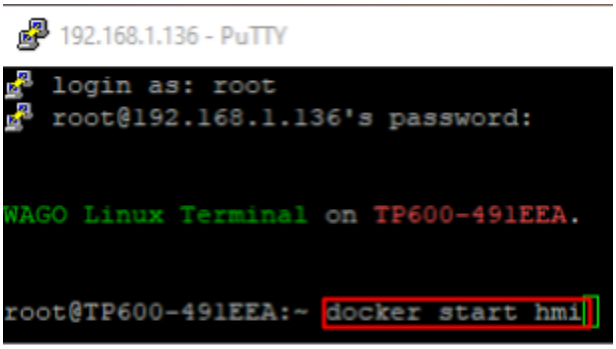

Figure 4

The website will now run on the touch panel.

To display the website, you must login to the device by typing the ip address of the TP 600 in the browser. You must then log in with username “**admin**” and password “**admin**”.
Go to “Configuration” -> “Browser Settings”, and add the website to favorites, as shown in figure 5 below.

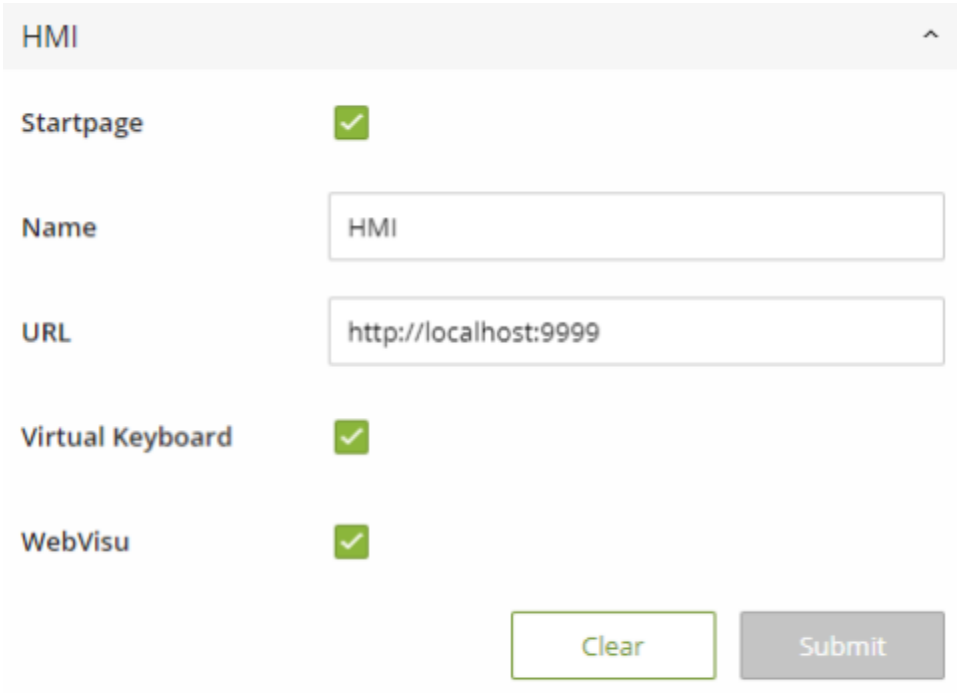

Figure 5

Downloading and changing IP - address

For first time installation, the docker image needs to be downloaded from the repository, get initiated and possibly change the IP address of the OPC-UA client to match the PLC.

Here are the steps given you have accessed the PLC terminal with Docker installed:

1. **docker pull orjpet/hmi** → Downloads the docker image
2. **docker run -d --restart always -p 9999:9999 --name hmi orjpet/hmi** → Initiates a container
3. **docker start hmi** → starts the container, only required if the container is stopped.

4. **docker exec -it hmi /bin/sh** → access container. May need to use “/bin/bash”
5. **ls -a** → Lists all files in the current directory. The opc.js file should be visible here.
6. **vi opc.js** → Opens opc.js file
7. press "i" to edit, change endpointURL to your own PLC IP-address, press "ESC" and type ":wq" and press "Enter" to save
8. Now by refreshing the webpage, after around 30 seconds the PLC will have a connection established with the HMI.

Top Navigation Bar

Page navigation

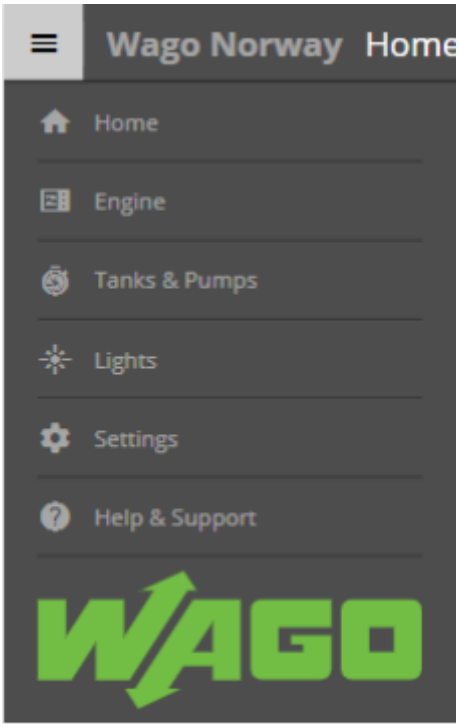

Figure 6

This is the page navigation menu, where you have access to all the pages related to the process you have. By clicking on the name of the page, you will be directed to that page.

Alarm menu

The alarm menu holds a list of alarms sent from the connected PLC. The example from the HMI in figure 7 below shows the alarm menu containing three alarms. In this menu, the user is able to acknowledge the alarm by pressing the “Ack” button. The alarm will then disappear from the list.

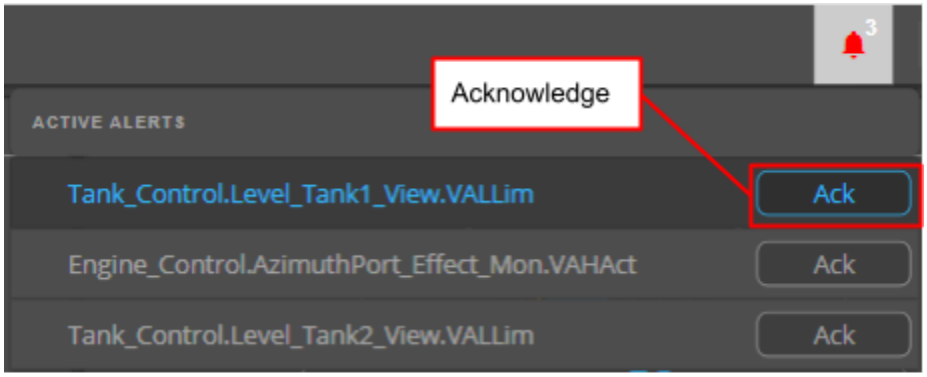

Figure 7

Account menu

The account menu shows an illustration of how a functioning account login menu would look like in the Open bridge design. The account menu has no functionality other than being a visual example.

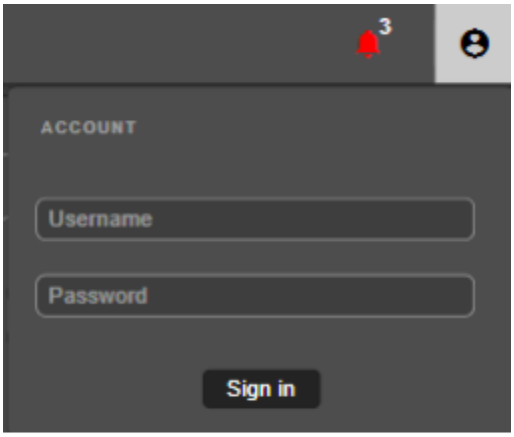

Figure 8

Themecolor menu

The themecolor menu lets the user change the color of the entire website. There are four themes to choose from; night, dusk, day and bright. The user can change the theme by clicking on one of the four icons shown in figure 9. The theme will then be active until another themecolor is chosen or the website is reloaded. Below are examples from each of the themes.

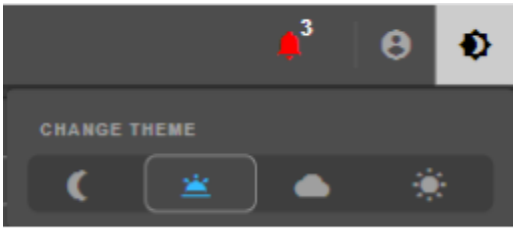

Figure 9

Night

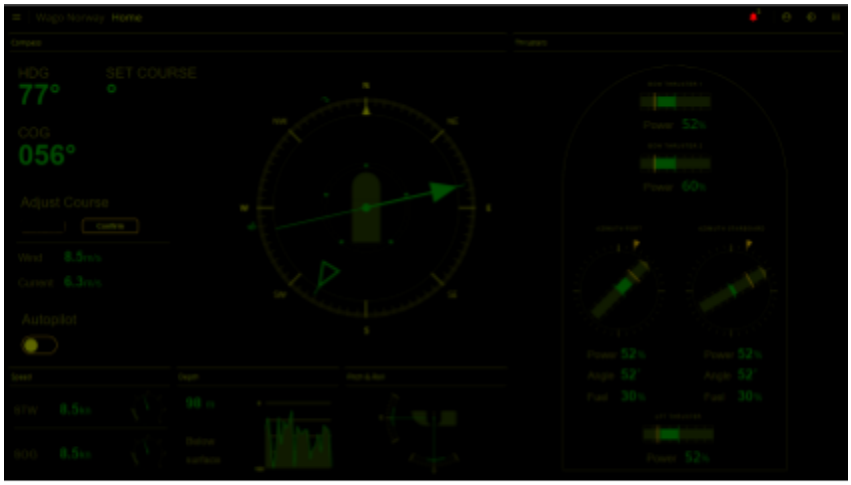

Figure 10

Dusk

Figure 11

Day

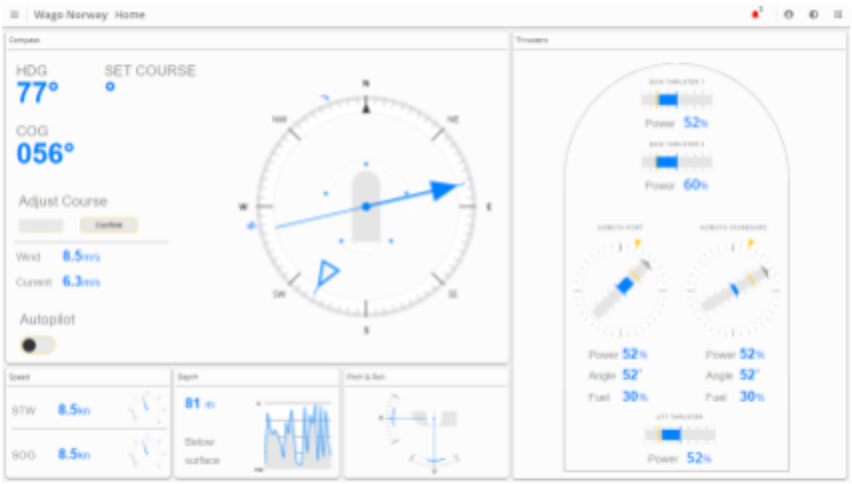

Figure 12

Bright

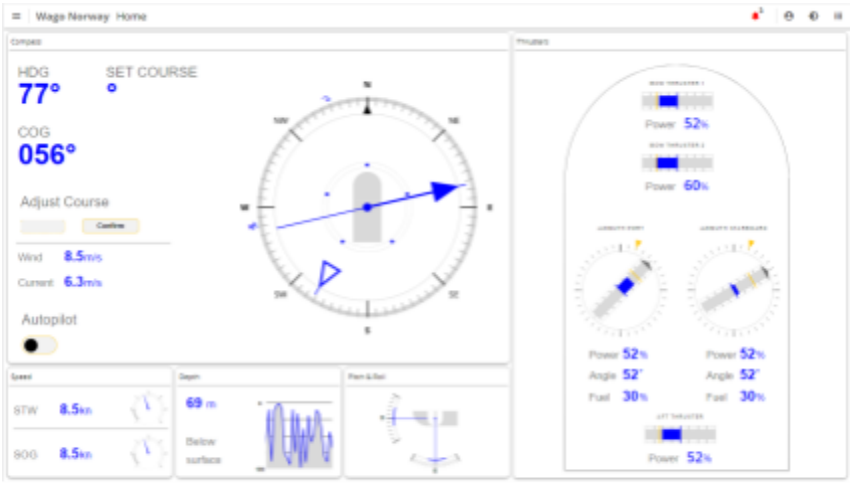

Figure 13

App menu

The app menu is only a visual presentation of how the app menu would look like with the open bridge design. The menu has no function other than being a visual example. The buttons on this menu change color on hover or on touch/click.

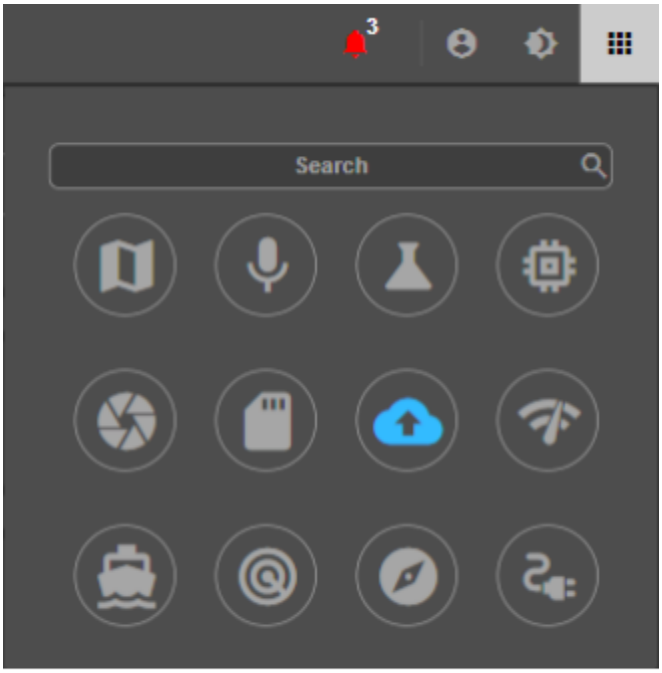

Figure 14

Home page (Ship navigation)

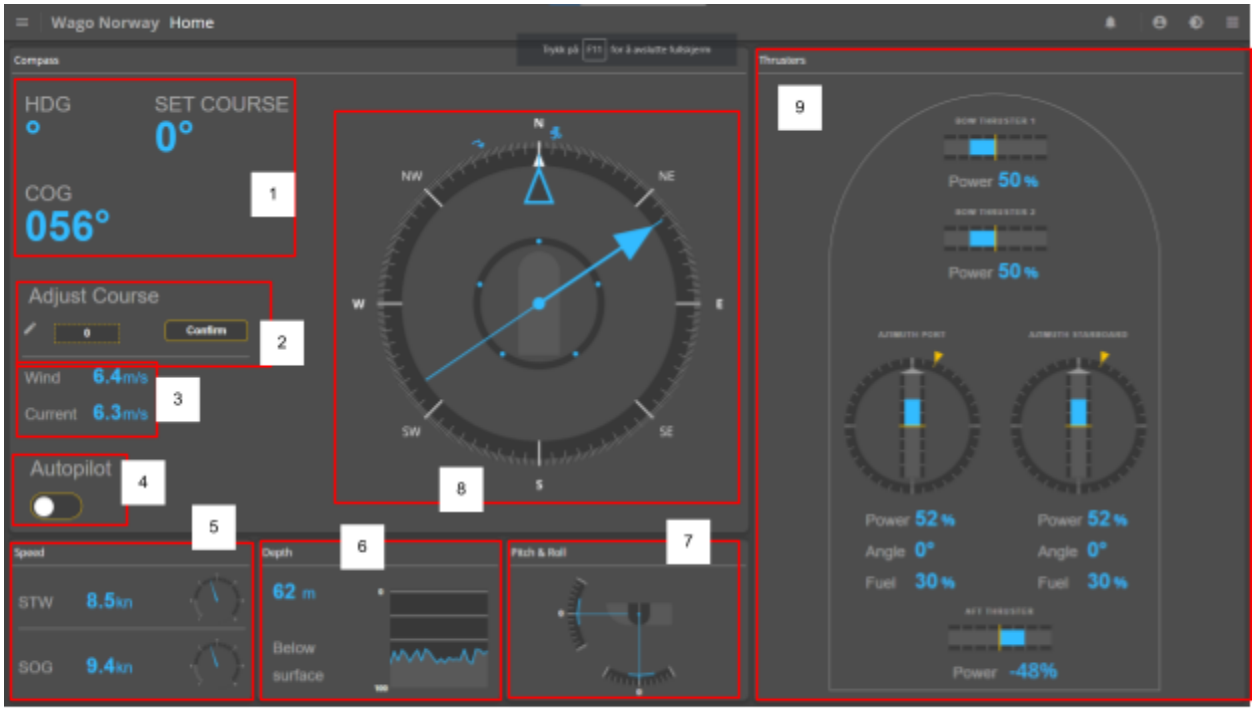

Figure 15

1. **Heading, course over ground and set course**
    - **HDG** is the current direction the ship is moving
    - **SET COURSE** is the given course you want the ship to head. This value is given from the “adjust course”(2) input. The ship will only move to the set course while “Autopilot”(4) is toggled on.
2. **Adjust course**
    - Here you can type in a heading in degrees and it will change the “set course” in (1)
3. **Shows the current and wind in meter per second**
4. **Autopilot toggle on/off**
5. **Speed through water (STW) and Speed over ground (SOG)**
    - **STW** Speed in relation to the waters movement
    - **SOG** Speed in relation to global positioning

6. Depth display

- Depth monitoring from sea level to seabed

7. Pitch & Roll

- monitors the pitch and roll of the ship
- Not currently functional. Only for visual purposes.

8. Compass

- **Compass needle:** a visualization of **COG**
- **Boat graphic:** Visualization of **HDG** 
- **Set Course:** Visualization of **Set Course** 
- **Wind direction** 
- **Direction of current** 

9. Thrusters monitoring

- **Bow Thrusters** Show current power usage in percent and direction by having zero percent in the center of the bar.
- **Azimuth port and starboard thrusters** Show power usage and power direction both as graphics and as values. Also shows angeling of the thrusters and fuel level for its dedicated fuel tank.
- **Aft Thruster** Show current power usage in percent and direction by having zero percent in the center of the bar.

Engine page

Figure 16

1. Azimuth section

- **Engine visualization:** The engine visualization shows both the port and the starboard azimuth engines. Here, the user can see a visualization of the amount of power in the engines as well as the direction the power is going.
- **Power:** The amount of power in the engines is shown in percent.
- **Angle:** The angle of the engines is shown in degrees.
- **Temperature:** The temperature of the engines is shown in degree Celsius.
- **Oil pressure:** The oil pressure of the engines is shown in psi (pounds per square inch).

2. Fuel section

- **Tanks visualization:** Visualizes the fuel level of the two main tanks on the ship.
- **Reserve tanks visualization:** Visualizes the fuel level of the two reserve tanks on the ship.
- **Level:** Shows the fuel level for each tank and reserve tank in percent.
- **Temp:** Shows the temperature of each tank and reserve tank in degree Celsius.

3. Bow and aft thrusters

- **Bow thruster visualization:** Visualizes the bow thrusters amount of power and its direction; left or right.
- **Aft thruster visualization:** Visualizes the aft thrusters amount of power and its direction; left or right.
- **Power left:** Shows the power in percent in the left direction.
- **Power right:** Shows the power in percent in the right direction.
- **Temperature:** Shows the temperature of the thruster engines in degree Celsius.

Tanks & Pumps page

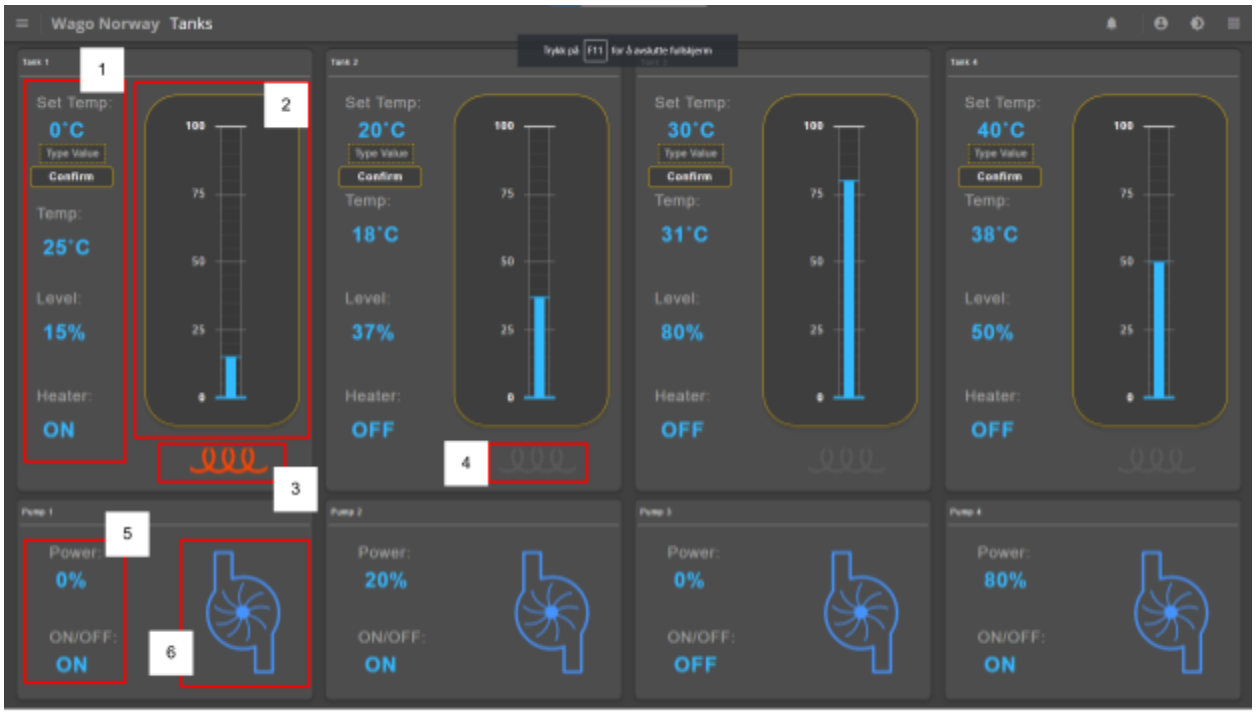

Figure 17

1. **Tank status**
    - **Set Temp** Type value in degrees celsius and confirm to keep the temperature in the tank at a given level
    - **Temp** Show current temperature in the tank in degrees celsius
    - **Level** Show tank level in percent
    - **Heater** Show if heater is on or off
2. **Tank level visualization**
    - Tank level in percent.
3. **Heater visualization ON**
4. **Heater visualization OFF**
5. **Pump status**
    - **Power** Show currently used power of the pump
    - **ON/OFF** Show if pump is on or off

6. Pump icon

- For aesthetic visualization of a pump

Lights page

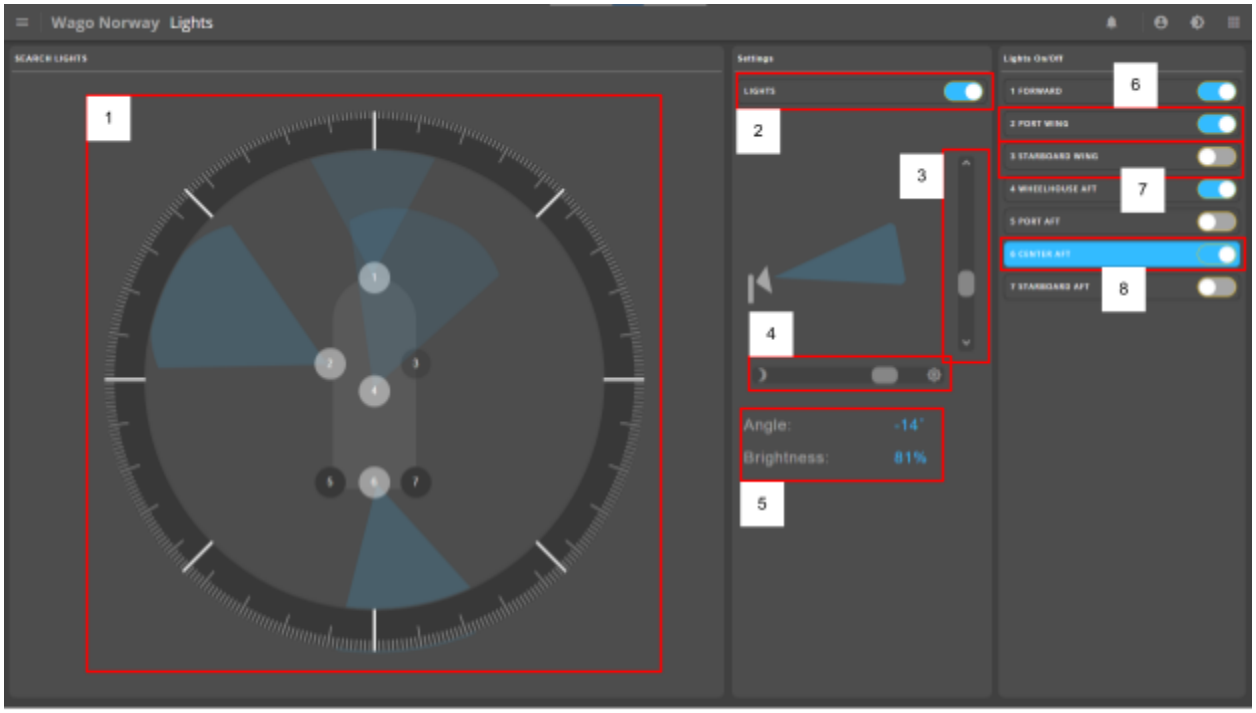

Figure 18

1. Lights visualization

- Show which lights are on, their angle and brightness in relation to the ship.

2. Main light switch

- Not currently operational, but is meant to act as main light switch that can turn off all lights with on click.

3. Angle slider

- Adjusts the angle of the currently selected light from -20 to 20 degrees.

4. Brightness slider

- Adjusts the brightness of the selected light.

5. **Light values**
    - Displays the current angle and brightness of the selected light.
6. **Light toggled ON**
7. **Light toggled OFF**
8. **Selected light**

Settings page

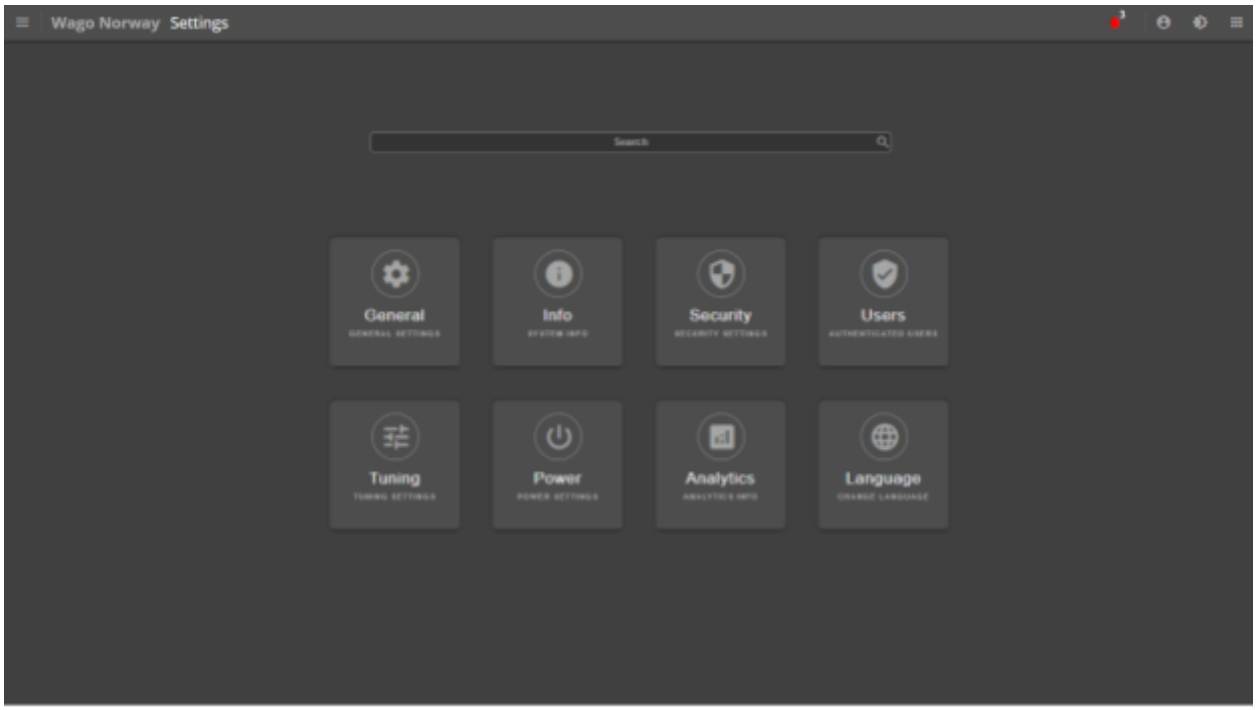

Figure 19

The settings page works only as a visual example of how this page would look like with the open bridge design. The page has no functionality or interactivity.

Help & Support page

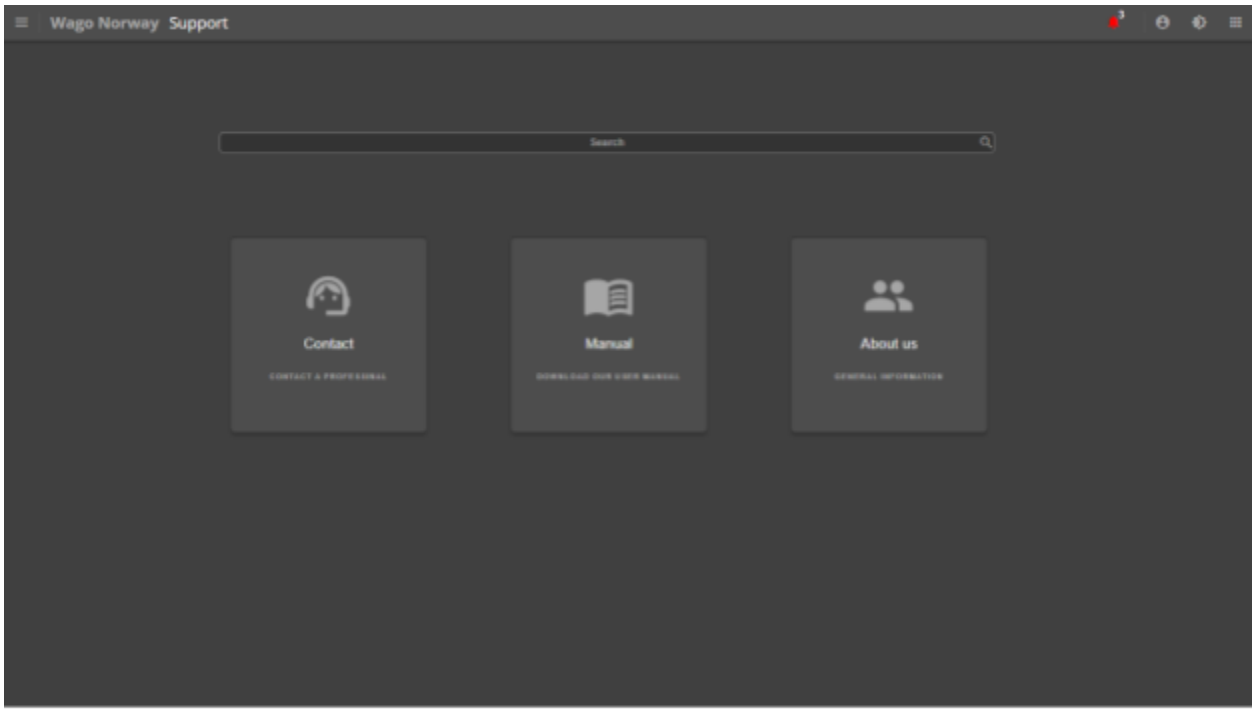

Figure 20

The Help & Support page works only as a visual example of how this page would look like with the open bridge design. The page has no functionality or interactivity.