Smart Jugs

Mobile Dev - Project

Authors

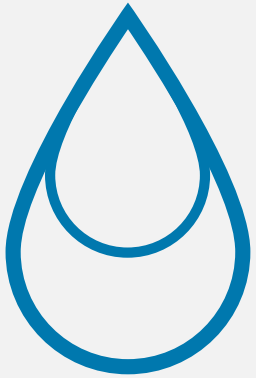
Kevin Cattaneo – S4944382

Riccardo Isola – S4943369

Overview

- Our project involves the connectivity of “Smart (Water) Jugs” (the sensor) and the tracking of the fluid filtered each second.

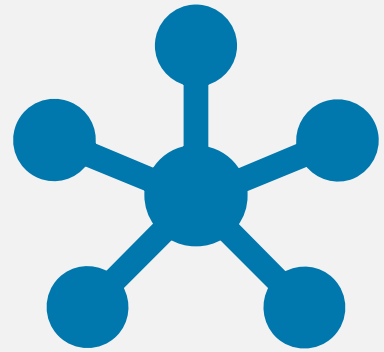
- We track:
  - The total number of liters filtered
  - The amount of water consumed each day
  - The filter usage
  - The kilograms of plastic saved
  - The location



- Coupled with a hardware sensor developed in parallel with the **Internet of Things** course.

Technologies

- The application needs:
  - **Wi-Fi** technology to work properly. Indeed, it is used to pair, to retrieve sensor data, perform login/registration, to manage account information and to collect data for aggregated data analysis by vendors.
  - **Location service** to collect location, transmitted without any other user information. This can be decided to be shared or not by the user.



- The application is implemented in **Kotlin** via **Android Studio**, we use **Room Database** to handle local storage.

- For handling HTTP requests and responses we used the **Retrofit** library.

- Any operation that needs to check the owning of a jug is done by a **JWT token** verification server-side, that is given upon a successful login.

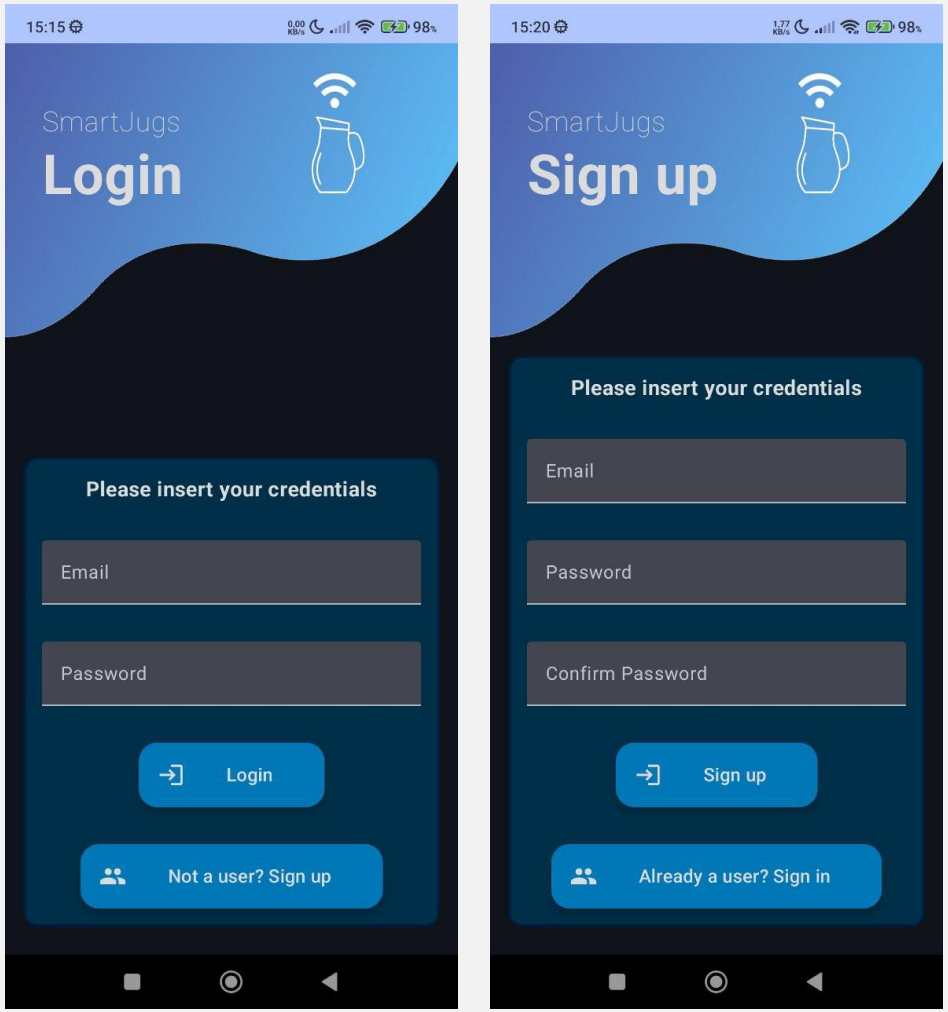
- The layout and design graphics are implemented in **Jetpack Compose**, utilizing **View Models** and **Kotlin Flows**.

Login / Registration

- The one on the left (Login page) will be the **first page** shown when the app opens (if not already logged), to continue in the app the user must provide their credentials.

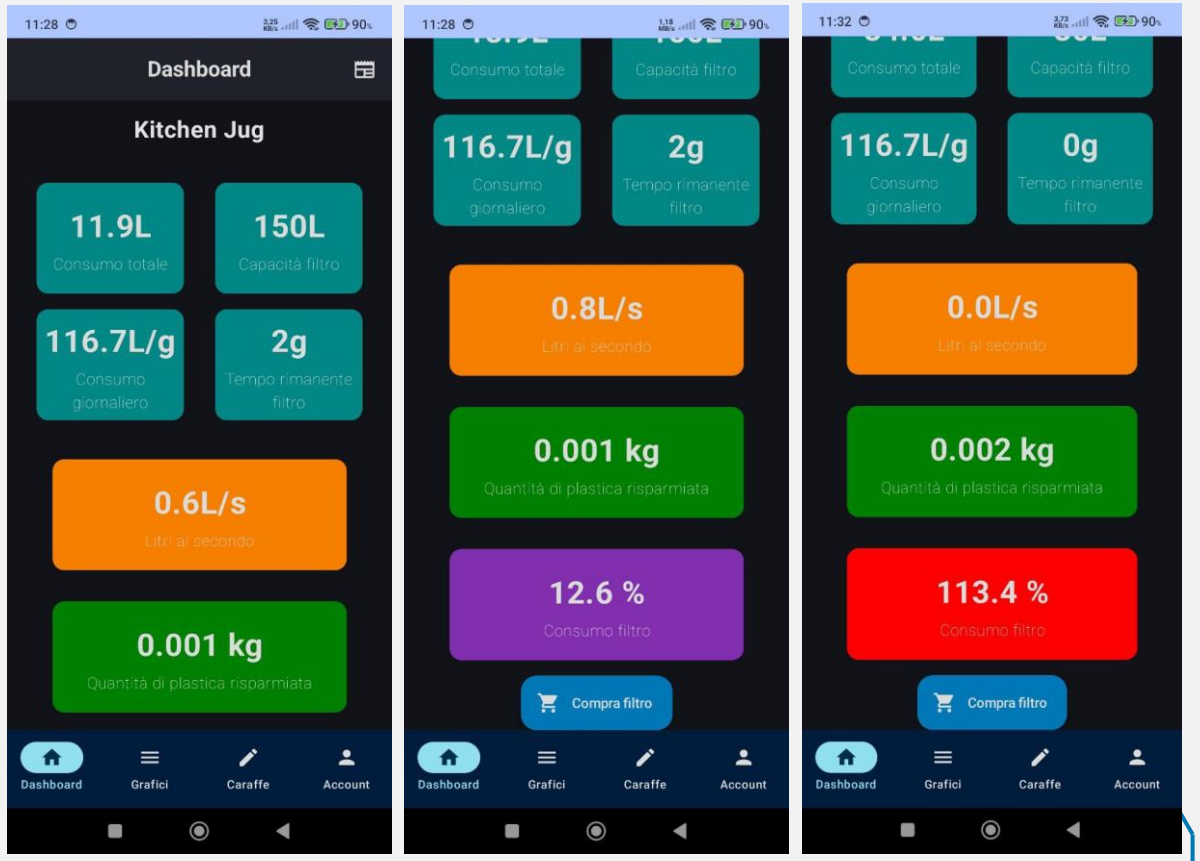
- On the right, instead, the user can sign in if has no account

- To make the application work, a **network connection is needed** to connect to the remote server with the database that contains the login information.



Dashboard

- This page shows all the information sent by the jug sensor, if at least one is paired.
- To know which jug has been selected, we show its name on the very top, under the navigation bar.
- The dashboard shows also, in the bottom part, a percentage of **the filter usage**, alerting with a red color if the filter is almost exhausted or overused.
- The user can also click on the bottom button to **buy a filter**, this will redirect him to an online web search.



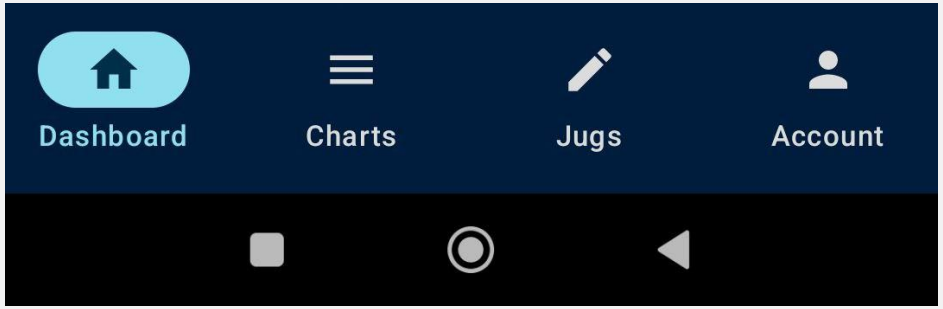
Navigation

Top-bar

We provide a top navigation bar with which the user can navigate to the previous page through the **arrow-back** icon, for pages where it is needed. Also the news feed can be reached from here

Bottom-bar

We provide a bottom navigation bar with which the user can navigate through the app and see other **sections** from jugs information / list to account management.



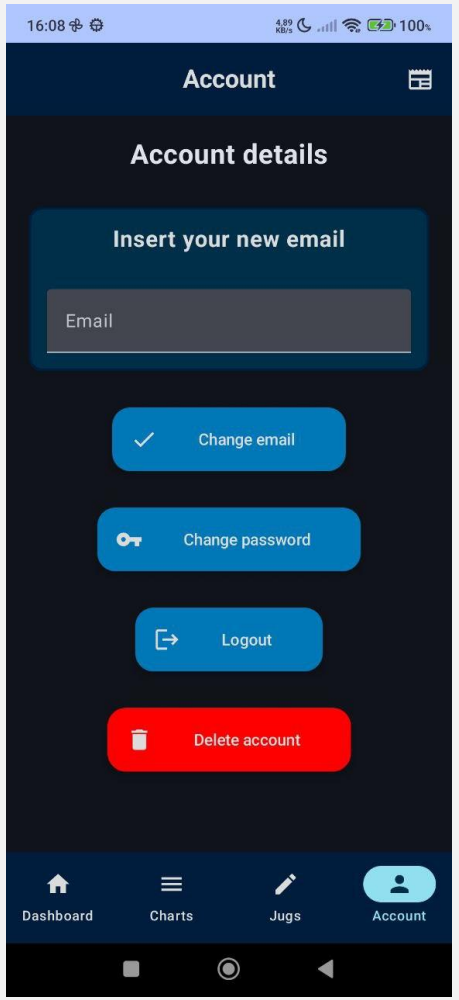
Charts

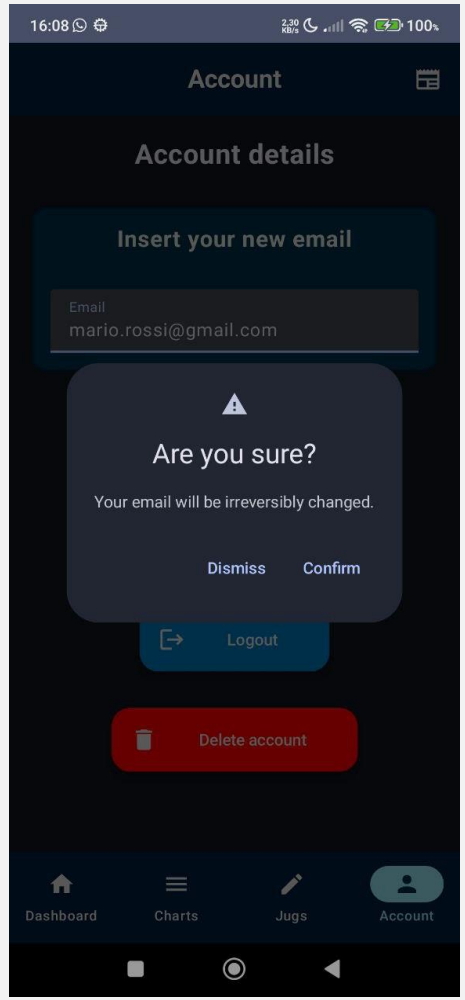
This view shows two charts about the water consumption respectively:

- in the **last hour**, so each minute the information is retrieved (excluding the current minute)
- in the **last week** (including the current day)

Account management

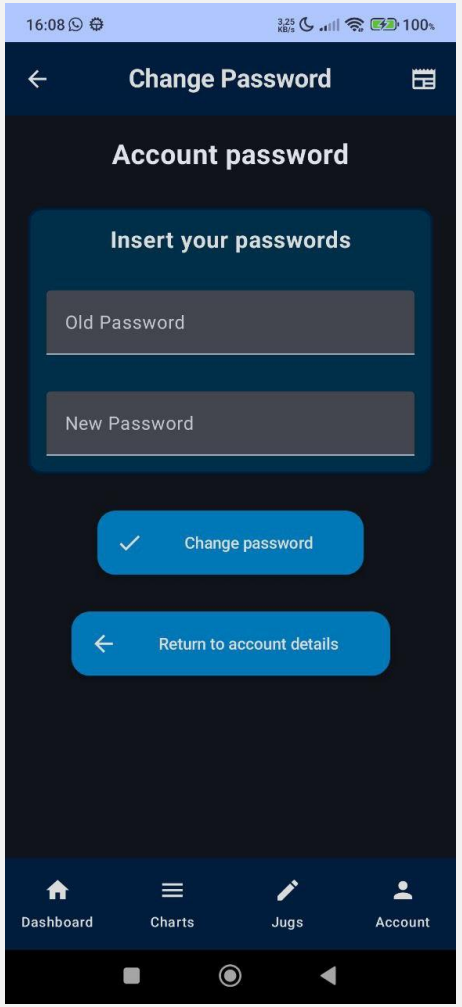
- In this page the user can **change their email** by editing the field, clicking the “Change Email” button and confirming the **alert dialog** pop up.
- By clicking on the “Change password” button the user will be redirected to the “Change Password” page.
- By clicking the “Disconnect” button the user will be disconnected.
- By clicking the “Delete account” button the user will be disconnected, their credentials and their jugs information deleted.





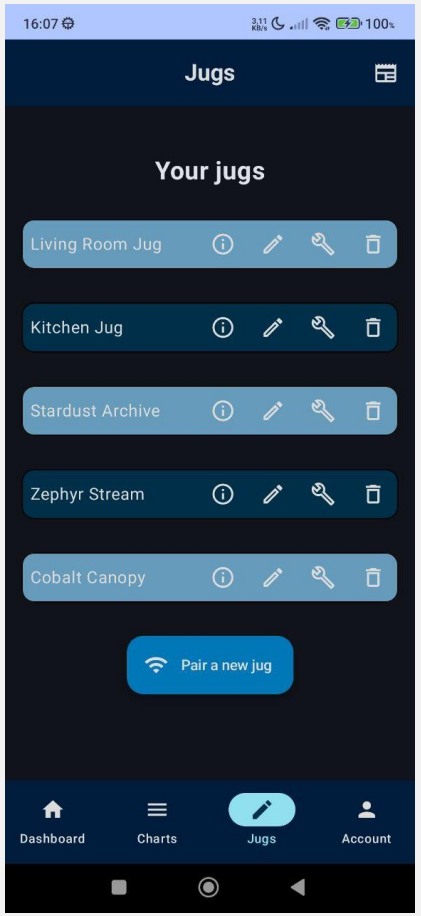
Change password

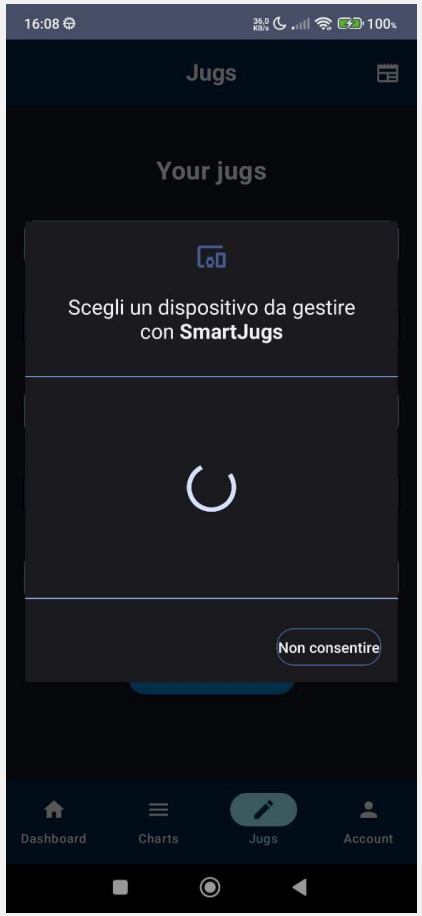
- In this page the user can edit the password fields to **change their password**.
- By clicking the “Change password” button an alert dialog pops up requesting a confirmation; by confirming this, the dialog closes and the password is updated.
- If the old password is not verified the password does not change and a **toast** appears to notify the user.



Jugs management

- In this page the user can review the owned jugs or pair new ones via Wi-Fi.
- This Wi-Fi will be **hosted** by the jug devices themselves and the process of searching can be started by clicking the button “Pair a new jug”.
- By clicking on the Information icon, the user will be redirected to the Dashboard, displaying the information about the selected jug.
- By clicking on the Edit icon (pencil), the user will be prompted with a dialog in which they have to provide a new name for the jug.
- By clicking on the Settings icon, the user will be prompted with a dialog in which they have to provide a new filter value for the jug, this emulates the changing filter of the jug.



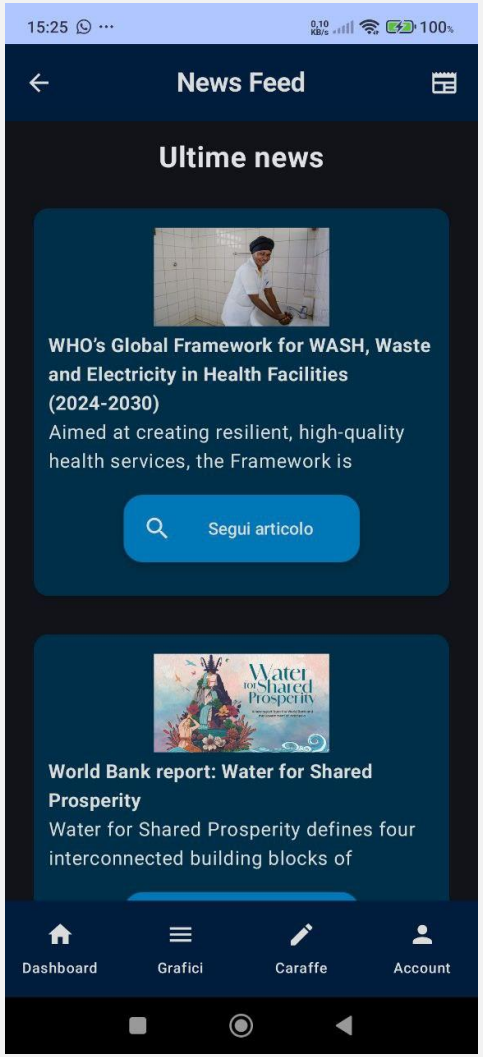


News Feed

- As an extra functionality, we also inserted a news feed, updated in **real-time**.

- In this page the user can review the latest notice world-wide about the water, to stay connected.
  The website we refer to is
  https://www.unwater.org/news.

- Clicking the upper arrow-back, will bring the application to the previous page viewed, whatever it was.

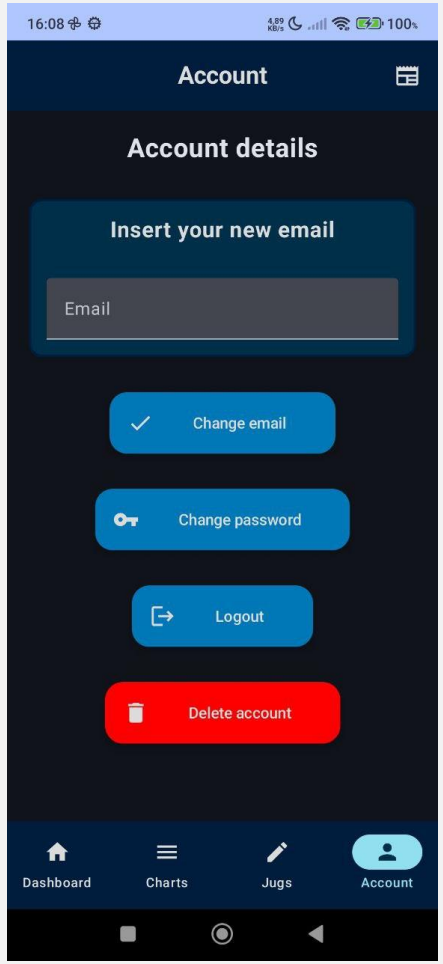


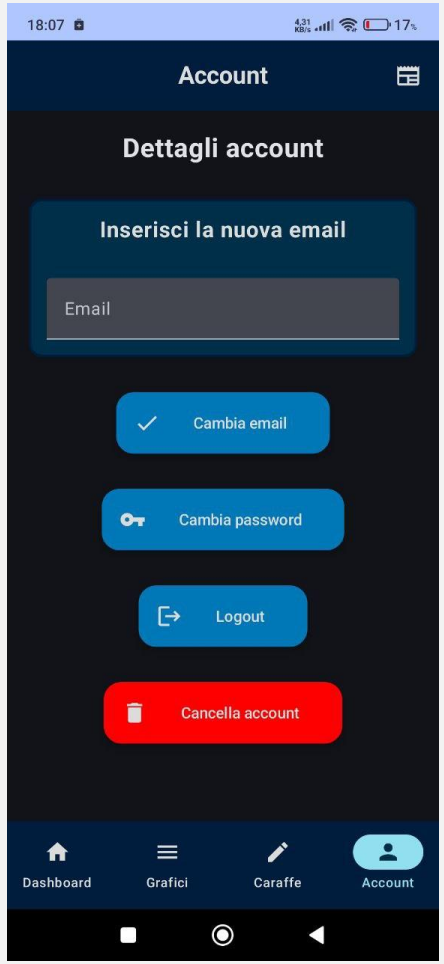
Other functionalities

Translation

Depending on the user's system language, the application currently supports the following languages:

- **English** (Default)
- **Italian**





Other functionalities

Push notifications (Firebase)

- When the filter usage has almost reached the limit (about 80%), the application will send a notification with a warning about a certain jug.

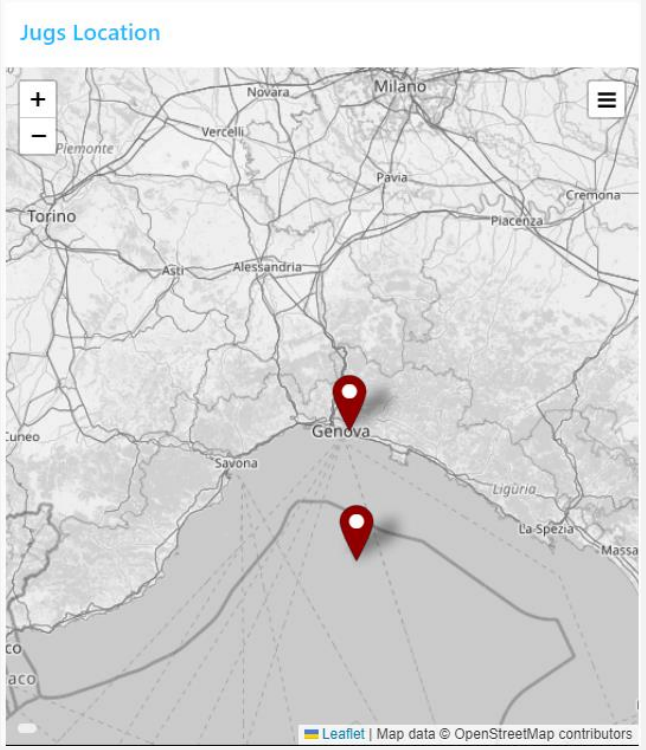
- By clicking on the notification, the application will open directly on the dashboard of the interested jug.

- The notification system is based on **Google Firebase.**

Other functionalities

Location

- We make the user choose if they want to share their position that is sent in an aggregated form to the company (coordinates and name of the jug is sent)
- The effective sharing is performed upon successfully pairing.
- The user can choose both to share an **approximate** location or not to share at all. Original position showed on the map was the DIBRIS (University of Genova)



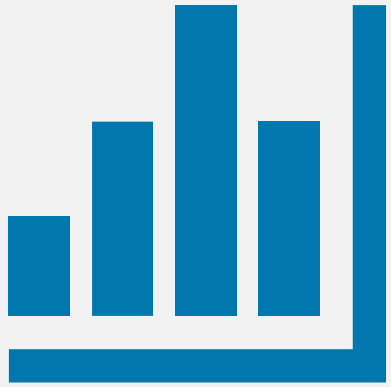
This map is taken from the SmartJugs employee dashboard: it is not provided to client nor to the mobile application.

Privacy of the user

- The jugs sensor data will be sent over **Wi-Fi** to the vendor server, in an aggregated way.
- Locally we use the **Room database** to save a userID and a token for authenticate any operation with their jugs.
- The only user data that will be saved on the vendor servers are their **credentials** (to handle login) and their associations with their jugs to properly display the dashboard for each owned jug.
- No other mobile device information is gathered and transmitted except for the **location** that can be chosen if to be shared or not.
- The permission that will be asked to the user upon the start of the application will be:
  - The first one is about the **location**. The user can choose both to share an approximate location or not to share at all.
  - The second one is about **notifications**: the user can choose if they want to receive notifications. Those notifications involve just the alert if a filter is exhausted.

Performances

- We also measured the main performances of our app, in the following order:
  - Registration/Login
  - Pairing of a new jug
  - Rename jug
  - Edit filter capacity
  - Navigation to the dashboard
  - Navigation to the chart view
  - Navigation to the news feed



- We observed that the most CPU intensive tasks involve the navigation through the section of the app: Dashboard, Chart View, News Feed. The most we reached is about 38% of the CPU, while remaining usually between 15%-20%.

- Talking about memory, on average we use 160MB (Dashboard), reaching 228MB in the Chart and News section.

Differences w.r.t proposal

- The user **registration** and **login** have been separated in two different pages, to have a cleaner interface
- Improved the **Dashboard** page, substituting the idea of the cylinder as status with a cleaner view: the percentage is put into a card that **changes color into red** if the usage of the filter is above a certain amount.
- The idea of sidebar navigation has been replaced with **a bottom bar** navigation. **A top bar** has been properly implemented.
- We slightly varied the charts, by using both **line** and **bar** plots.
- A cleaner look has been put into the Account and Password management page, giving the user a better overview, with icons, of which button do what.
- The management of the jugs has now **more actions** that can be performed on each jug.
- Since a new functionality was suggested to be added, we decided to **introduce a news feed** about information world-wide on the water topics.

Thanks for your attention