



HyperLab

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Abstract

The **HyperLab** project was conceived as both an extension and upgrade of the **SLab Tools** project, funded by INAF in 2023 under the 'Call for Funding of Fundamental Research 2023', in the *Data Analysis Grant* category.

SLab Tools was created to assist and streamline the work at the **Spectroscopy LABoratory (SLAB)** at the IAPS institute, utilizing modern tools such as a database for saving and quickly retrieving data, and a duo app (mobile and web) for managing and analyzing data.

HyperLab builds on this concept by replacing the original app, which was designed with UWP technology (only for Windows 10/11), with a multi-platform app that performs the same tasks while adding new capabilities, such as fundamental data analysis techniques. The goal is to develop a general-purpose tool for the scientific community.

Why?

The project is born with the twofold idea of:

1. Streamlining the time-consuming routine of laboratory personnel: performing multiple acquisitions for each spectrum to create the final one, adding ancillary information about measurements and samples, and saving this information for future use;
2. sharing data with the scientific community for:
 - increasing the value of scientific data by enabling other scientists to retrieve and use it for their own research;
 - promoting the activities conducted at SLab by receiving citations in published papers that include our data.
3. providing community of a modern tool which:
 - doesn't require the old-fashioned complicated installation of development environment + tons of libraries;
 - is available also on modern devices such as phones and tablets;
 - allows natural interaction through a user interface.

How

The web app

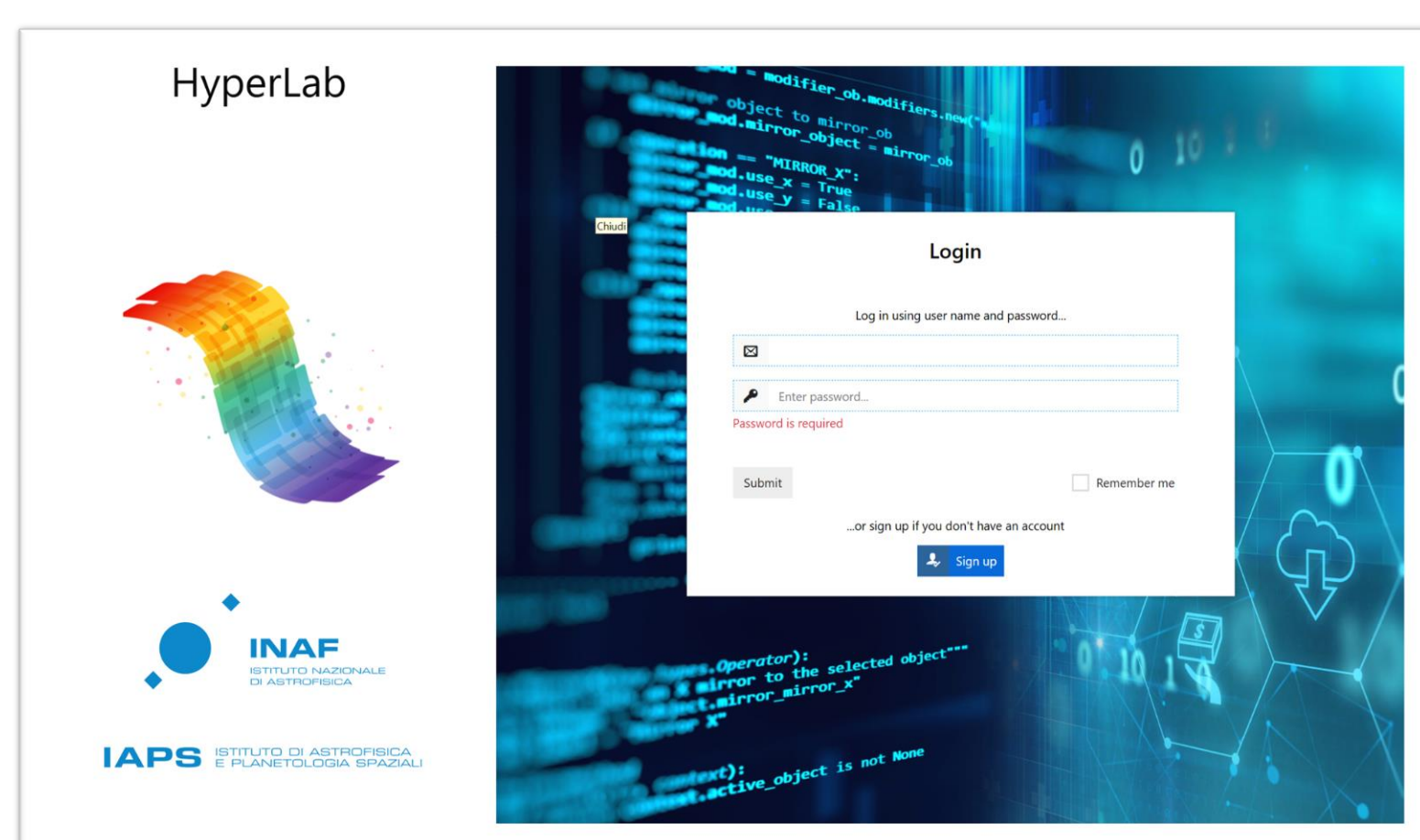


Fig. 1 – The *HyperLab* web app login/register page

The web app has been designed with the dual role of:

1. working as a back-end for all features provided by the desktop/mobile app;
2. providing its own front-end the required services.

Main capabilities of the web app are:

- providing login/registration interface for users;
- offering a page for creating simple or complex queries to search and retrieve spectra from the database;
- supplying a page for applying fundamental techniques for data analysis, such as removing continuum, smoothing and band analysis



The web app is currently published at <https://hyperlab.inaf.it>



The on-line product is an alpha version only dedicated to the team for developing and testing purposes. The registration service is consequently not working.

Mobile/desktop app

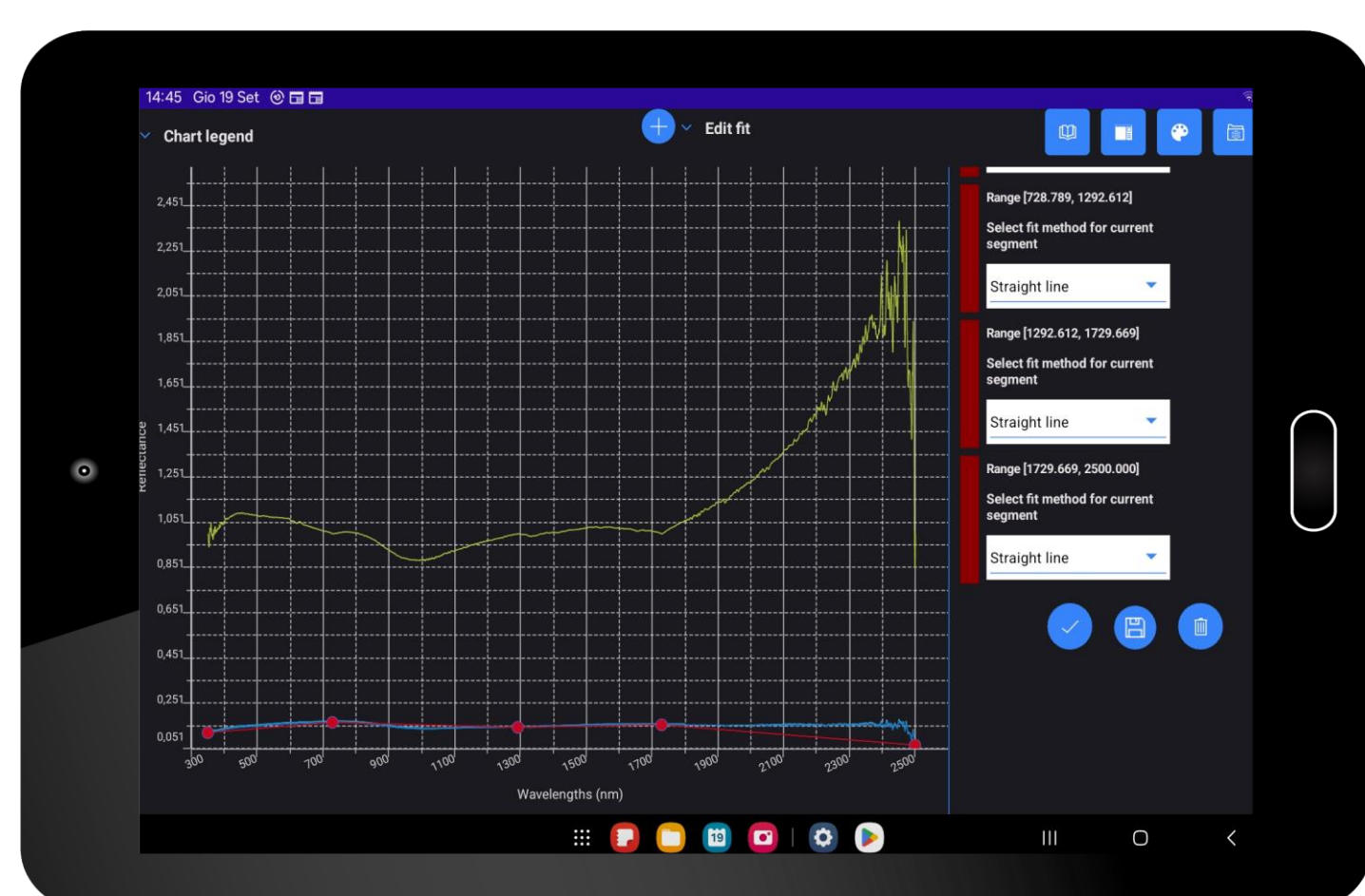


Fig. 2 – View of the data analysis page on a tablet

App development – phase 1

We decided to use a UWP (Universal Windows Platform) app, for the **SLab Tools**, developed to enable laboratory personnel to upload acquired spectra to the database after entering ancillary information. This app also includes basic data analysis capabilities. The decision to develop exclusively for Windows was driven by the limitations of the acquisition software, which operates solely on this platform.

App development – phase 2

Given the highly fragmented nature of operating systems within the research community, we decided to enhance our app to support multiple platforms.

Additionally, inspired by an idea we've been considering for a long time, we are introducing new features to make the app appealing to a broader audience, thus transforming **SLab Tools** in the **HyperLab**.



Fig. 4 – The *HyperLab* system utilizes desktop/mobile application that connect to the database via a web application, which also functions as a REST API.

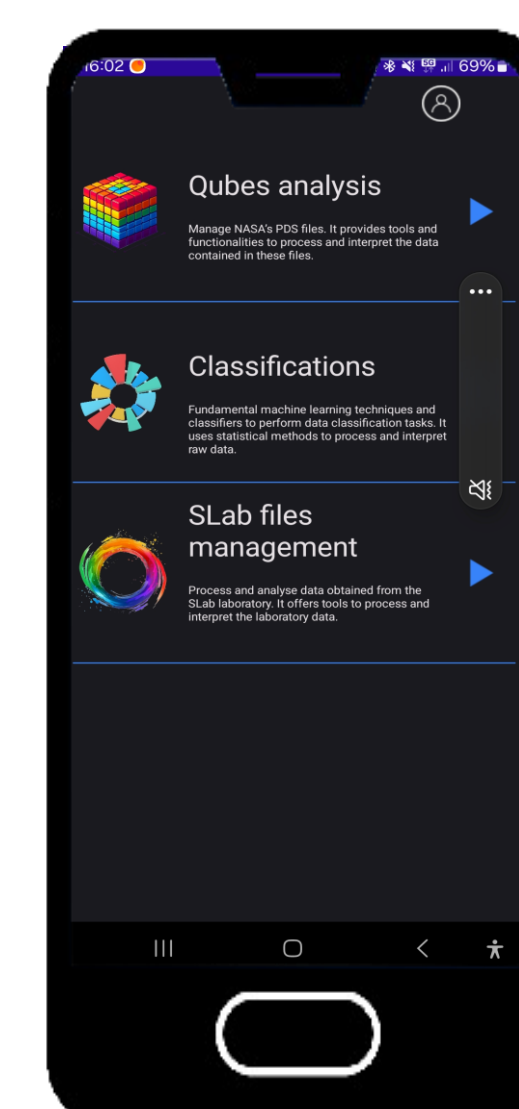


Fig.3 – View of the main menu on a phone

Technologies

This system is a **cross-platform application** designed to manage and streamline business operations. It leverages on:

1. Microsoft **MAUI (Multi-platform App UI)** for the front-end, ensuring a consistent and responsive user interface across Windows, macOS, iOS, and Android devices.
2. The back-end is powered by **ASP.NET**, providing robust and scalable web services and APIs.
3. Data storage and management are handled by **SQL Server**, ensuring reliable and secure data transactions.

Acknowledgements: This project was funded by INAF 2023 under the 'Call for Funding of Fundamental Research 2023', in the *Data Analysis Grant* category

