

Supplementary Information for

Integrated Instrumental Analysis Teaching Platform with Smartphone-Operated Fluorometer

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PUSH NOTIFICATION SERVICE INSTALLATION GUIDE

1. GOOGLE FIREBASE CONFIGURATION

1.1. GOOGLE FIREBASE CONSOLE

Go to [Google Firebase](#) console.

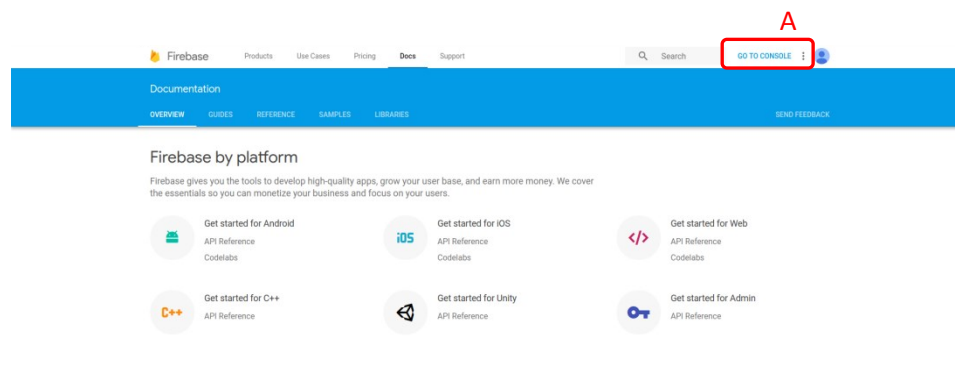


Figure S1 : Access panel to google firebase and its console(A).

1.2. CREATE A PROJECT

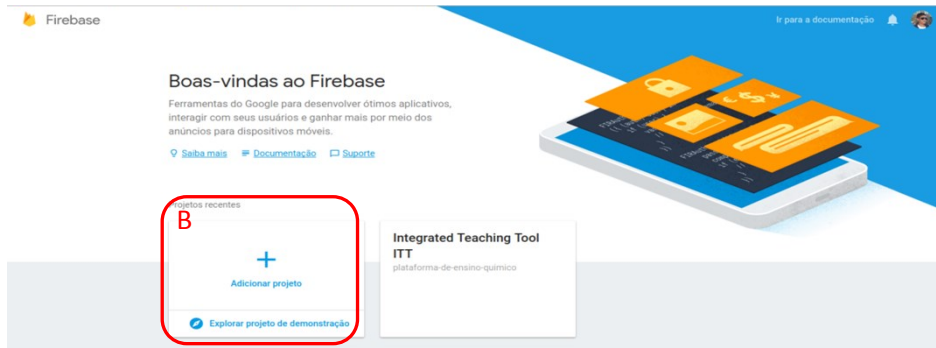


Figure S2: Firebase home page and button to create a new project(B).

1.3. API KEY (SERVER KEY) and GOOGLE PROJECT NUMBER (SENDER KEY)

1.3.1 Go to Project Overview (C) >CLOUD MASSAGING (D)

1.3.2. Copy the **API KEY (E)** and **Google Project Number (F)**

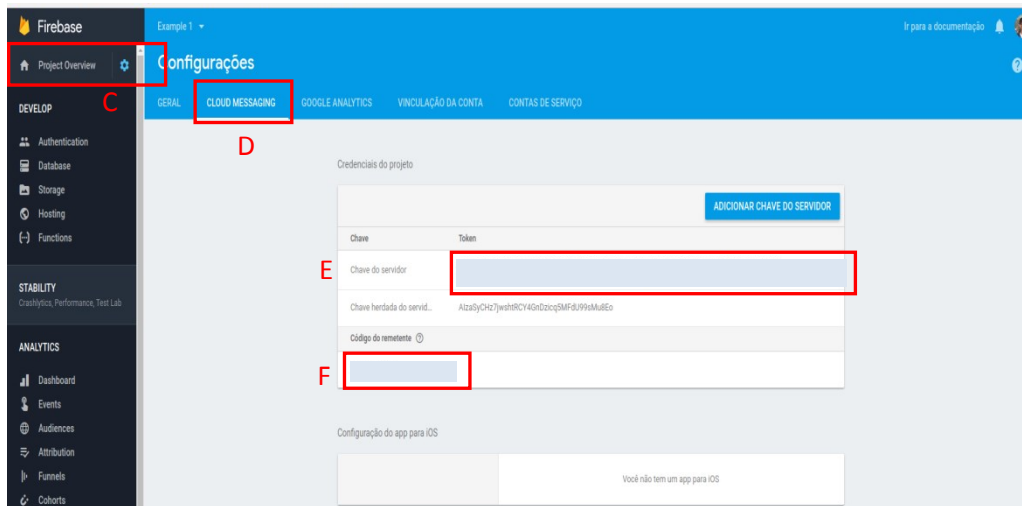


Figure S3: Google firebase panel and its respective Cloud Messaging (D) section where the API KEY (E) and Google Project Number (F) are available.

2. ONE SIGNAL PLATFORM CONFIGURATION

2.1 OneSignal platform

Access the OneSignal platform and click in GET STARTED(G) for mobile notifications.

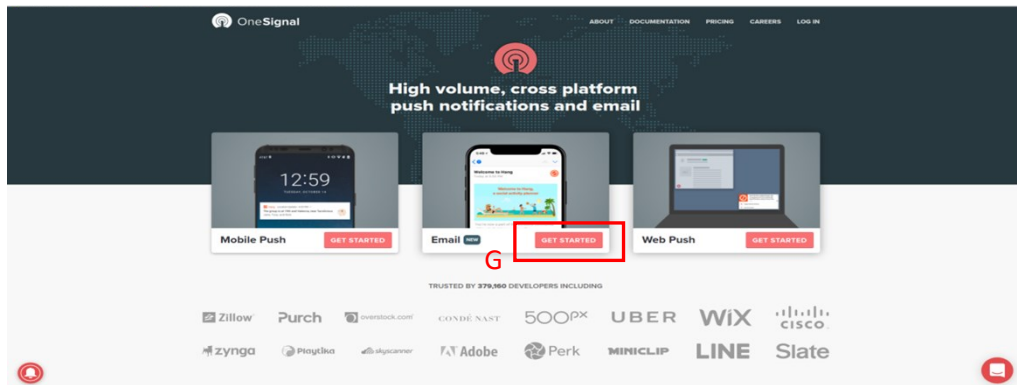


Figure S4: Home page of OneSignal platform and button to initialize the service (G).

2.2 CHOOSE THE PLATFORM

Select the Google Android (H) as platform and click in next button (I).

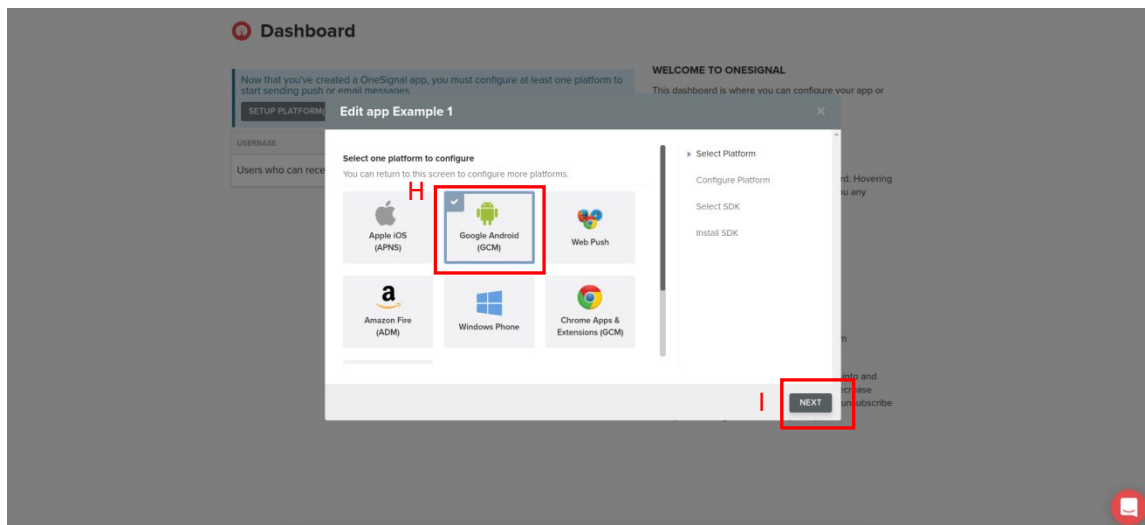


Figure S5: Screen to select the platform.

2.2.1 Google Android (GCM) configuration

Paste the **API KEY** and **Google Project Number** from item 1.3.2 in their respective fields (J).

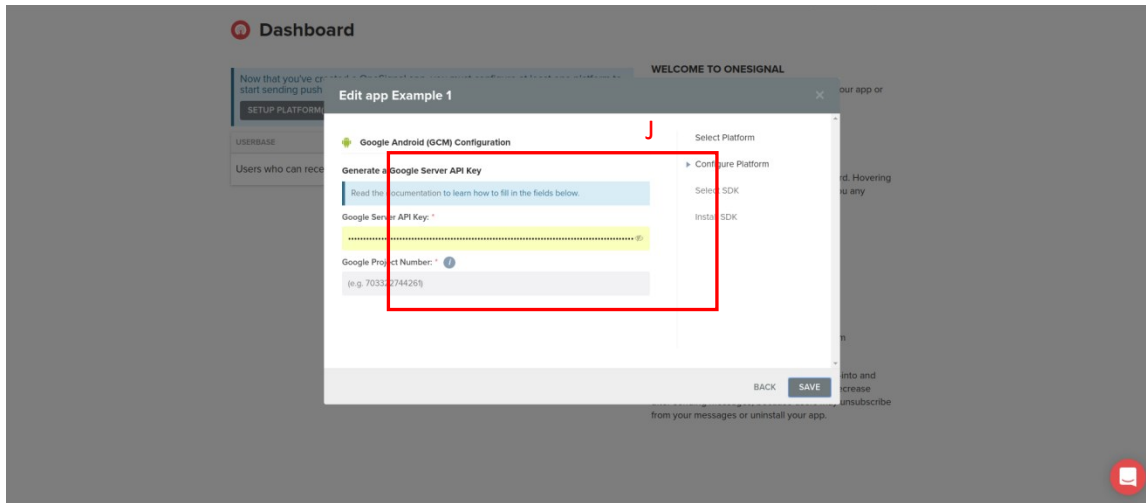


Figure S6: Fields to insert the API KEY and Google Project Number.

2.2.2 Choosing the software development (SDK)

Select the Server API (K).

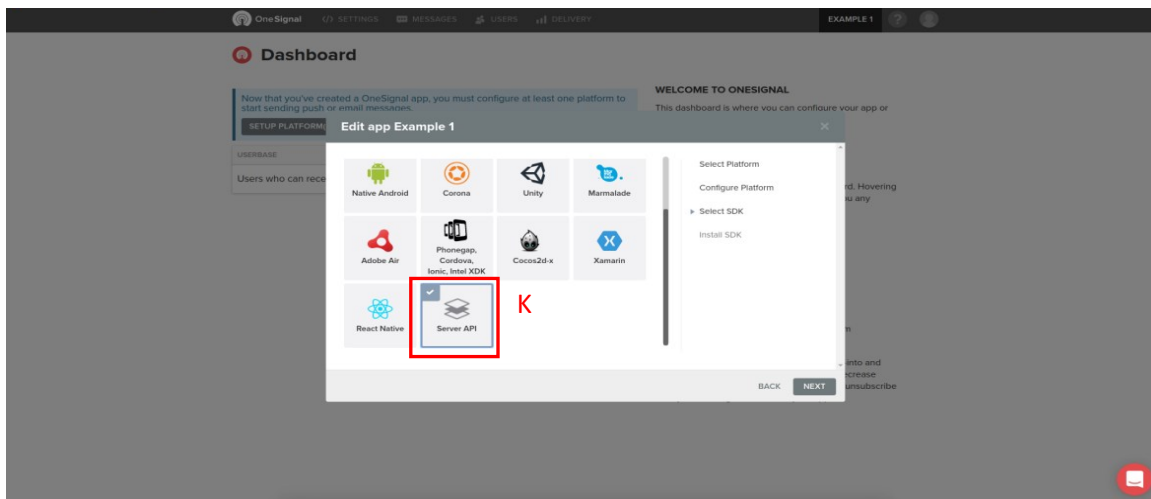


Figure S7: Server API (K) panel selecting.

2.2.3. Server API Integration

The **APP ID** (L) must be saved because it is the key's identification of push notification system. This key must be implemented on the app software.

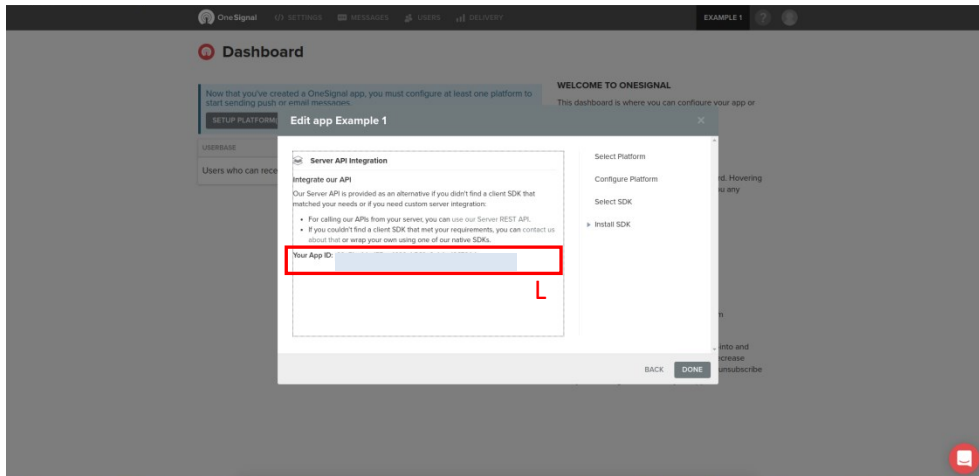


Figure S8: Server API integration and its App ID (L)

3. Configuration on the Android App

In the thinkable platform you must add the OneSignal Plugin (M) in the application's source code. Then, paste the API ID from item 2.2.3 in the box properties (N).

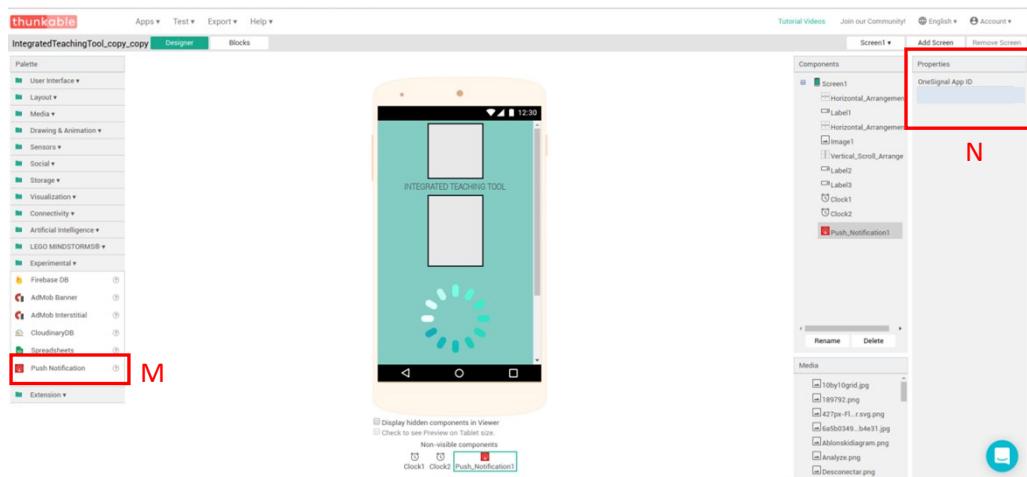


Figure S9: Thinkable online environment with their respective section to add the plugin (M) and properties box (N) to paste the App ID.

OneSignal Dashboard

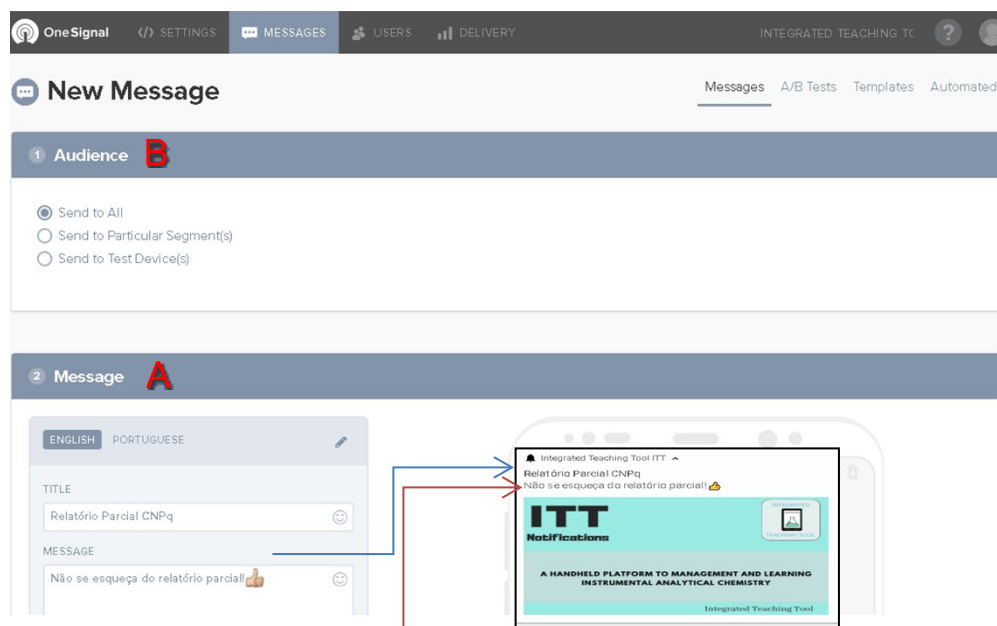


Figure S10: Dashboard responsible for send notifications to the ITT app. Once logged, the administrator can select the target group (B) and write the notification by the message box (A).

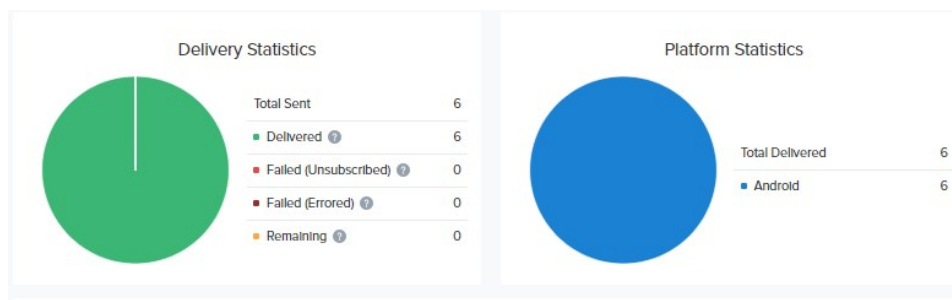


Figure S11: Delivery section where is possible to view message's statistics.

Sample Educational Modules

The proposed app can be tailored to display any material considered appropriate for the students in a particular class. Although these materials are constantly updated, a good example of an open source text is:

- Chapter 10F in Analytical Chemistry 2.1, David Harvey, DePauw University, 2016
http://dpuadweb.depauw.edu/harvey_web/eTextProject/AC2.1Files/AnalChem2.1.pdf

This can be also complemented by several educational articles and simple examples, where the technique is also discussed:

- Protein tryptophan accessibility studied by fluorescence quenching, Matías Möller Ana Denicola, Biochemistry and Molecular Biology Education 2002, 3, 175–178, (<https://doi.org/10.1002/bmb.2002.494030030035>)
- Primary and secondary inner filtering. Effect of $K_2Cr_2O_7$ on fluorescence emission intensities of quinine sulfate, Sheryl A. Tucker, Vicki L. Amszi, and William E. Acree, J. Chem. Educ. 1992, 69, 1, A8 (<https://doi.org/10.1021/ed069pA8>)
- Fluorescence and Light Scattering, Ronald J. Clarke and Anna Oprysa, J. Chem. Educ. 2004, 81, 5, 705 (<https://doi.org/10.1021/ed081p705>)
- Fluorescence, Absorption, and Excitation Spectra of Polycyclic Aromatic Hydrocarbons as a Tool for Quantitative Analysis, A. M. Rivera-Figueroa, K. A. Ramazan, and B. J. Finlayson-Pitts, J. Chem. Educ. 2004, 81, 2, 242 (<https://doi.org/10.1021/ed081p242>)
- Fluorescence Spectroscopy in a Shoebox, M. Farooq Wahab, J. Chem. Educ. 2007, 84, 8, 1308 (<https://doi.org/10.1021/ed084p1308>)
- FluSpec: A Simulated Experiment in Fluorescence Spectroscopy, Stephen W. Bigger, Andrew S. Bigger, and Kenneth P. Ghiggino, J. Chem. Educ. 2014, 91, 7, 1081-1083 (<https://doi.org/10.1021/ed400748d>)
- Fluorescence Spectroscopy: A Rapid Tool for Analyzing Dairy Products, Charlotte Miller Andersen and Grith Mortensen, J. Agric. Food Chem. 2008, 56, 3, 720-729 (<https://doi.org/10.1021/jf072025o>)

Optoelectronics components

The radiation source of our equipment it is a high-power ultraviolet Led that emits a narrow wavelength at 365nm. Wherefore, an excitation monochromatic filter is unnecessary. The optoelectronics components are following in Figure 3.,

<p style="text-align: center;">UV LED</p> 	<p style="text-align: center;">Specifications</p> <p style="text-align: center;">365 +- 5nm</p> <p style="text-align: center;">1W</p>
<p style="text-align: center;">Detector + filter</p> 	<p style="text-align: center;">Specifications</p> <p style="text-align: center;">Spectral responsivity: 300 to 1100nm</p> <p style="text-align: center;">420 high pass filter</p>
<p style="text-align: center;">Photodiode spectral response</p>	<p style="text-align: center;">Secondary filter transmittance</p>

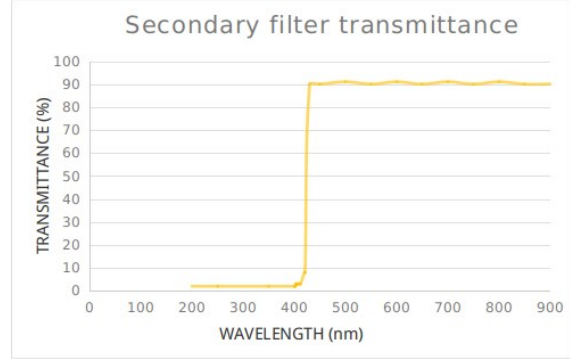
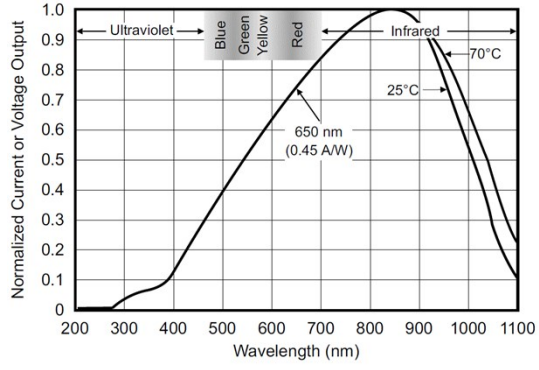


Figure 3: Optoelectronics components and technical information about the instrument developed.