

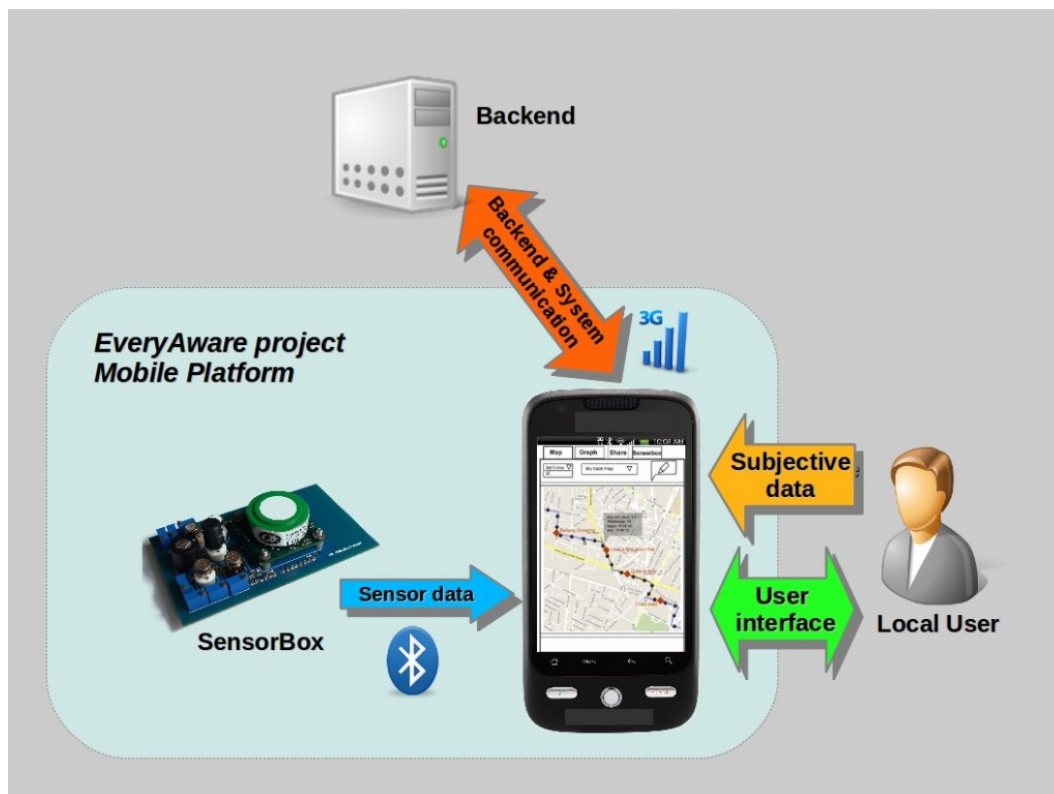


Guidelines for using AirProbe

AirProbe is an Android smartphone application that allows the user of an EveryAware sensor box to monitor Air Pollution and enrich the readings with personal annotations. It represents the interface between the sensor box and the main server and it is primarily designed to:

- display information about the current air quality;
- record the user trip: Air Probe receives geo-referenced data collected in real time from the sensor box and shows them on a map;
- upload the recorded trips to the EveryAware servers;
- allow the user to annotate their journey.

Actions such as establishing the Bluetooth connection, recording a trip, viewing it on a map and inserting a personal annotation are easily performed using a few steps.



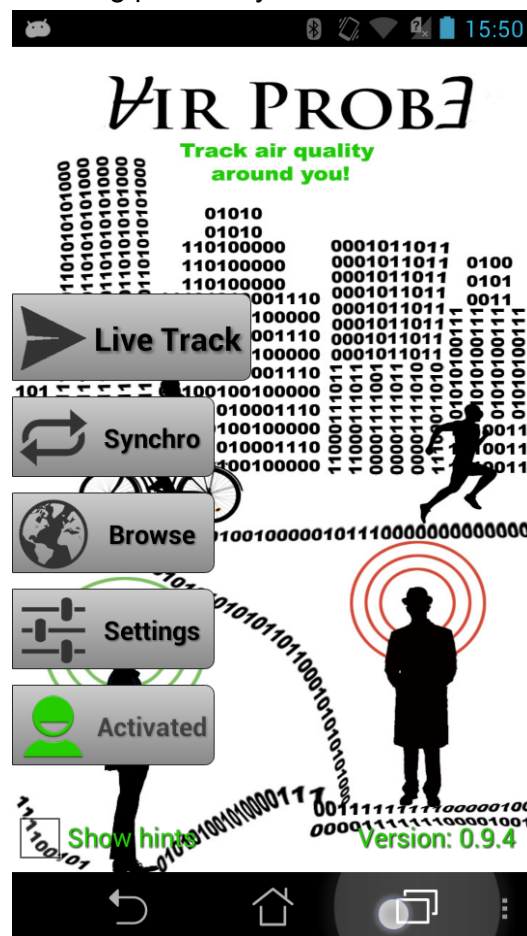
1. Requirements

- i) Device running Android 2.3.3 (or above), with at least 512 Mb of RAM and 320x480 pixel minimum screen resolution to run AirProbe; the app is essential to send collected data to the server but has some functionalities such as map and graph views to let the user monitor data. It also calculates the estimated Black Carbon level from the raw sensor box input and shows it to the user.
- ii) sensor box to record pollution levels and tracks; it can work 'alone' or 'coupled' with AirProbe via a Bluetooth connection. When working alone, the sensor box stores on its own memory card what we call 'history records'. When it is coupled, it sends both real time and history records to the phone.
- iii) An active account on our official website www.airprobe.eu.

2. Working modes

When AirProbe is launched, the user can choose from a set of 3 different working modes:

- i) *Live track*: to open a Bluetooth connection to a running sensor box and receive real time and history data from it.
- ii) *Synchronization*: to open a Bluetooth connection to a running sensor box with the aim to download history data from the sensor box and send them to the server.
- iii) *Browse*: to explore the map while visualising black carbon measurements around the current user position and browsing previously recorded tracks.

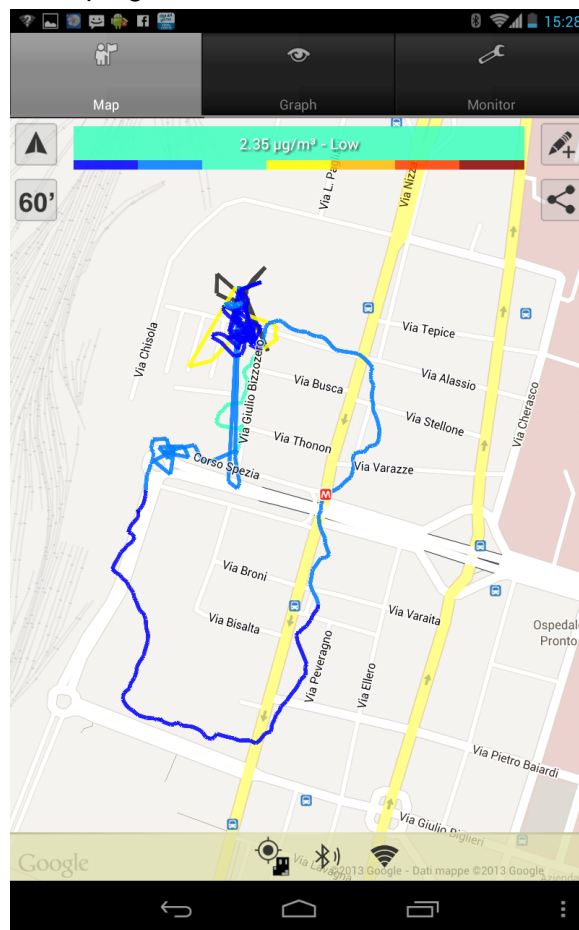


3. Live Track mode

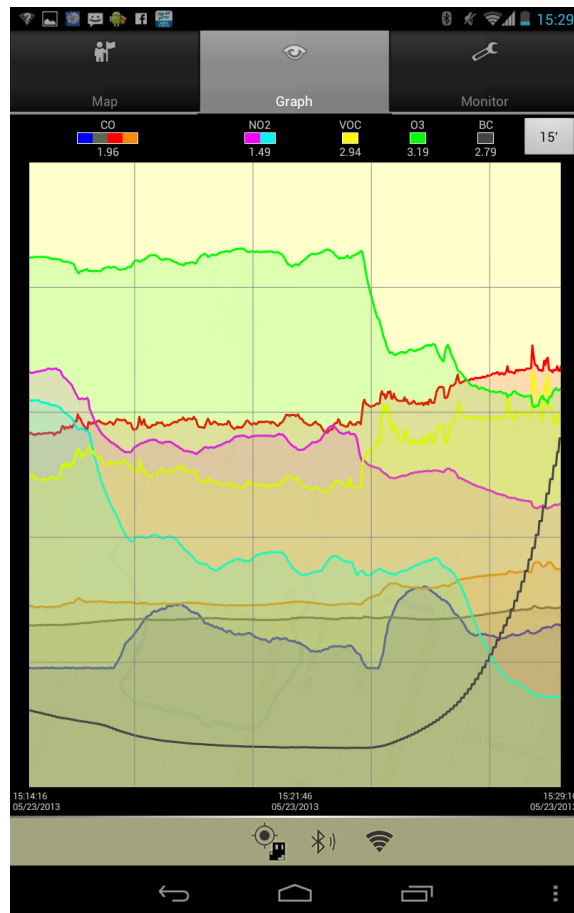
In Live track mode, AirProbe receives data collected in real time from the sensor box it is connected to. There are three different views accessible from the tabs, from left to right:

Map tab: the users can follow their live track, made of segments represented with different colors, depending on real time Black Carbon levels. They can also write annotations and share them on Facebook/Twitter (buttons on top right corner). The represented track length can be of 5, 15, 60 minutes. Camera tracking can be switched on/off (these functions are controlled by the top left buttons). Located at the top center, the Black Carbon value measured in real time is visible, together with a colored scale.

This tab also allows for annotating, i.e. adding tags to, the current point in the track, by clicking on the 'pencil' button at the top right.



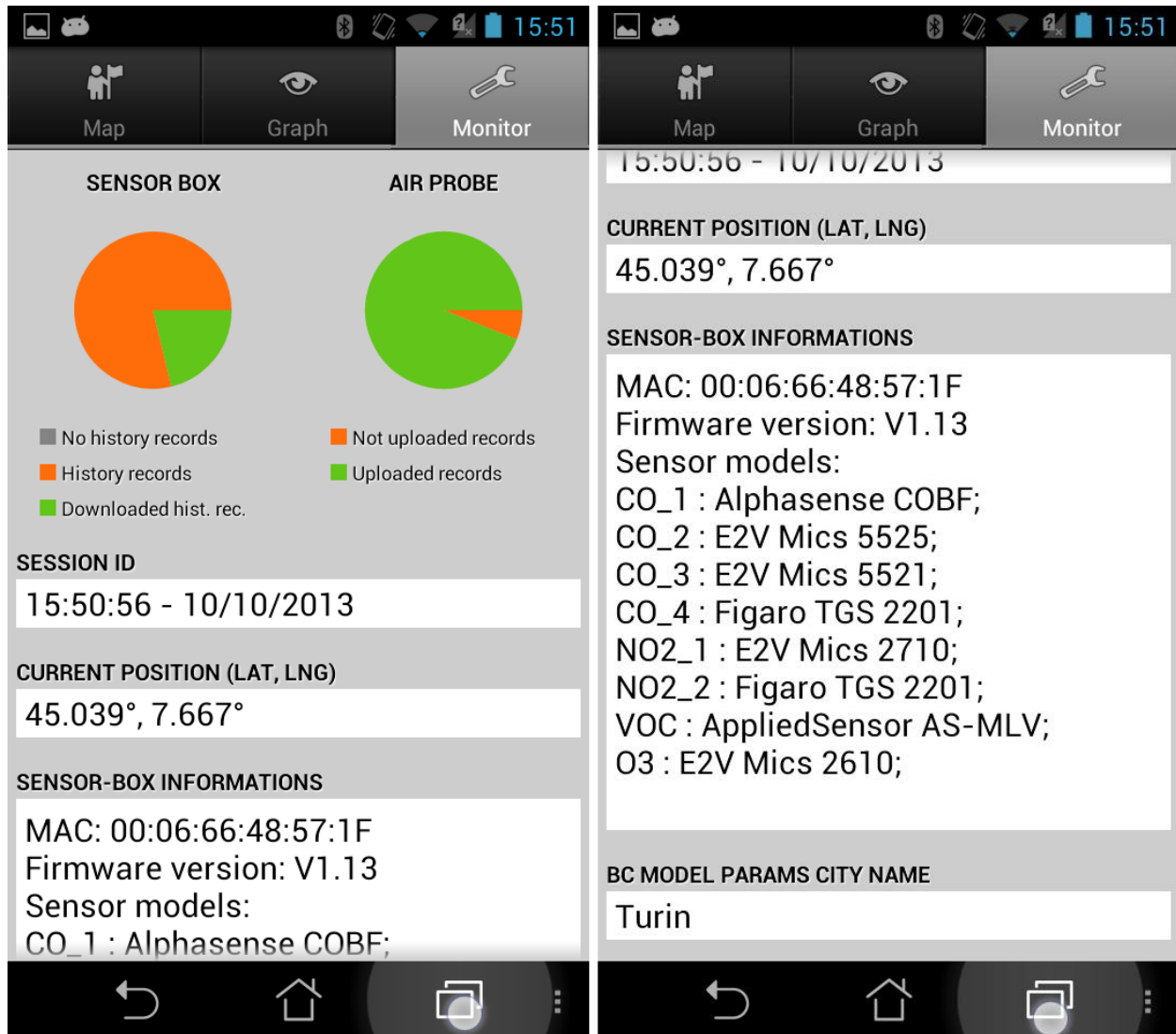
Graph tab: it shows a graph of the estimated Black Carbon and raw data from individual sensors, over a variable range of time, i.e. for the last 1 to 30 minutes. This range can be changed by clicking on the button located at the top right of the screen. The user can query the value of each sensor by tapping on the series. The graph is updated every two seconds. The values are also shown at the top for each pollutant (average over the multiple sensors, where it is the case).



Monitor tab: it shows statistics about the current connection such as:

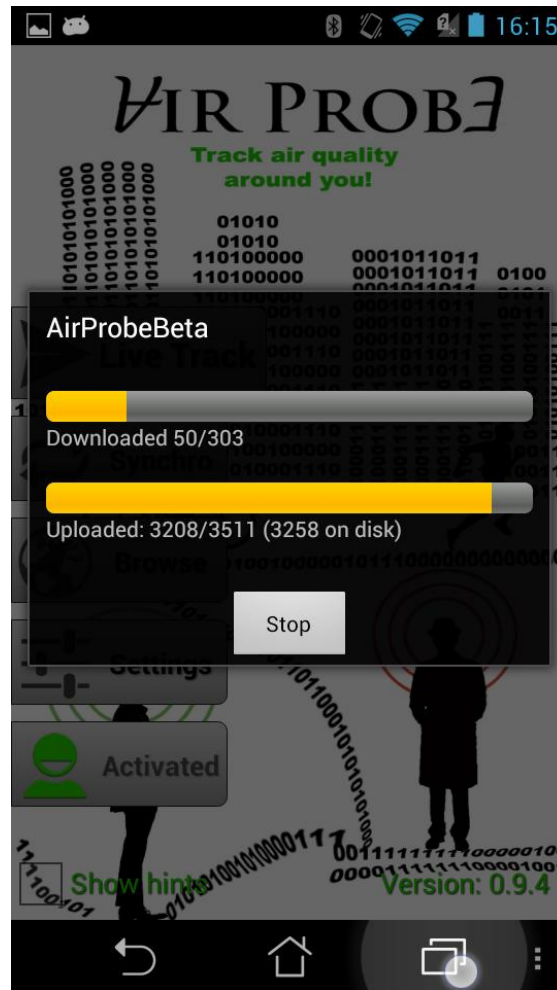
- number of collected history records saved on the sensor box and how many of these have been sent to AirProbe. One data point corresponds to one measurement, performed every second.
- number of records saved in the AirProbe internal database and how many of these have been sent to the server

This view also shows information about the sensor box: MAC address, firmware version, installed sensor models, the city on which the Black Carbon calculation model is applied.



4. Synchronization mode

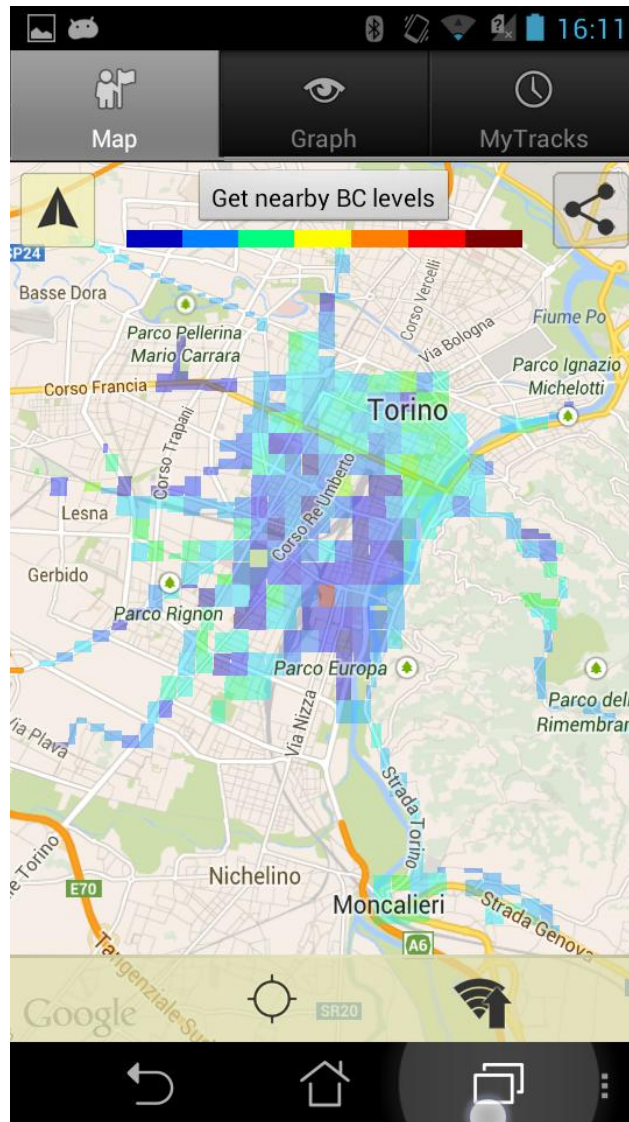
This working mode allows AirProbe to download history records from the sensor box, which have been recorded when the sensor box was powered on without an active Bluetooth connection to the app. When AirProbe receives data from the sensor box, it stores them in its internal database and sends them to the server when an Internet connection is available. By default the data is uploaded to the server only when there is an active WIFI connection, however this can be changed to use the data network, from the app settings.



5. Browse mode

This working mode is the only one that does not require a Bluetooth connection to the sensor box. The three following views are accessible from corresponding tabs:

- *Map*: the user can see the Black Carbon levels around his current position, obtained from the server by pressing "Get nearby BC levels" button. If a track from the "MyTracks" tab has been previously selected, this is also displayed on the map.
- *Graph*: it shows the behavior of the raw pollutants and Black Carbon, if calculated, for the track selected in the 'My Tracks' tab (only tracks recorded in the coupled mode have BC values computed, so only these will show on the map or in the graph)
- *My Track*: it offers the list of tracks available in the AirProbe internal database (on the mobile device). This lists all tracks that have not been uploaded to the server yet, plus those that have been uploaded but are newer than the 'Uploaded records max age' value in the Settings (by default 24 hours).



6. Settings

The settings mode allows users to change the settings of the application. These are:

- i) **Upload records max age**: when a record is sent to the server, it is not deleted from the AirProbe internal database until it is considered "old". This value defines when a sent record is old and next to be deleted. If a user has a low performance phone, the value can be decreased to 6 or 12 hours. Otherwise, this value can be increased to 36 hours if the user wants to have a larger number of tracks available in Browse mode
- ii) **Store'n'forward frequency**: records are not sent continuously to server, but they are organized into packets and sent every N seconds. For example, if AirProbe works in Live track mode, it is receiving one record per second and, every 30 seconds, these records are packed and sent to the server, if store'n'forward frequency is set to 30. Other values are: 15s, 60s, 5m and 1s. History data are sent to the server in the same manner (they have bigger priority in this process, because they are older than real time data).
- iii) **Upload data on**: limit data uploads to the server only to wifi networks or allow both wifi and mobile networks.

- iv) *History data download*: it affects only Live track mode; if turned on, the sensor box sends to AirProbe also history records (if any) together with real time records. Otherwise history records will be only uploaded in Synchronization mode. By default this option is *On*.
- v) *Enable network gps*: if on, gps fixes coming from Network provider are used. They can come from CellID, WiFi access points, A-Gps system
- vi) *Direct connect to sensor box*: it contains the data of the saved sensor box Mac address to speed up the start of the Bluetooth connection

7. Activate AirProbe login

To access Live track and Synchronization modes, AirProbe needs to be activated. To do this, the user needs an active login on our official website (www.airprobe.eu). The creation of an account can be done via a browser or from AirProbe, while the activation phase is done only by AirProbe. There is a wizard that guides the user in all steps. Activation cannot be undone, unless the user uninstalls the app.