NoiseTube User Guide

Written by Matthias Stevens

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Welcome!

Thanks you for your interest in NoiseTube! In this document we introduce the basic concepts and goals of the project, and, most importantly, we explain how *you* can contribute to this innovative research project.

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1. Introduction

NoiseTube is a research project of the Sony Computer Science Laboratory in Paris[1] in collaboration with the Vrije Universiteit Brussel[2]. The project is focused on developing a new participative approach for monitoring noise pollution involving the general public. It fits within the emerging research field of participatory and people-centric sensing.

Our goal is to extend the current usage of mobile phones by turning them into noise sensors enabling each citizen to measure his own exposure in his everyday environment and participate in the collective noise mapping of his city or neighbourhood.

In this document we explain how you, whether you are an average citizen, a city official or a researcher, can get involved in an contribute to the NoiseTube project. The document is conceived as a manual for the NoiseTube platform which consists of a web application and an application for mobile phones.

[1] Sony CSL Paris: http://www.csl.sony.fr
[2] VUB: http://www.vub.ac.be ; ARTI lab: http://arti.vub.ac.be ; SOFT lab: http://soft.vub.ac.be

2. Getting started

Here we explain the basic features of the NoiseTube web application, accessible on www.noisetube.net.

2.1. Exploring the Web application

The address of the NoiseTube web application is www.noisetube.net. If you go here you will be welcomed by the home page, as shown on Figure 1, which introduces the project in English and French. You can always go back here by clicking on the **About** link (or one of the flags) in the menu bar on top of the website. More importantly, using the menu bar you can navigate to the different parts of the website:

Figure 1. NoiseTube web portal homepage

- **Cities**
  Here you can explore noise (pollution) exposure data per city. The list is sorted according to the number of contributions that have been made for each city.
- **People**
  Here you can explore noise (pollution) exposure data contributed by different NoiseTube members. The list is sorted according to the number of contributions that have been made by each member. Clicking on a member's name will take you to that persons ELog page (see 2.3.1) where you can see his or her shared contributions.
- **Tags**
  Here we present an innovative feature that allows you to navigate and search through the semantic space consisting of the manual and automatic annotations (tags) that have been associated with the noise exposure data we collect.
- **Download**
  Here you can download the NoiseTube mobile application to install on your phone. Refer to section 3. for information and instructions. While not required it is recommend to first create an account (see below) before downloading the application.
- **Join!**
  Click here to create your own account and become a NoiseTube contributor. Refer to section 2.2.

- **Login**
  Once you have an account, click here to login to access the member-only website features (see 2.3).
- **Help**
  Click here to find the latest version of this user guide.
- **Publications**
  Here you can access the scientific papers that we have published about this project.
- **Team**
  Click here to find out who is behind the NoiseTube project.

2.2. Creating an account

By clicking on the **Join!** Item in the menu bar you will be led to the sign-up form, shown in Figure 2.

Chose a username and a password and provide us with a *valid* e-mail address. Furthermore we like to know which kind of mobile phone you use (brand and model) so we can prioritise further development and testing of our mobile application for the most used phone models. Also please tell us where you live (city, country) so our system can associate your contributions with that place if the data is not geo-tagged already (through GPS or manually).

Finally, to protect NoiseTube from *spambots* and similar internet hazards we ask you to fill out the CAPTCHA field to prove that you are indeed a human being and not a computer program. You can do this by simply typing the "wavy" words which are shown. If the words are not readble you can click on the buttons to either see a new pair of words or to hear them being pronounced.

After filling out the form, click the "Sign up" button.

Figure 2. NoiseTube sign-up form

2.3. Member-only Web application features

After creating an account you can begin to explore the member-only features of NoiseTube. To do this click the **Login** button on the menu bar, type in your username and password and click the "Log in" button. In case you forgot your password there is a link you can click to receive a new password by e-mail.

2.3.1 Your eLog

After logging in you will end up on your personal *ELog* page. Taking inspiration from the term *(we)blog*, we came up with the concept of an *environmental* or *exposure log*, or ELog for short.

If you just created an account your ELog will still be empty but this is the place where you can see an overview of all the measurement sessions (called *tracks*) that you have contributed to NoiseTube. Figure 3, on the next page, shows a screenshot of a ELog with content. For each track a summary of the measurements is provided, including a loudness histogram, total duration, distance covered, average loudness, etc. Also different types of contextual tags associated with the data in this track are shown:

location tags, time tags, social tags inputted by yourself, etc. Furthermore, if the track was recorded with GPS coordinates an small map will show the location where the track was made and a big map in KML format (see 0) can be download. Since NoiseTube contributors have ownership over their contributions you can download the data (in JSON format) by clicking on the "Data" link and you are also free to delete any of your previously recorded tracks by clicking de "Delete" link.

On the left side of the ELog page overall summary information is shown about your activity, frequently occurring tags and the daily distribution pattern of your exposure to noise. There is also a "Upload data" link which takes you to the page where you can upload tracks file recorded on your phone using NoiseTube Mobile (in file saving mode, see 0).

You can always go back here by clicking on the **Your ELog** link in the menu bar.

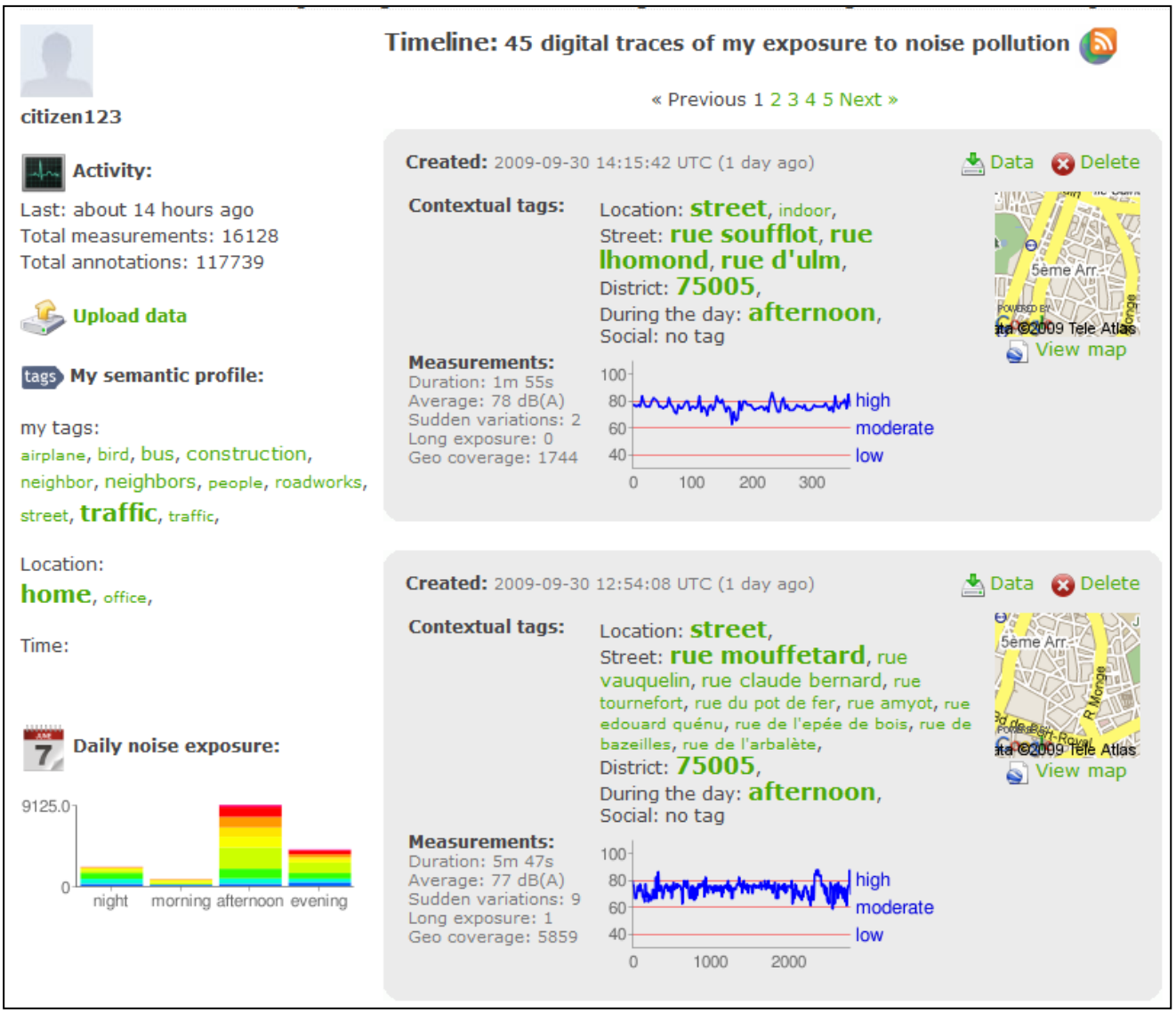


Figure 3. Personal environmental/exposure log or *eLog*

2.3.2 Your profile

By clicking on the **Your profile** link in the menu bar you will end up on a page where you can edit your profile details (e.g. city/country, type of phone) and upload a personalised avatar picture.

2.4. KML maps

For the Cities, People and Tags page, as well from your own ELog you can download maps in KML format. These maps can be viewed, navigated and analysed using the Google Earth[3] software.

The maps have multiple layers, such as loudness levels, social tagging, contributors, street and district aggregations, etc. Floating above the map a dynamic legend is shown consisting of a pie chart with the most frequently occurring social tags, a loudness distribution graph and loudness scale bar.

Figure 4, shown as example of such map display by Google Earth.

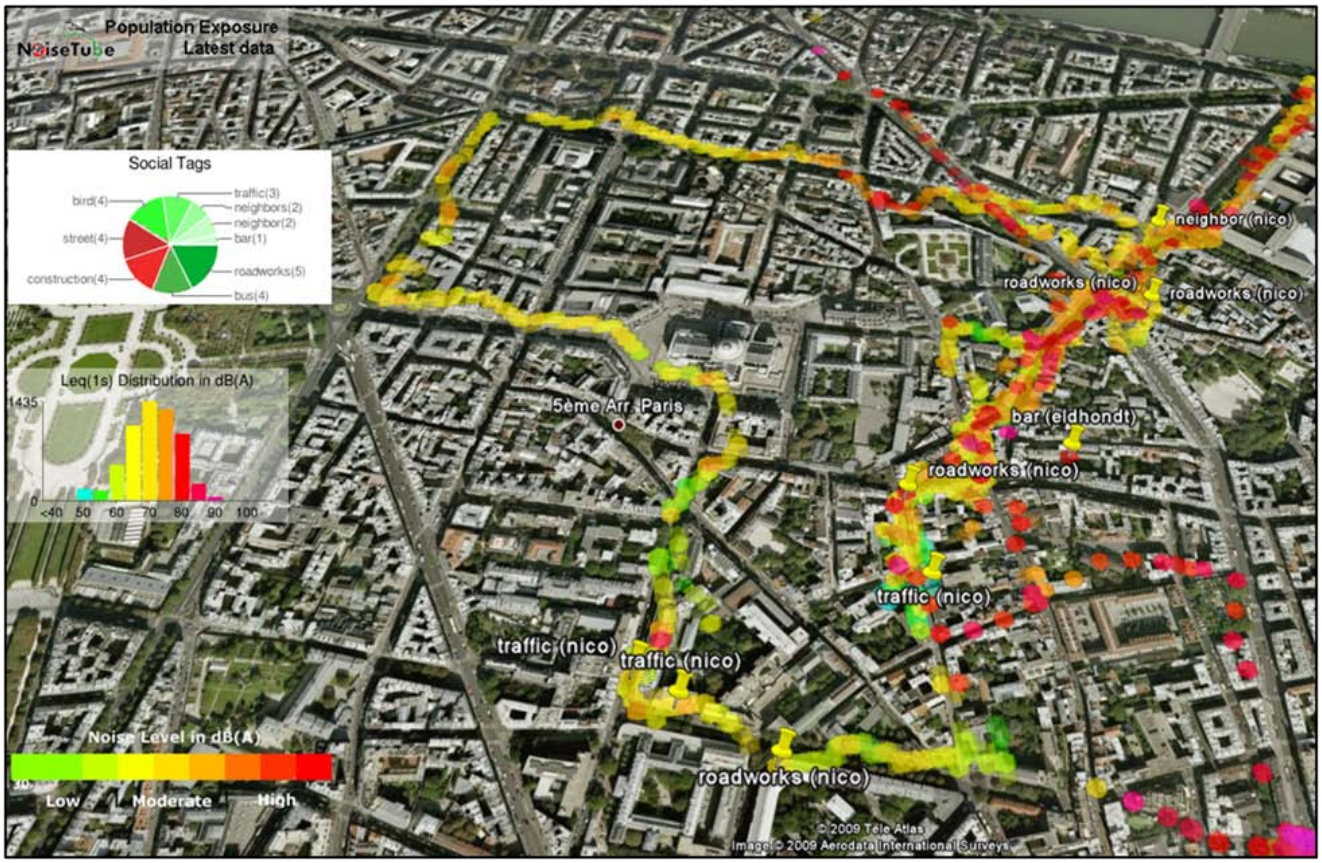


Figure 4. Noise exposure map of Paris (5th arr.), in Google Earth

[3] http://earth.google.com

3. Mobile Application

This section introduces NoiseTube Mobile, its technical requirements and how to download, install, configure and use it. Currently this application is only available for the Java (J2ME CLDC/MIDP) platform. While we might develop version for other platforms (e.g. iPhoneOS or Android) in the future all information in this section applies to the current Java version.

3.1. Requirements

3.1.1 General requirements

Here is an overview of the general hardware, software and user requirements for using Noise Mobile on mobile phones:

Hardware:

- Fast CPU (recommended types/clock speeds to be determined)
- Enough memory (recommended size to be determined)
- *Optional* – GPS receiver (built-it or external connected over Bluetooth)
- *Optional* – Bluetooth (for external GPS)

Software/platform:

- Java 2 Micro Edition (J2ME) support, with:
  - Connected Limited Device Configuration (CLDC), v1.1 or higher
  - Mobile Information Device Profile (MIDP), v2.0 or higher
  - JSR-135 Mobile Media API (MMAPI), v1.0 or higher, with support for recording audio in PCM, WAV, AU or RAW format[4]
  - JSR-75 FileConnection Optional Package (FCOP), v1.0 or higher
  - *Optional* – JSR-179 Location API, v1.0 or higher

User subscription:

- *Optional* – A "data plan" for Internet access to transmit measurement data (alternatively this can be saved to files to be uploaded using a PC and a browser). Note that the amount of data sent by the program is very limited (< 0,5MB per hour of use).

[4] Our noise level computation algorithm only works on uncompressed audio signals (in PCM, WAV, AU or RAW format). Some phones have support for JSR-135 but only allow recording of compressed audio (for example in AMR format) which renders them unsuitable to be used with NoiseTube Mobile.

3.1.2 Supported phone brands, platforms and models

In the table in Figure 5 you can find a summary of all mobile phone platforms, brands and models that may or may not be supported by NoiseTube Mobile at this point. There is still a lot of testing work to be done and we would like to invite anyone who is interested in the NoiseTube project to test the software on phones they have access to and inform us of the results (thanks in advance).

Platform	Platform version	Platform notes	Supported brands/models (at least according to specifications, sometimes tested as well)	Maybe ...
Series 40 (S40)	5th Edition & earlier	No GPS and JSR-179 support, only AMR recording	**None** (unless there is one which records audio in uncompressed format instead of AMR, but as far as we know there is no such S40 phone)	
	6th Edition	GPS and JSR-179 support was added	?	
Maemo	?	Nokia's Linux-based platform. Not yet looked into.	?	
S60/Symbian	S60 2nd Edition (FP1/FP2/FP3) & earlier	Old. Not looked into.	?	Nokia 6260? (testers wanted)
	S60 3th Edition (Symbian v9.1)	Right JSRs should supported (including JSR-179), but all models seem to lack built-in GPS	Nokia E65 (tested & calibrated) Nokia 3250, 5500 Sport, E50, E60, E61, E62, E70, N71, N73, N75, N77, N80, N91, N92, N93	Samsung SGH-i570 (differences with Nokia's running on same platform unknown; testers wanted)
	S60 3th Edition FP1 (Symbian v9.2)	Some models lack built-in GPS	Nokia 6110 Navigator (semi-tested) Nokia N95 (semi-tested) Nokia N95 8GB (tested & calibrated) Nokia 5700 XpressMusic, 6120 classic, 6121 classic, 6124 classic, 6290, E51, E63, E66, E71, E90 Communicator, N76, N81, N81 8GB, N82	LG KS10, KT610, KT615 Samsung SGH-G810, SGH-i400, SGH-i408, SGH-i450, SGH-i458, SGH-i520, SGH-i550, SGH-i550w, SGH-i560, SGH-i568 (differences with Nokia's running on same platform unknown; testers wanted)
		Almost all models have built-in GPS	Nokia N96 (tested & calibrated) Nokia N85 (tested & calibrated) Nokia E75 (tested) Nokia 6220 classic (tested) nokia 5320/5630/5730 XpressMusic (no GPS), 6210 Navigator, 6650 fold, 6710 Navigator, 6720 classic, 6730 classic, 6760 slide, 6790 Surge, E52, E71x, E72, N78, N79, N86 8MP	Samsung GT-i8510 (INNOV8), GT-I7110, Samsung SGH-L870 (differences with Nokia's running on same platform unknown; testers wanted)
	S60 5th Edition (Symbian v9.4)	First S60 models with touch screen	Nokia 5800 XpressMusic (tested & calibrated) / Navigation Edition Nokia N97 Nokia N97 Mini	Samsung i8910 Omnia HD Sony Ericsson Satio (differences with Nokia's running on same platform unknown; testers wanted)
UIQ/Symbian	UIQ 3 (Symbian v9.1)	Old. No longer in development. Only tested model (Sony Ericsson P1i) does not support audio capture.	**None** (Tested Sony Ericsson P1i but it does not work)	
Sony Ericsson Java Platform / Sony Ericsson proprietary OS	JP-2, JP-3, JP-4	Java (J2ME CLDC/MIDP) supported, JSR-75 & JSR-179 support lacking; hardware probably too slow.	**None** Not yet looked into, feel free to test and please report back to us...	
	JP-5, JP-6, JP-7	Java (J2ME CLDC/MIDP) supported, only JSR-179 support lacking; hardware probably still too slow.	**None** Not yet looked into, feel free to test and please report back to us...	
	JP-8, v8.x and higher	Complete Java (J2ME CLDC/MIDP) + JSR support	Sony Ericsson C902 (tested, works but is slow and lacks GPS) Sony Ericsson W995 (tested & calibrated) Sony Ericsson W890i (tested, works fine but lacks GPS)	
Samsung proprietary OS	?	Java (J2ME CLDC/MIDP) supported, JSR support varies (good specs listing needed). Only tested model (SGH-F490) only supports AMR recording.	**None** (Tested Samsung SGH-F490 but it does not work)	
Blackberry	?	Most have Java (J2ME CLDC/MIDP) support, JSR support unclear.	**None** Not yet looked into, feel free to test and please report back to us...	
Windows Mobile	v6 / v6.1 / v6.5	Runs on an large variety of devices from HTC, Sony Ericsson, Acer, Dell, etc. Many hardware and software differences. Java (J2ME CLDC/MIDP) is often supported, JSR support varies and often incomplete.	**None** (Tested Samsung GT-I8000 Omnia II but it does not work, only does AMR recording)	Would be interesting to try out the Sony Ericsson Xperia (testers wanted)
iPhone OS	-	No Java support, software would need to be ported	**None**	
Android	-	Non-standard Java support (not J2ME CLDC/MIDP), software would need to be ported	**None**	

Figure 5. Summary of NoiseTube support on different mobile phone platforms, brands and models

3.2. Downloading, Installation & Permissions

3.2.1 Downloading

To download NoiseTube Mobile, go to the NoiseTube website (http://www.noisetube.net), and click on the **Download** link in the menu bar (or go directly to http://www.noisetube.net/download). On this webpage (see Figure 6) you will find links to 2 varieties of the application: one is for phones with GPS (and JSR-179) support, the other one is for phones without GPS. Click on either one of the links to start downloading. When in doubt, try to look up the specifications of your phone (see 3.1.2). If you prefer to be on the safe side, pick the GPS-less version.

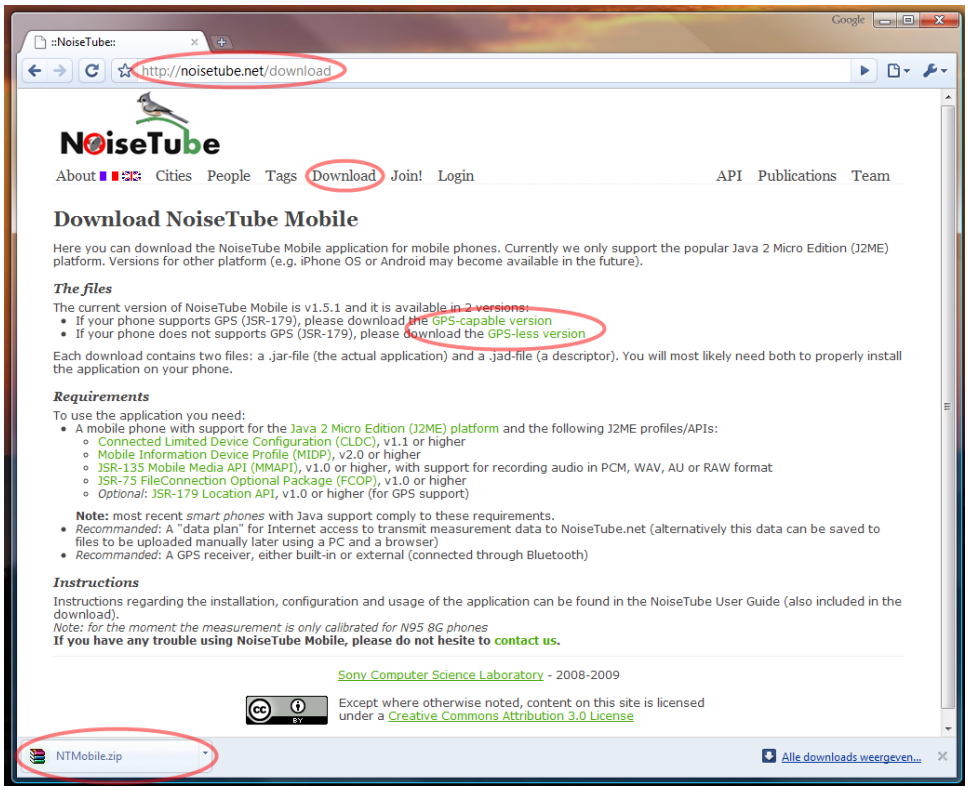


Figure 6. NoiseTube Mobile Download page (http://www.noisetube.net/download)

Your browser will now ask you to confirm that you want to download **NTMobile[GPSless].zip**, a ZIP file containing the application. Save the file to a location on your computer (e.g. on Windows: C:\Users\<You>\Downloads\ or C:\Users\<You>\Desktop) and wait for the download to complete (on broadband this should not take more than a few minutes).

Next, extract the file (using the ZIP extraction feature of Windows or a tool such as WinZIP or WinRAR) to a temporary folder (e.g. C:\Users\<You>\Desktop\NTMobile\) and open the folder (see Figure 7). Inside you will find 3 files:
NTMobile[GPSless].jar (the actual application),
NTMobile[GPSless].jad (a descriptor file) and PDF file containing a copy of this document.

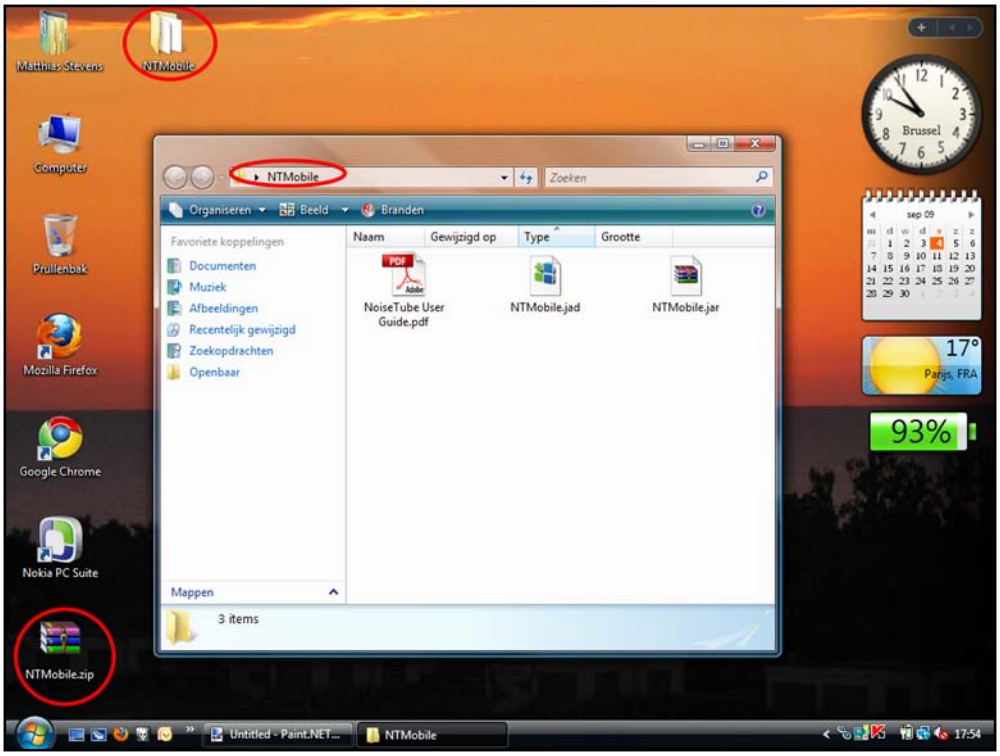


Figure 7. Extracting ZIP file and examining the contents

3.2.2 Installation

Depending on the brand of your phone the installation procedure is slightly different Please follow the instructions for your brand or refer to the generic instructions if your brand is not listed.

A. Sony Ericsson phones

To install the program on Sony Ericsson phones using a Windows computer we recommend using the **Sony Ericsson PC Suite** software. If you do not yet have this software installed go to one of the following links to download the latest version:

http://www.sonyericsson.com/cws/support/softwaredownloads/detailed/pcsuite

Once you have installed Sony Ericsson PC Suite, run the program and follow instructions to connect your phone to your computer (using USB, Bluetooth or Infrared). Once your phone is connected it will show up on top of the PC Suite interface (see Figure 8). Next, go to "Editors", in the menu on the left and then to "Files". You should now see the file transfer interface as shown on the screenshot in Figure 8. In the left part of the interface, navigate to the folder on your computer where you put the NoiseTube Mobile files (see 3.2.1) and select both the JAR and the JAD file. In the right part of the interface navigate to a writable directory (usually "\Other") on your phone's memory (on top) OR on its memory card. Next, hit the arrow button to transfer the files. Your phone may ask you to confirm the transfers (click "Yes").

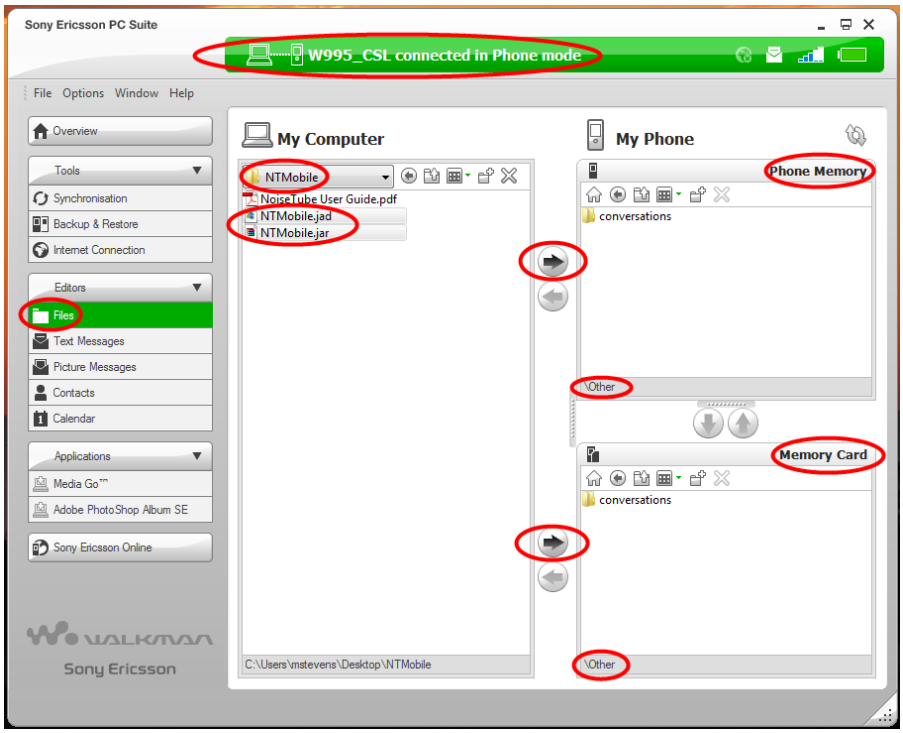
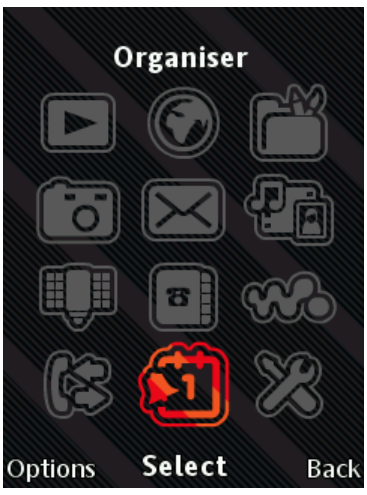


Figure 8. Sony Ericsson PC Suite: transferring application to phone

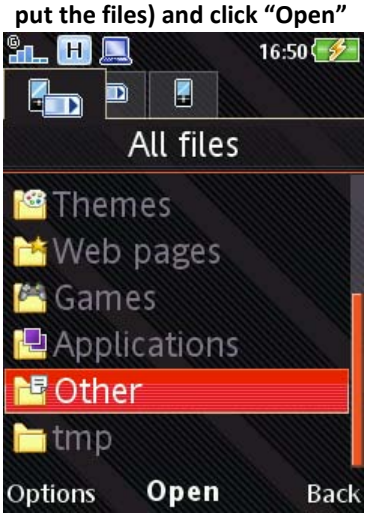
Next, take your phone to complete the installation process by following the instructions in Figure 9.

In your phone's main "Menu", click on the "Organiser" icon



In the "Organiser" menu, go to "File manager" and click "Select"

In the "File manager", navigate to the *Other* folder (or where you put the files) and click "Open"



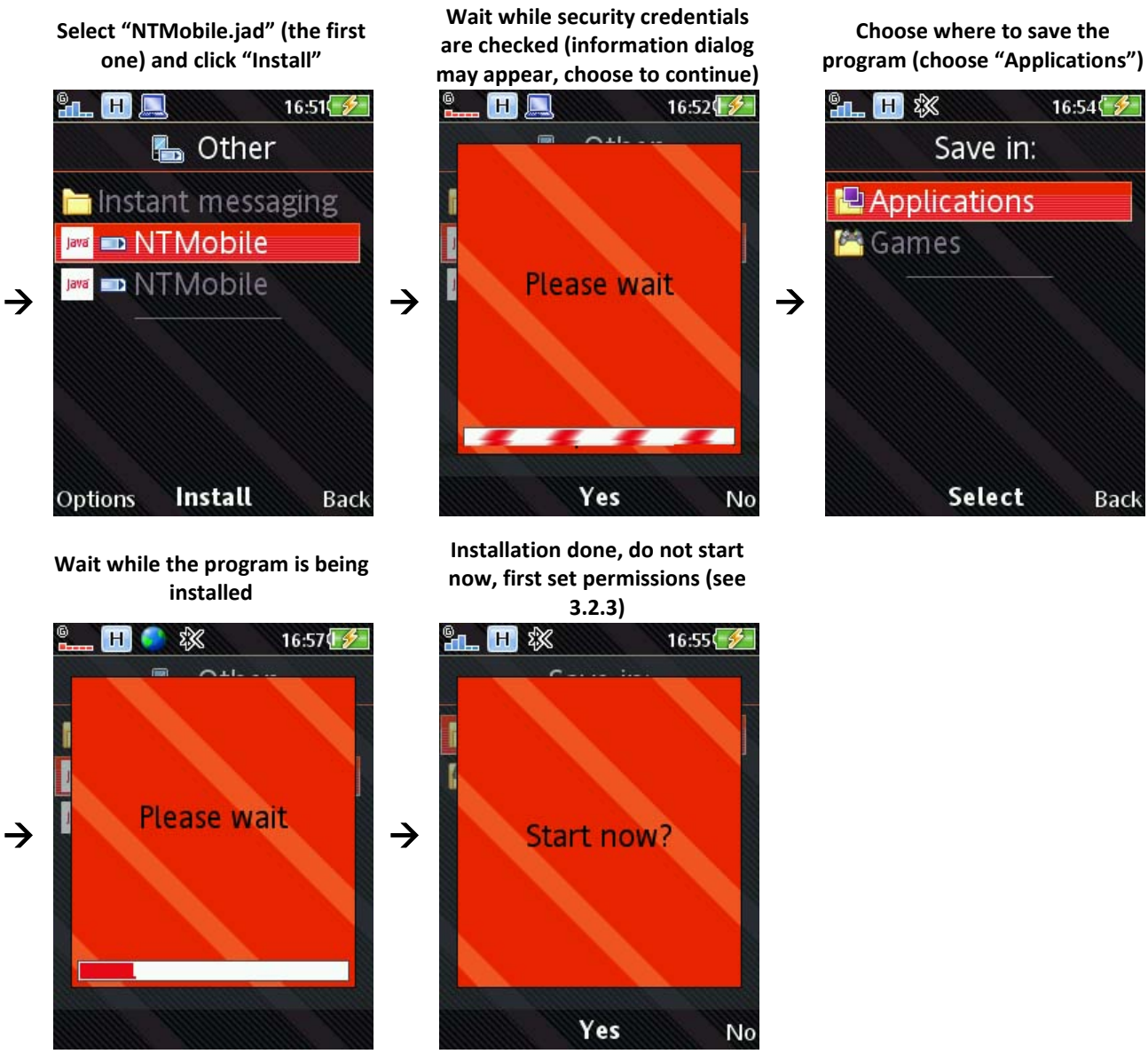


Figure 9. Completing application installation on a Sony Ericsson phone

B. Nokia phones

Installing applications on Nokia phones using a computer running Windows is straightforward using the **Nokia PC Suite**. If you do not yet have this software installed go to one of the following links to download the latest version:

- http://europe.nokia.com/A4144903
- http://www.nokiausa.com/A4986251
- http://www.nokia-asia.com/A4482316

Once you have installed[5] Nokia PC Suite, run the program and follow instructions to connect your phone to your computer (using USB, Bluetooth or Infrared). When the phone is connected it will show up on the top left of the PC Suite interface (see Figure 10). Next click on the icon highlighted in Figure 10 to start the Nokia Application Installer.

You should new see the Nokia Application Installer interface as

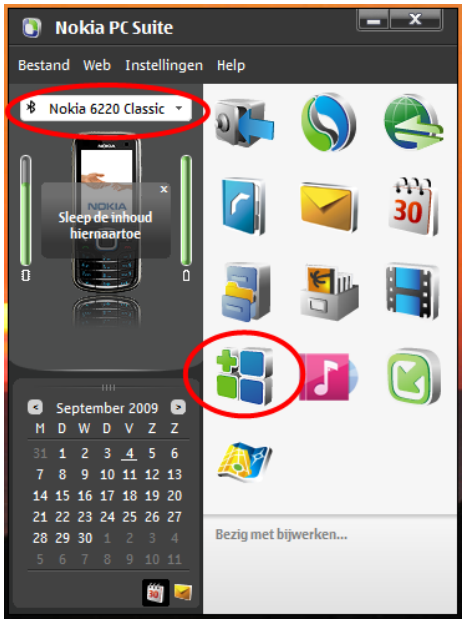


Figure 10. Nokia PC Suite, starting Nokia Application Installer

[5] Installation instructions for Nokia PC Suite can be found here: http://europe.nokia.com/get-support-and-software/download-software/nokia-pc-suites/how-to/get-started/install-nokia-pc-suite

shown by Figure 11. In the left part of the interface, navigate to the folder on your computer where you put the NoiseTube Mobile files (see 3.2.1) and select both the JAR file. In the right part of the interface select your phone if it was not already selected. Next, hit the arrow button to transfer the files.

Next, take your phone to complete the installation process by following the instructions in Figure 12.

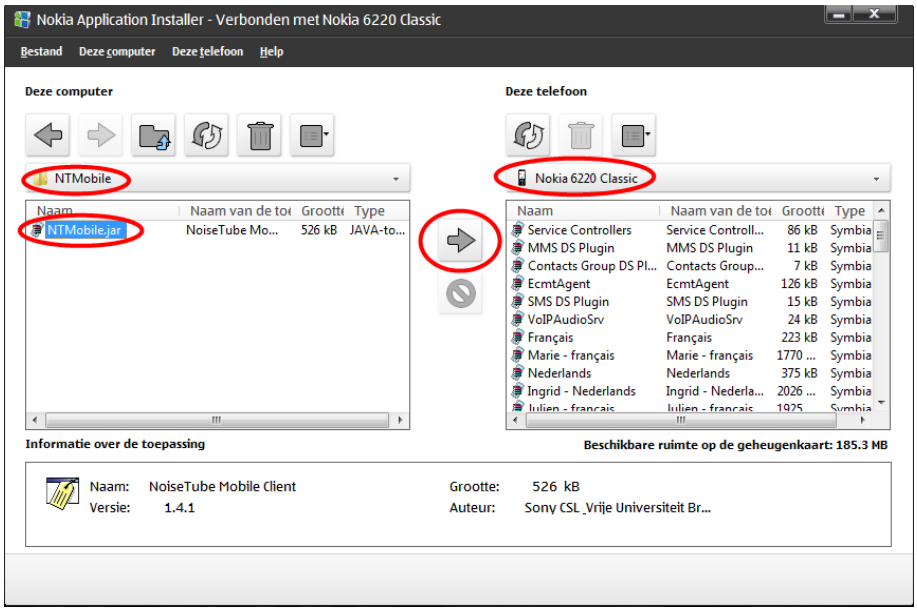


Figure 11. Nokia Application Installer, transferring application to phone

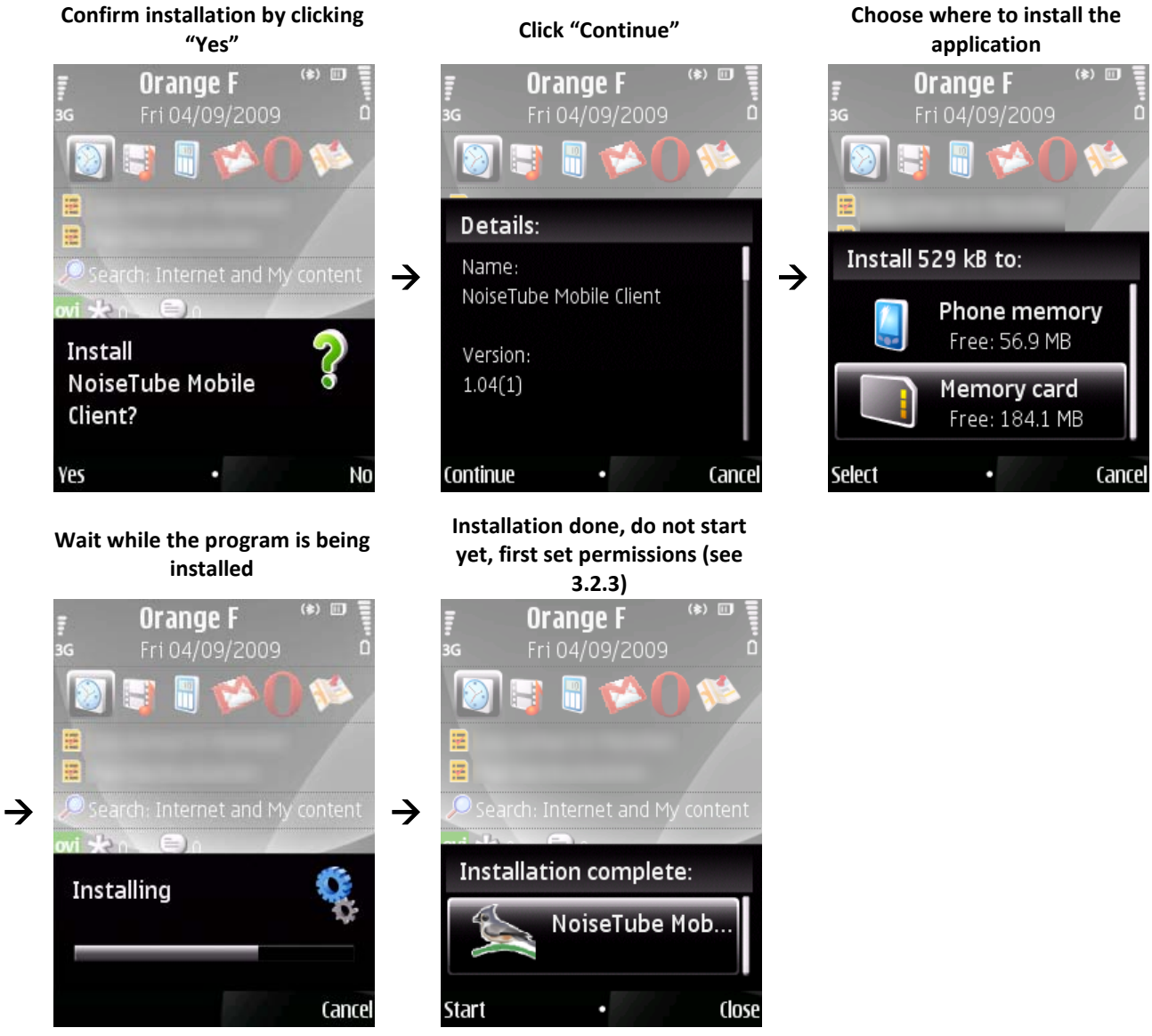


Figure 12. Completing application installation on a Nokia (S60) phone

C. Generic instructions (other brands / manual transfer)

Other brands of phones may also come with specific PC software but discussing them all goes beyond the scope of this document. Therefore we provide generic installation instructions that should work on most phones.

To transfer the application manually to your phone you can either connect it to your computer with a USB cable (if the phone asks you to choose a particular USB mode pick Mass Storage mode), connect it to your computer using Bluetooth (this usually requires vendor specific software to be installed on your computer) or you can take out your phone's memory card and access it with a flash card reader.

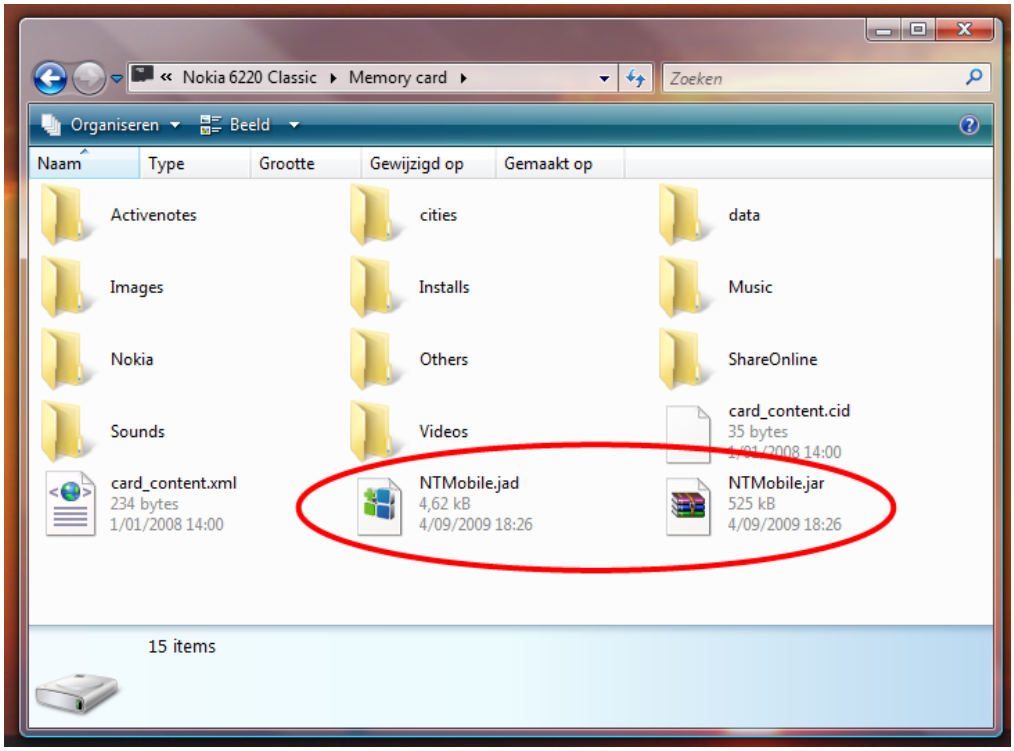


Figure 13. Transferring the application manually

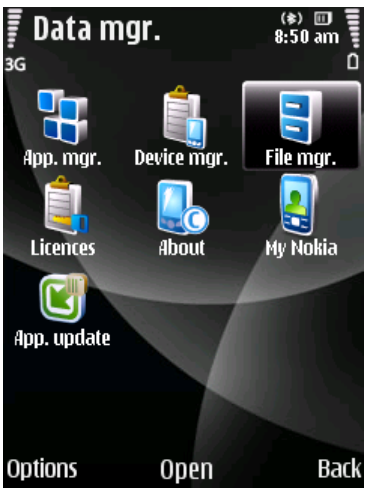
Next, navigate to the phone memory or the memory card starting from My Computer and copy the JAR and JAD files you extracted from the ZIP file to it (see 3.2.1), as shown by Figure 13.

Next, take your phone, put the memory card back in if needed, and use the phone's file manager feature to go to the location where you put the 2 files. Next, select the JAR file and execute it. This will start the installation. Follow instructions on the screen of the phone. Figure 14 shows the process for Nokia phones.

In your phone's main "Menu", click on the "Settings" icon

In the "Settings" menu, click on the "Data manager" icon

In the "Data manager", click on the "File Manager" icon



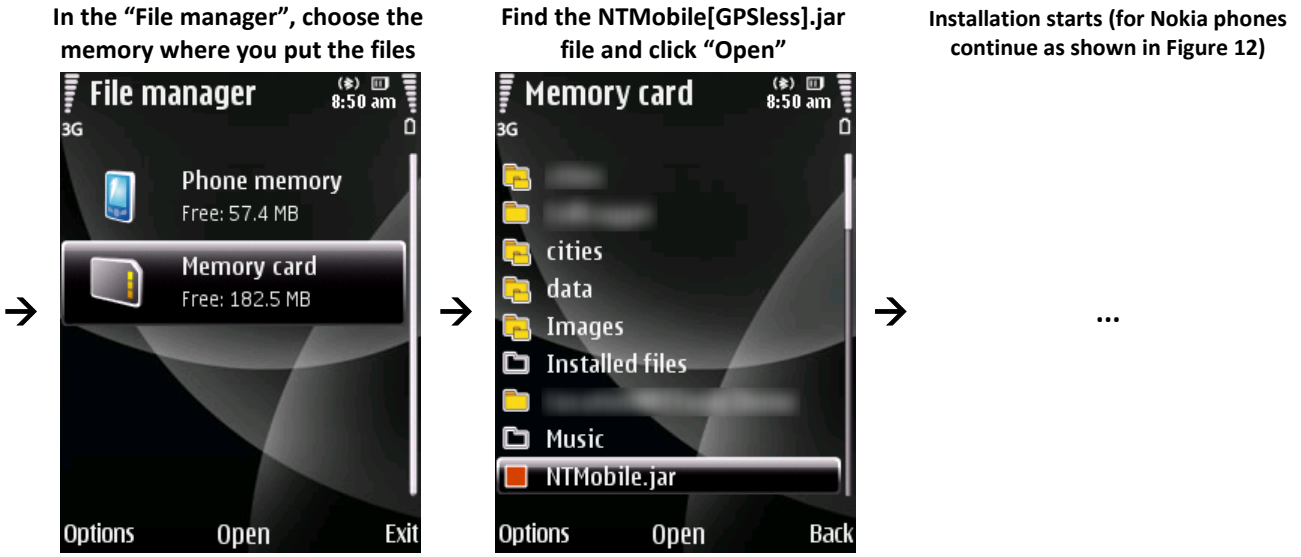


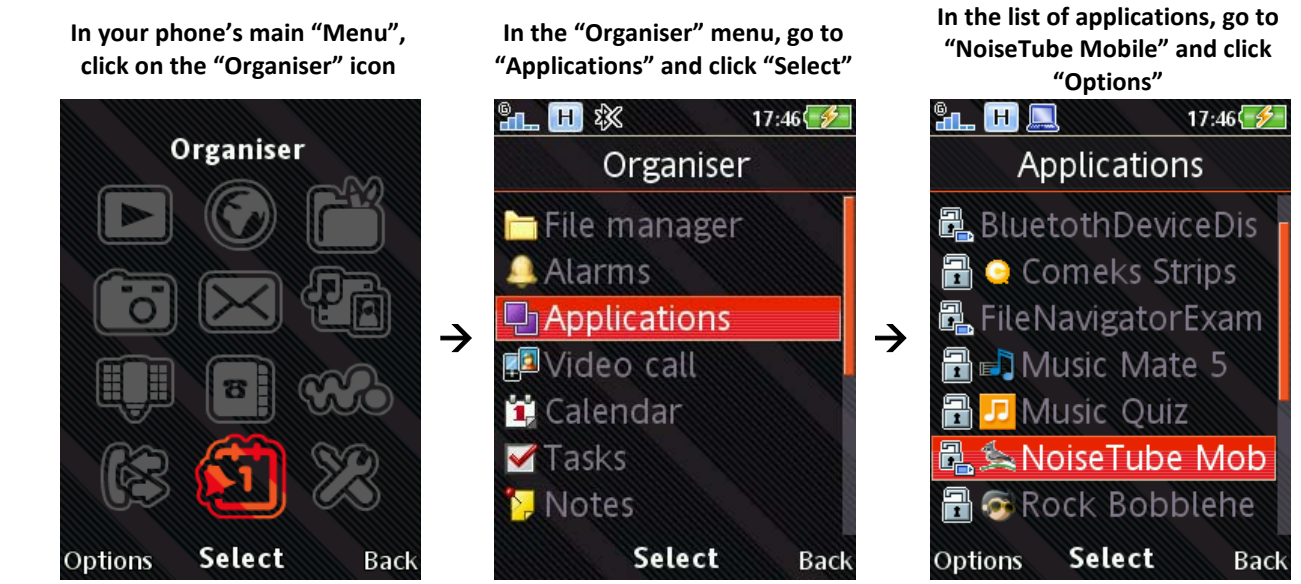
Figure 14. Manually starting installation after manual transfer on a Nokia (S60) phone

3.2.3 Permissions

To function properly the NoiseTube Mobile application needs to have permission to use certain features of your phone. By default you will be asked to explicitly grant permission each time the program needs to record sound, access the network, use GPS, etc. On some phones you can give permanent permission at that moment, on others however you cannot, which causes constant annoying interruptions of the program. Therefore we highly recommend that you configure your phone such that the program has permanent permission to use these features before actually starting the program for the first time. In what follows we will show you how to do this on Sony Ericsson and Nokia phones. The procedure should be similar on phones from other brands.

A. Sony Ericsson phones

On Sony Ericsson phones it is recommend to marking the NoiseTube Mobile application as "trusted", on which case the phone will never prompt to request permission for the application to access phone features. Figure 15 shows how to do this.



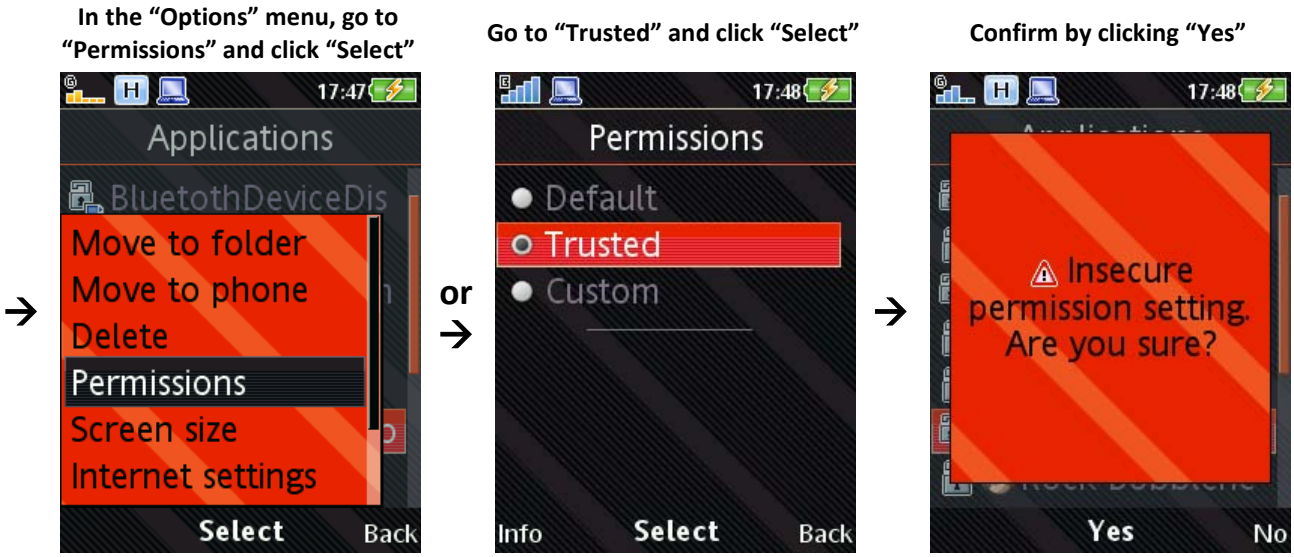


Figure 15. Marking the application as trusted on a Sony Ericsson phone

If you do not like to give unconditional access to all phone features (or your phone does not allow marking the application as trusted) you can also configure access to individual features. To do this, start as shown in Figure 15 until the 4th step and then continue as shown in Figure 16. Now set permissions for individual features as explained below.

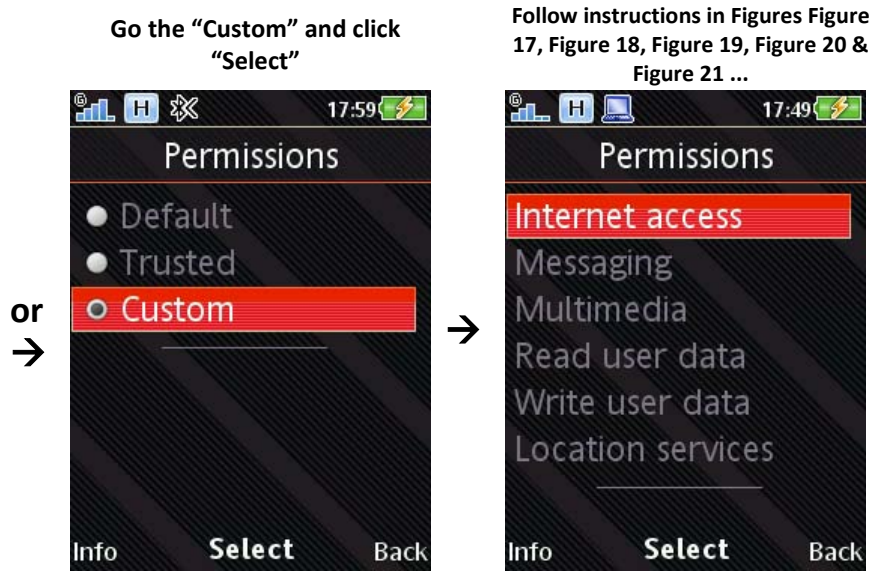


Figure 16. Custom permission settings on a Sony Ericsson phone

Internet access (optional)

To be able to access the Internet in the first place the application needs to be granted network access. If you have a data plan (see 3.1.1) and unless you prefer to store data in files that can later be uploaded, granting the program full network access is highly recommended. Figure 17 shows how to do this.

Figure 17. Granting Internet access

Multimedia

To be to record sound able (needed to measure noise exposure) the program needs to be able to access the multimedia features of your phone. It is therefore necessary that you grant the program to always have full access to these features. Figure 18 shows you how to make this setting.

Figure 18. Granting access to Multimedia features

Reading data

To be able to store program settings and record data to a file (instead of sending it over the Internet) the program needs to have read access to the memory(card) of your phone. It is therefore necessary that you give the program permanent permission to read used data. Figure 19 shows you how to make this setting.

Figure 19. Allowing to program to read user data

Writing data

To be able to store program settings and record data to a file (instead of sending it over the Internet) the program also needs to have write access to the memory(card) of your phone. It is therefore necessary that you give the program permanent permission to edit used data. Figure 20 shows you how to make this setting.

Figure 20. Allowing to program to write user data

Positioning

If your phone has support for geographic positioning (most likely through a built-in or external GPS-receiver) we recommend that you allow the NoiseTube Mobile application to use this feature. That way your noise measurements and tags will automatically be stored with geographic coordinates so they can later be displayed on accurate maps. Figure 21 shows how the grant the application permanent access to your phone’s positioning features. Note this is not needed for the GPS-less variety of NoiseTube Mobile.

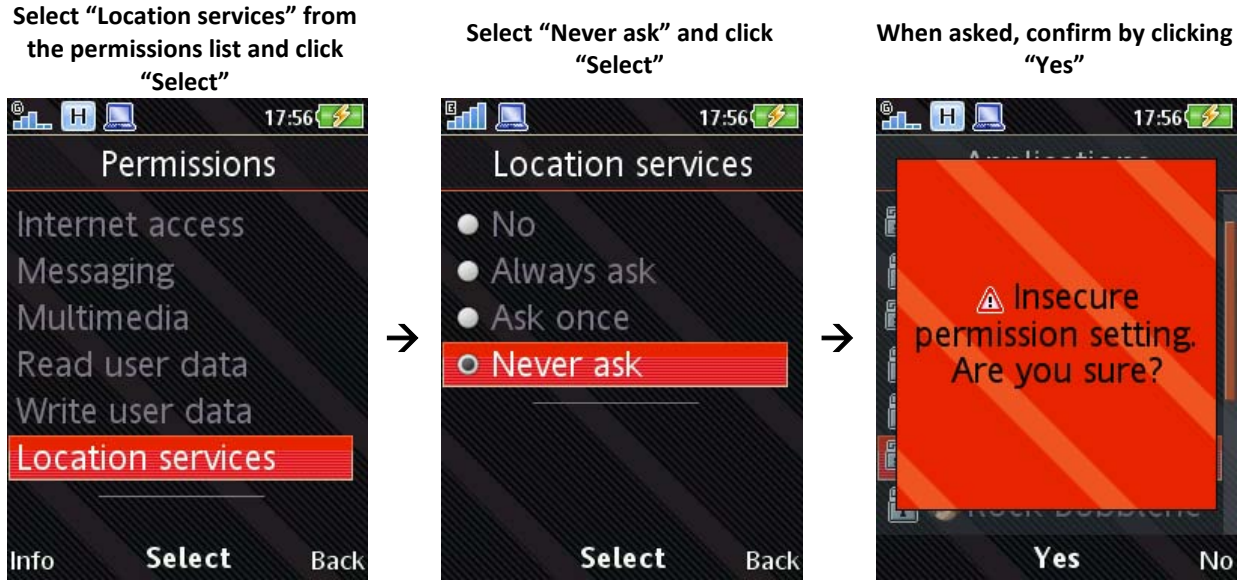


Figure 21. Granting access to location services

B. Nokia phones

On Nokia phones it is recommend to give the application permanent permission to use a number of individual phone features (there is no overall “trusted” setting). We will now show how to do this on a S60-based Nokia phone.

Figure 22 shows you how to navigate through to phone’s menus to reach the Application Manager component and next to reach the list of permission settings for the NoiseTube Mobile application.

Figure 22. Navigating to the list of settings for the NoiseTube Mobile application

In what follows we will help you to make the required (or recommended) settings in this list. When you are done, hit "Back" twice and then hit "Exit" to leave the Application Manager.

Access point (optional)

To enable the program to communicate through the Internet (provided that you have a data plan, see 3.1.1), it will use one of the network access points configured on your phone. By default it will either ask you for the access point to use upon every run, or it will use the one that has been globally defined to be used by all programs on the phone. However, if you want the NoiseTube application to use a *specific* access point, without having to select it upon every run, you can use the access point setting, as shown in Figure 23.

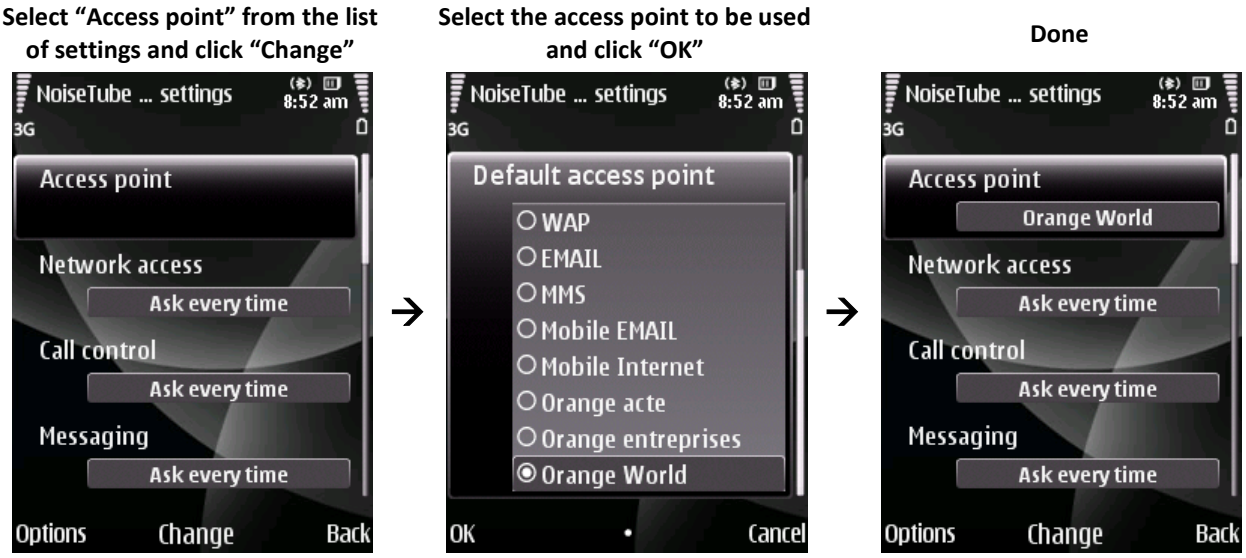


Figure 23. Setting up a default access point to be used by the NoiseTube Mobile application

Network access setting (optional)

To be able to access the Internet in the first place the application needs to be granted network access. If you have a data plan (see 3.1.1) and unless you prefer to store data in files that can later be uploaded, granting the program full network access is highly recommended. Figure 24 shows how enable to the program to access the network without having to ask for permission upon every run (recommended).

Figure 24. Granting network access

Multimedia

To be to record sound able (needed to measure noise exposure) the program needs to be able to access the multimedia features of your phone. It is therefore necessary that you grant the program to always have full access to these features. Figure 25 shows you how to make this setting.

Figure 25. Granting access to Multimedia features

Reading data

To be able to store program settings and record data to a file (instead of sending it over the Internet) the program needs to have read access to the memory(card) of your phone. It is therefore necessary that you give the program permanent permission to read used data. Figure 26 shows you how to make this setting.

Figure 26. Allowing to program to read user data

Writing data

To be able to store program settings and record data to a file (instead of sending it over the Internet) the program also needs to have write access to the memory(card) of your phone. It is therefore necessary that you give the program permanent permission to edit used data. Figure 27 shows you how to make this setting.

Figure 27. Allowing to program to edit user data

Positioning

If your phone has support for geographic positioning (most likely through a built-in or external GPS-receiver) we recommend that you allow the NoiseTube Mobile application to use this feature. That way your noise measurements and tags will automatically be stored with geographic coordinates so they can later be displayed on accurate maps. Figure 28 shows how the grant the application permanent access to your phone's positioning features. Note this is not needed for the GPS-less variety of NoiseTube Mobile.

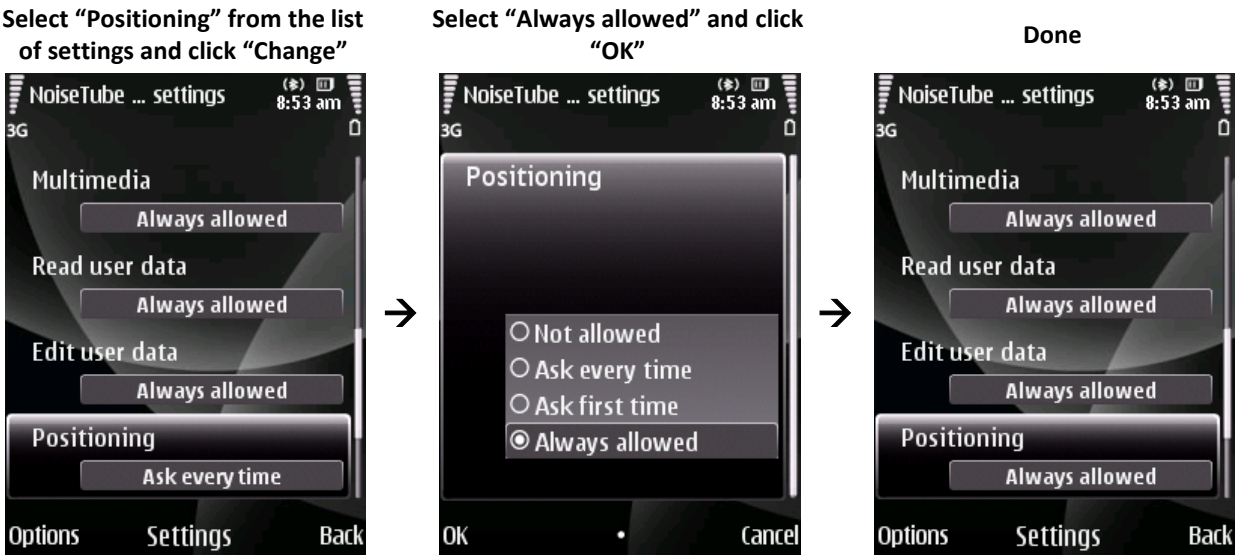


Figure 28. Granting access to Positioning features

3.3. Using the application

In this section we will explain how to use NoiseTube Mobile to measure and monitor the noise level in your daily environment.

This explanation expects that the application is properly installed (see 3.2.2) on your phone and that the necessary permission settings (see 3.2.3) have been made.

Figure 29. NoiseTube icon

To start the application go to your phone's applications menu, look for NoiseTube Mobile (marked by the NoiseTube icon, as shown in Figure 29), select it and click "Start" or "Run".

3.3.1 Logging in

When you first start the application it will detect whether it can access the Internet (using your data plan, see 3.1.1) and contact the central NoiseTube server. If this is successful the program will ask you to login by providing your NoiseTube username and password and clicking "Login", as shown on Figure 30. This is the username and password of the account you created on the NoiseTube website (see 2.2).

Figure 30. Login in with your NoiseTube account

Logging in is necessary to automatically send the data you record to the central NoiseTube web application to store them there (see 3.3.3 C.) for later consultation (i.e. through maps) or sharing with others. If you would prefer to keep your data offline or you want to manually upload it later (see 0) to avoid expenses on your data plan, simply click "Skip".

3.3.2 Noise measuring interface

After logging in (or skipping it) the noise measuring interface, as shown by Figure 31, will appear on the screen of your phone. This the main screen of the application.

In the top part of the screen you can see the noise level (loudness) you are exposed to in real time. The number that is shown is an L_{eq} value measured in dB(A). This value is updated every 1-2 seconds and is computed by a signal processing algorithm in the application which uses the sound that is recorded through the microphone of your phone (or an external one) as input. Next to the noise level value a histogram shows the noise level variation during the last few minutes. The green line – at 40 dB(A) – indicates harmless levels and the red line – at 80 dB(A) – indicates (potentially) harmful levels. Vertical lines

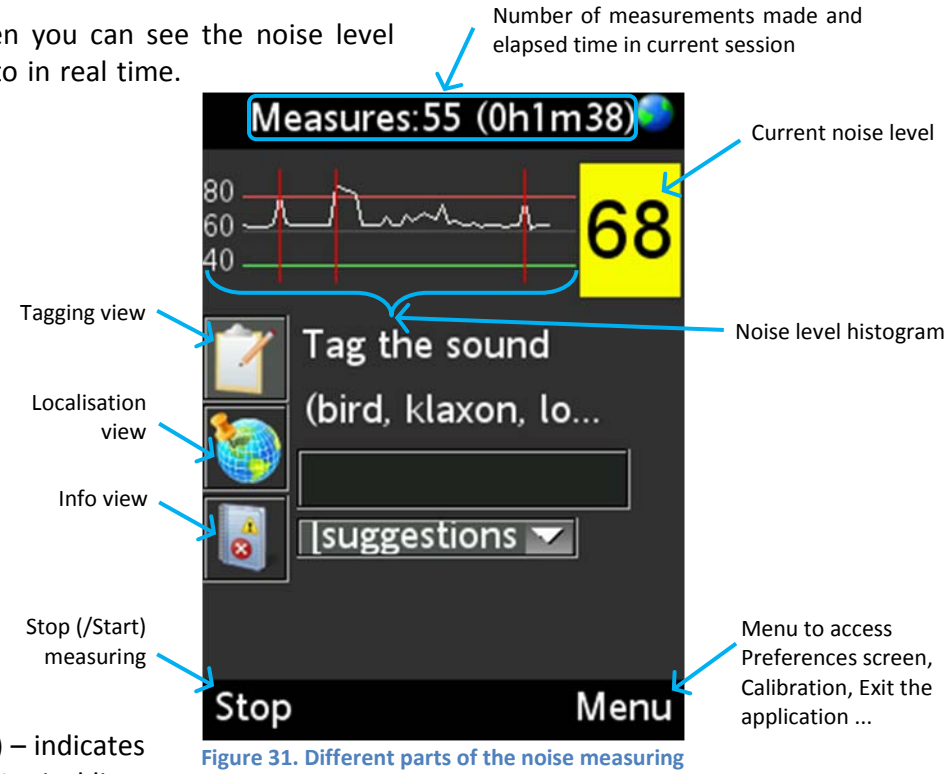


Figure 31. Different parts of the noise measuring interface

(blue and red) correspond to tagged measurements.

In the lower part of the screen you can switch between 3 different views: Tagging view, Localisation view and Log view. Switching is done by using the "Up" and "Down" keys on your phone, as illustrated by the diagram in Figure 32. We will now discuss the different views.

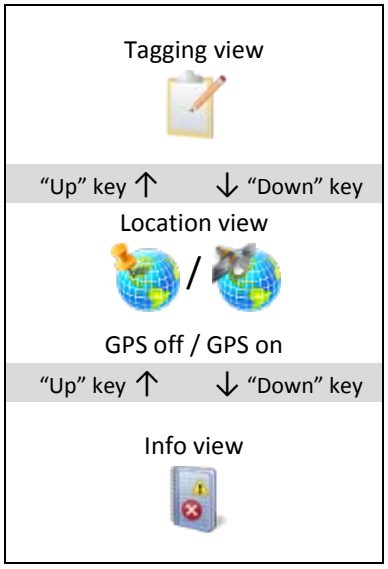


Figure 32. Switching between views in noise measuring interface

A. Tagging view

In the Tagging view, shown below the loudness histogram in Figure 33, you can annotate (*tag*) the noise exposure measurements you are making with additional information (metadata). The purpose of this metadata is to augment the raw measurement values with meaningful information that facilitates data interpretation and informs the NoiseTube community. For example you can indicate sources of noise (such as "traffic", "airplane", etc.) and describe your own subjective perception of the situation (e.g. "annoying", "pleasant", "loud", ...). However, these are just suggestions, the tagging system is totally open ended, which means you can use it to provide whatever kind of information you like.

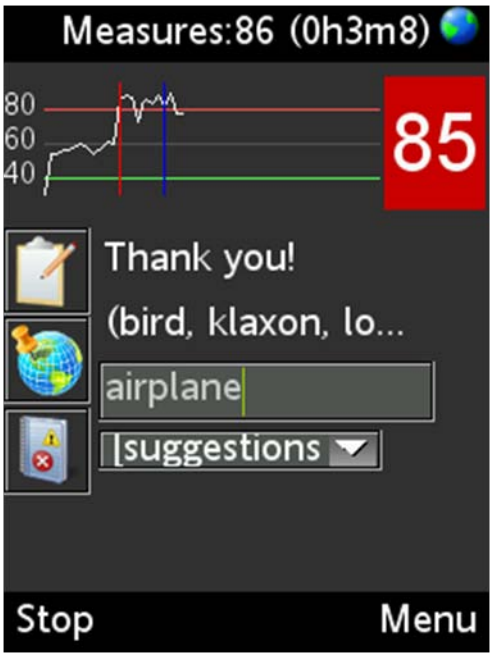


Figure 34 Tagging view, typing a tag

To make an annotation, go to the Tagging view (as explained in Figure 32) and click on the "Select" key of your phone (the main "Ok" button). You are now in the tagging text field, as shown in Figure 34. Here you can type any word or a number of words separated by commas. When you are done typing confirm by clicking on the "Select" key. Alternatively you can also select a tag from a list of suggestions, as shown in Figure 33. To do this push the "Down" key when you are in the text field, and then the "Select" key to open up the list, next move up and down the list with the "Up"/"Down" keys and confirm with the "Select" key. Tags that you have typed before will also appear in the suggestions list for quick reuse. Once you have tagged a measurement a blue vertical line will appear in the histogram to mark it.

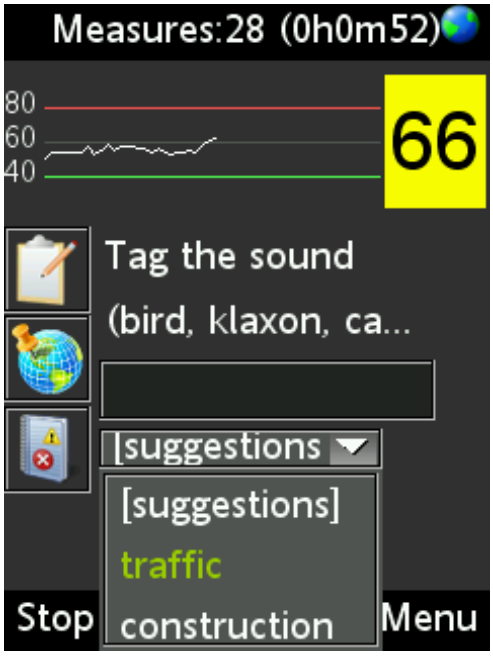


Figure 33. Tagging view, using suggested tag

In addition to the process of manual tagging the application also contains an automatic tagging component. This component constantly analyses the noise measurements and looks for specific patterns such as high loudness variation and prolonged exposures to high noise levels. When detected these patterns are also saved as tags and marked with a red vertical line.

B. Localisation view

In the Localisation view you can switch between Automatic (uses GPS) and Manual localisation mode. To do this, first go to the Localisation view (as explained in Figure 32) and then click (again) on the "Select" key of your phone (the main "Ok" button) to switch between Automatic and Manual mode.

Figure 35. Localisation view in Automatic mode

When in Automatic mode the Localisation view will show information messages about the status of the GPS receiver ("Started", "Location found", "Invalid location"), as shown by Figure 35. If GPS is working properly your measurement data will automatically be associated with GPS coordinates. If the GPS receiver has trouble finding your location (e.g. when you enter a building), messages about invalid location will appear. If this situation continues during a few minutes the program will automatically switch back to manual mode. However, it will periodically retry to activate automatic mode (e.g. for re-enabling GPS when you left that building). If you want to entirely switch off the use of GPS, you can do so in the Preferences screen (see 3.3.3).

When in Manual mode locations can be specified in much the same ways as sound tagging feature explained above, as shown on Figure 36. You can ether use a text field to type in a location or select a suggested or previously used location from the list. Users are free to describe locations in whichever way they want but suggested ways are the use of street addresses or personal markers[6] such as "home", "work", "office", "parents", etc.

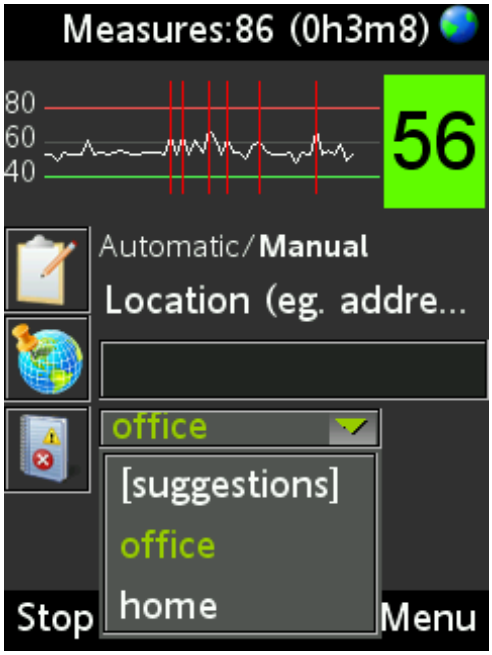


Figure 36. Localisation view in Manual mode

Note that when the program detects that your phone does not support GPS, when you have switched off GPS usage in the Preferences screen (see 3.3.3 A.) or when you are running the GPS-less version of the application, only the Manual localisation mode will be available.

C. Info view

In this view, shown in Figure 37, the program displays some helpful information about its operation.

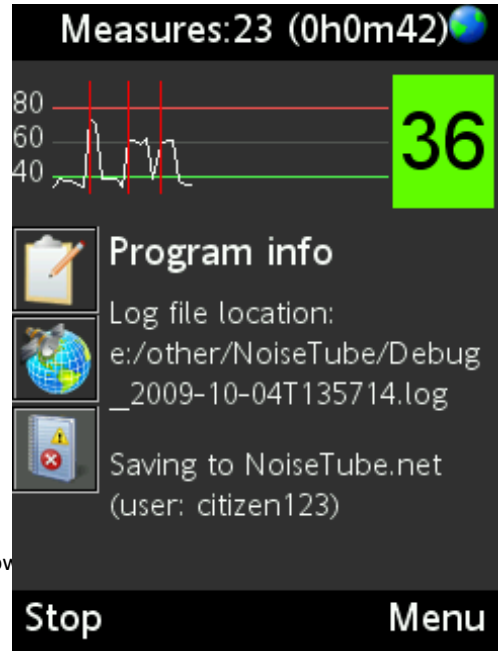


Figure 37. Info view

First it shows the location of the log file. In this file the program writes device parameters and diagnostic information meant for debugging purposes. Non-expert users can ignore this. However, when you have trouble using NoiseTube Mobile and wish to tell us about it, it can be helpful to send us the log files. The files (named *Debug_<date>T<time>.log*) are created on either your phone's

[6] In the future we might introduce a feature in the web application which would allow personal 'favourite" places on a map, for later use in NoiseTube Mobile.

built-in memory or the memory card (depending on the setting discussed in 3.3.3 B.). We invite you to send us these log files in case of trouble but also to report about successful experimentation with the program. The logs are especially interesting for us if you are using a device for which we do not yet know whether the program works properly or not (see 3.1.2).

Secondly the Info view shows where the program is saving measurement data (either to NoiseTube.net or to a *track* file, see 3.3.3 C.).

3.3.3 Preferences

The change a number of program setting NoiseTube mobile has a Preferences screen which is accessible through the menu at the bottom right of the noise measuring interface, as shown on Figure 38.

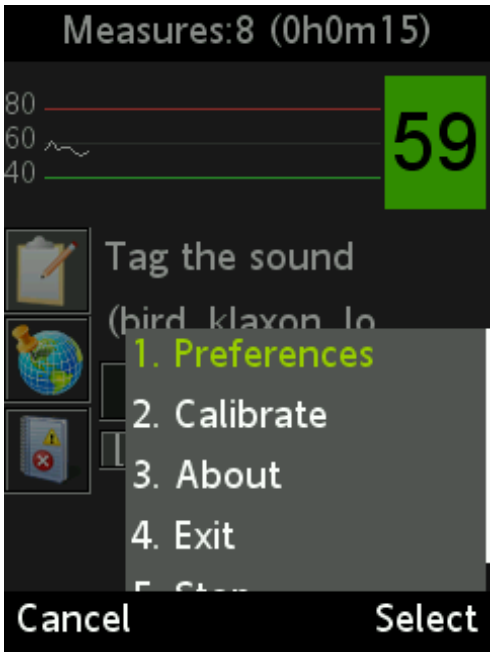


Figure 38. Opening Preferences

Figure 39 shows the actual Preferences screen and in the following paragraphs we discuss the individual settings that can be changed.

A. GPS

The "Use GPS for localisation" option is enabled by default if your phone has GPS support. By unchecking the box you can entirely disable the use of GPS. By checking it GPS usage will be re-enabled.

B. Memory card

The "Prefer memory card" option (on by default) determines whether the program will if your phones removable memory card (if there is one) instead of the built-in memory. This applies to all files created by the program: log files (see 3.3.2 C.) and track files (see 3.3.3 C.).

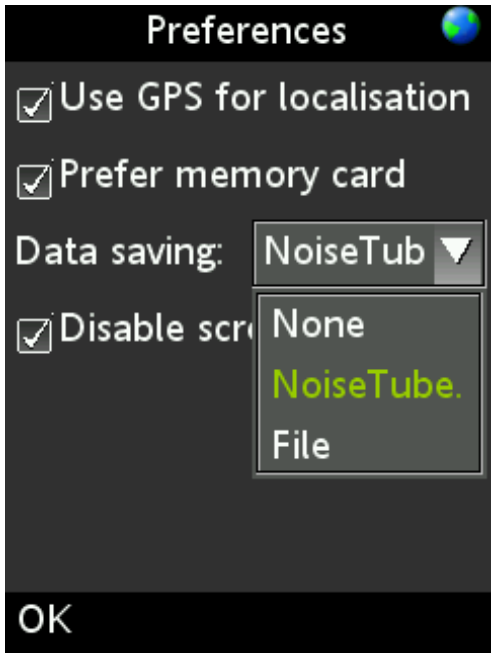


Figure 39. Preferences screen

C. Data saving method

NoiseTube Mobile supports several ways to save the data it collects. You can choose between 3 options in the data saving list: no saving, sending the data directly to the NoiseTube.net website or saving the data to files stored on the phone. Later we are planning to add an option that uses SMS messages.

Saving to NoiseTube.net

If the program detects to it can access the Internet (using your data plan, see 3.1.1) saving to the website will be enabled by default when you start the program for the first time (in which case you will also be presented with the login screen, see 3.3.1). When website saving is active this will be indicated by a message in the bottom part of the Info view of the noise measurement interface (see Figure 37). By saving to the website your measurement sessions will automatically and up as track on your ELog page (see 2.3.1). They will also be shared with other users by default, unless you disable this on your profile page (see 2.3.2).

Saving to file

When you the program cannot access the Internet it will attempt to save you data to file by default. In this case the program will make new file (name *Track_<date>T<time>.xml*) per measurement session.

These files are stored on your phone's built-in memory or the memory card (depending on the setting discussed in 3.3.3 B.). In the bottom part of the Info view of the noise measurement interface you can see the location (file path) that is in use, as shown on XXX. After saving data to file you can recover these track files from your phone and upload them yourself on the NoiseTube website (see 0).

Saving through SMS

While to option is still hidden in current versions of the program we a preparing a new version which will allow data to be sent to the NoiseTube server through SMS message. Initially this service will only be available in France.

D. Disabling screensaver or power saving

Most phones have a power saving feature that dims or switches off the screen after a period of inactivity (e.g. no buttons pushed during 30 seconds). When using NoiseTube Mobile this can be annoying as users often want to watch the measurement data on the screen for longer periods of time. To solve this problem the program can, provided that your phone supports this, disable this feature. If your phone supports disabling the power saving, the program will do so by default, but you can re-enable power saving by unchecking the "Disable screensaver/power saving" checkbox. If your phone does not support this you will not see this checkbox and power saving will not be disabled.

3.4. Best practises for noise measuring

There a few simple rules to properly use NoiseTube Mobile to measure your exposure to noise:

- Do not make measurement while the phone is in your pocket or purse, nor while you are making or receiving a phone call or typing a text message[7].
- While make measurements try keep the phone in your hand, slightly away from your body, as shown on Figure 40. Optionally you can point the microphone (usually at the bottom of the device) towards the suspected source of noise.
- Your are entirely free to decide the times and places at which you make measurement, however minimum duration of 5 minutes is recommended.
- You can use NoiseTube Mobile indoors but because GPS most likely will not work there we invite you to manually type in a location for the data to be useful[8].

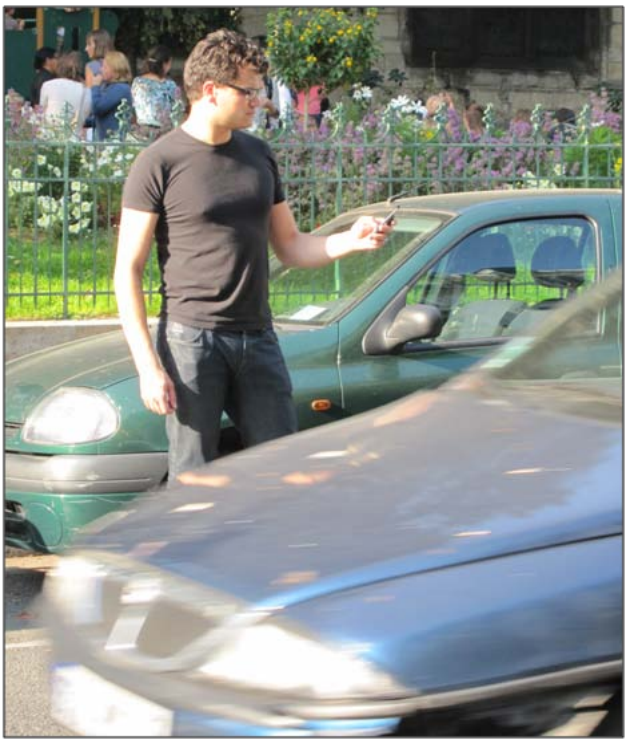


Figure 40. Using NoiseTube Mobile in the street

[7] In the future we may add a feature that turns off measuring when an incoming phone call of text message is detected.

[8] In the future we may add an alternative localisation feature that uses information about the cellular network (i.e. Cell ID) in case there is no GPS coverage.

3.5. Uploading data

When you are using the file saving mode (see 3.3.3 C.), for example because you do not have a data plan (see 3.1.1), we invite you to afterwards manually upload the track files you have made to the NoiseTube web application. This can be done using any Internet connected computer.

To do this, connect your phone to your computer using Bluetooth or USB (see 3.2.2 C.) and access the phone's file system, either using software of the vendor (e.g. Nokia or Sony Ericsson PC Suite) or through "My Computer". Look for the track file(s), either on the phone's built-in memory or the memory card (in the latter can you can also take the memory card out of the phone and access it using a flash card reader), based on file path you saw in the Info view, as shown in Figure 41.

Once you found the track file(s), as shown on Figure 42, copy them to a directory on your computer (this is also the way to find the log files the program creates; see 3.3.2 C.).

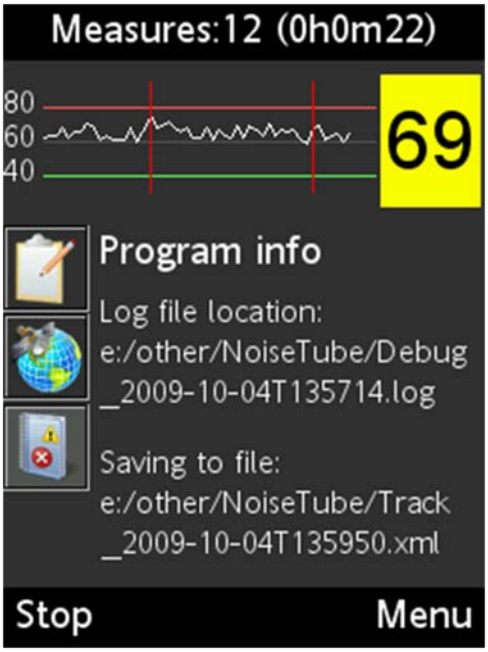


Figure 41. Info view, showing track file location

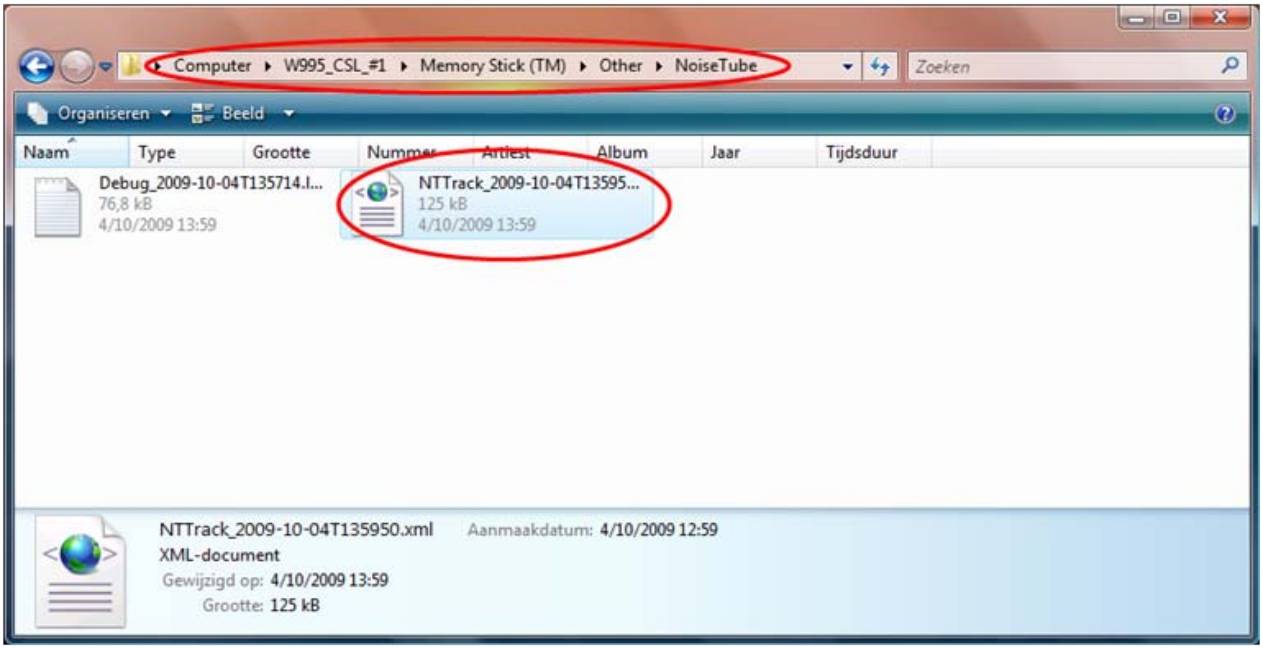


Figure 42. Looking for track (& log) files on the phone

Next, open you browser, and go to www.noisetube.net. Login with your NoiseTube account – or first create one (see 2.2) if you have not done so already. On your ELog page, click on the "Upload data" link. On the Upload page, click on the "Pick file" button and use the file selector dialog to select a track file from the phone, the memory card or the directory where you copied it, as shown in Figure 43. Next click "Open" and then "Upload and process". If all goes will be redirected back to you ELog page and the new track will be listed (possibly still be marked as being in post-processing phase, in which case you should wait a few minutes and come back to the ELog page or refresh it). Repeat this process for every track file you which to upload.

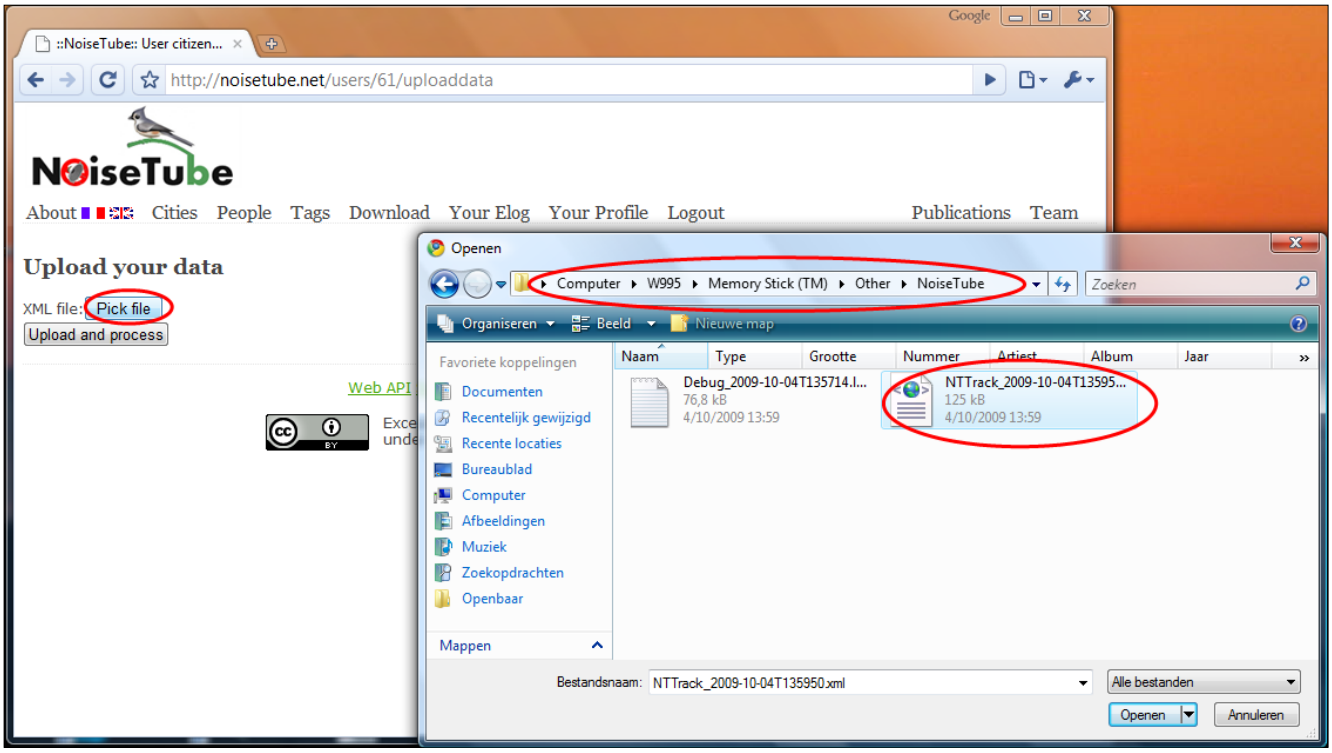


Figure 43. Uploading a track file to NoiseTube.net

3.6. Calibration

To achieve a reasonable level of accuracy the loudness measuring algorithm in the mobile application needs to be calibrated, ideally for each phone model. Currently the software has only been calibrated for a limited number of models (listed here: http://noisetube.net/download). The phone detects these models and will apply the correct settings accordingly.

This does not mean that you cannot or should not use NoiseTube Mobile on other phone models. It only means that we cannot guarantee that the L_{eq} values you will get will be accurate enough to compare with other data. Even so the data you should still allow you to see the variations in loudness you are exposed to at different locations and a different times of the day.

For advanced users who have access to a (semi)professional sound level meter we have implemented a self calibration feature in the mobile application. Instructions on how to go about this can be found here: http://docs.google.com/View?id=dchqdm7_298gxfb9pd9

4. Advanced Web application features

4.1. Exploring and interpreting of noise exposure data through tags

A truly innovating way to explore the noise exposure data that is made available through NoiseTube is the tag exploration feature, accessible by clicking on the **Tags** link in the menu bar.

As shown by Figure 44, this feature allows you search through and zoom in on parts of the entire NoiseTube dataset by selecting a set of tags or a "Scope". With each selected tag you effectively zoom in on a small subset of the dataset. Tags can be removes from the set by clicking on the "x" link next to them in the "Scope" listing.

The tags are grouped in different categories and come from both manual user input and automatic tagging classifiers can add additional contextual information concerning noise signal behaviour, user activity, weather conditions at the time of measurement, time markers (e.g. "evening", "weekend", "winter", etc.) and location markers which are generated by reverse geo-coding GPS coordinates (e.g. "Paris", "Rue Monge", etc.).

Figure 44. Exploring noise exposure data through tags

At any point in your exploration you can download a map of the current dataset by cling on the KML icon.

4.2. API

The NoiseTube platform exposes a public web API which enables anyone to use NoiseTube data or widgets in third-party applications, websites or mash-ups. At http://noisetube.net/api/index you can find documentation about this API.

5. Becoming a NoiseTube partner

One of the principal aspects of the NoiseTube noise monitoring platform is its participative nature. As a result we are constantly looking for new users, both individuals and groups. So we invite anyone to talk, blog and publish about NoiseTube to enable us to gather a critical mass of contributors. Apart from contributing users we are also looking for potential partnerships with government or city officials, NGOs and researchers.

Interesting collaborations could include joint validation experiments with researchers or officials active in the fields of environmental monitoring and modelling, social and environmental awareness campaigns technology adoption promotion.

However, we also look forward to get a chance to work with NGOs and neighbourhood networks concerned with (urban) noise pollution. Since we envision NoiseTube as an empowering tool that should enable ideally anyone to gather evidence on noise pollution we believe such partnerships could be beneficial for both the organisations in question as for the validation and future development of the NoiseTube platform.