ABBI User Manual for the Experimenter

Version 1.0.1 October 2014

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History

- 1.0.0. (sept. 14): Initial draft (GBB). Editing (SI and GZ).
- 1.0.1. (3/10/14): Small changes, updated password for abbi2.iit (GBB). Version put on OwnCloud.

ABBI device

The ABBI device does not have a switch button but it goes automatically in low-power consumption (STAND-BY) mode when it is not moved. ***Moving the device will wake it up automatically*** (AWAKE mode). If the battery runs low, it will go in a sleeping mode (ASLEEP) from which it cannot be awaken unless it has been recharded or it is charging (see Power management for more details).

Connection

The ABBI can connect to an application running on an Android phone or PC through a Bluetooth Low-Energy (BLE) link (also called Bluetooth 4.0 or Smart Bluetooth). To establish the connection, it is ***necessary to shake the device*** so that the ABBI device "advertises" while the application is "scanning". To lower consumption, the ABBI device is advertising only for 15 sec. after shaking the device. The device makes a brief high-pitch sound when it crosses the acceleration threshold and starts to advertise.

A device can be connected only to one cell phone or application at the time. When several devices are advertising, the application must select with which device to connect.

The ABBI device does not disconnect unless it receive a command to disconnect from the application or the link is interrupted for any reason. For example, the application exits or the ABBI device is moved out of range.   At the end of the connection, the ABBI device will not advertise automatically; it is necessary to shake it to make it advertise again.

Power management

The ABBI device does not have a switch button but it goes automatically in low-power consumption mode (STAND-BY mode) when it is not moved. Moving the device will awake it and make it to produce sounds (AWAKE mode). When battery tension drops below a minimum value, it will go a sleeping mode where it cannot be awakened until the battery has been recharged (ASLEEP mode). Note that partial recharging is sufficient but it would be best to ask user to recharge. Note that the device continues to consume a bit of energy even in the STAND-BY and ASLEEP modes to keep the clock and a minimum of functionality. When the voltage goes below a critical value, it will completely shut down. In this case, the clock time is lost

The maximum battery charge of the ABBI device is about 120 mAh. The battery can be recharged through a standard USB port (Type-A/Micro-B cable adapter similar to the adapter used on many cell phones). A green LED signals the connection to a powered USB port. A red LED turns on while the battery is charging and it turns off when the battery is fully charged. The the full recharge cycle requires from 2 to 4 hours.

The energy consumption depends on the use of the ABBI device. In the AWAKE mode, the power consumption is about 15 mAh + 8 mAh if the ABBI device is advertising and/or connected through the Bluetooth link + 10-100 mAh depending on the audio signal.   The power consumption is heavily affected by the characteristics of the audio signal. Producing intermittent sounds and lowering the volume can improve considerably the autonomy of the device.   In the STAND-BY or ASLEEP mode, it is necessary to recharge the device at least once every 2-3 days to avoid that it completely turns off.

Android application

Installation

To install ABBI, you need to connect to a Gmail account. If the phone do not have SIM card, you can use any WIFI connection instead.

At IIT, you can connect to *iit-rbcs* WIFI network with:

- Network: iit-rbcs
- Username: abbi_guest
- Password: abbi_guest.

The android application is distributed as an attachment to an email on google account. If the account does not exist yet, you need to create a Google account on the phone

- Google account: abbi2.iit@gmail.com
- password: abbi2apps

Open Gmail application and find email with last version of the application. Open email, click on attachment and proceed with installation

Usage

User Mode   Experimenter mode
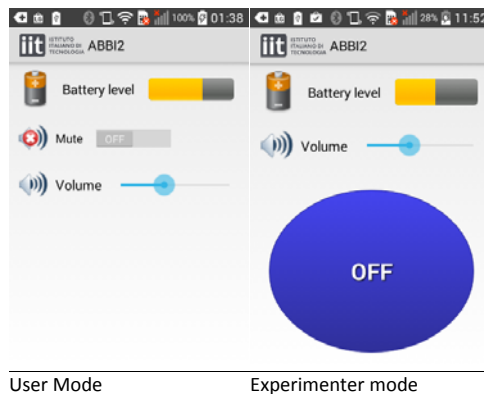
The Android application has one user mode and one experimenter mode. To switch between the two modes, you need to click 9 times on the IIT logo in the top left corner. Note that you cannot switch mode a second time unless you exit first from the application.

Note that the application is localized according to the language setting of the phone (at the moment, only English and Italian).

User mode

The user mode allows simply controlling the volume and checking the battery level (see ABBI User Manual). When using it, the ABBI device is configured so that sounds are triggered by the user movement.

Connection. The first time the application is started it is necessary to pair the application with a device. The next times, it will remember the identity of the device (MAC address) and automatically connects when the device is advertising.

To change the device which the Android device is paired in the user mode, you need

1. switch to the experimenter mode and exit the application
2. restart the application and pair with the new device
3. switch back to the user mode and exit the application.

Alternatively, you can reinstall the application.

Timeout. The screen timeout of the Android phone stops the application and therefore the connection with the ABBI device (usually after 1 minute of non-use). To reconnect with the ABBI, it is necessary to reactivate the application on the phone and shake again ABBI.

Experimenter mode

The experimenter mode allows the experimenter to remote control the beginning and end of the current sound with the ON/OFF button. *You need to put back the application in the user mode to configure the device with movement triggered-sound*.

Connection. When starting the application in the experimenter mode, it is possible to choose with which device to connect. You need to push the SCAN button while the device is advertising and select the device in the list. If you wait too long to select the device, it is possible that the device stops advertising (but it does not disappear from the list). In this case, it is not possible to connect and you need to make it advertise by shaking it.

Timeout. When using the android Application in Experimenter mode, the screen timeout of the Android phone is deactivated to avoid losing the connection.

PC application

The PC application allows having information on the state of the ABBI device and changing parameters controlling the functions of the ABBI device.
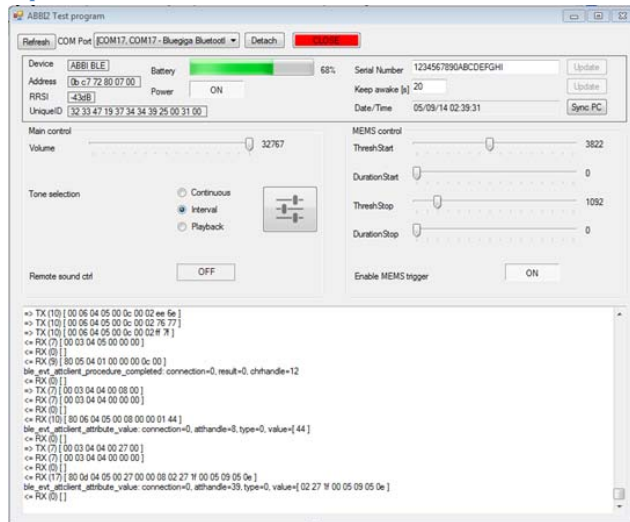
Requirements

The application works with Windows XP, Windows 7 and Windows 8 on a PC equipped with a Bluetooth LE USB dongle from BlueGiga (BLED112).

Note: Windows XP and Windows 7 lack support to develop applications for generic Bluetooth LE ports. Even though many PCs have Bluetooth LE (or. 4.0) port, Windows XP and Windows 7 applications need to use brand-specific driver and libraries for the Bluetooth LE port. Windows 8 offers library functions to develop generic Bluetooth LE applications. Using a specific external dongle make the application useable on Windows XP and Windows 7 machines which are equipped with different Bluetooth LE chips.

Installation

To install the application, you need simply to have the application executable ABBI2CFG.exe and its configuration file in the same directory.

Graphical User Interface


The Graphical User Interface (GUI) of the PC application is composed of four regions. The top row groups together buttons to connect and disconnect with ABBI device. The panel below displays information about the ABBI device (e.g. battery level) and allows the user to set some important parameters (e.g., serial number, clock). The next area allows controlling the characteristics of the sounds and how it is triggered. Finally, the bottom area displays communication between the ABBI device and the PC.

The current values of the parameters are retrieved from the ABBI device when the connection is established.

Connection

Bluetooth port. In order to establish a connection, need to select the Bluetooth/COM port.
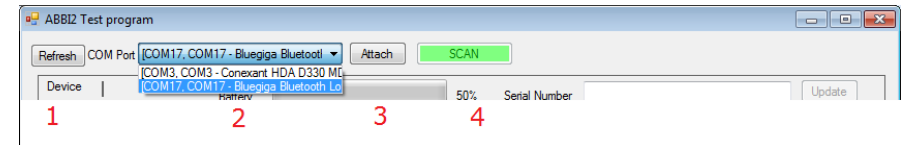
1. Push refresh to update the list Bluetooth/COM ports available
2. Select a Bluetooth LE port (e.g Bluegiga)
3. Attach/Open the port

Advertising, scanning and connecting. To establish the connection, the ABBI device must "advertise" its presence. Advertising occurs when

- ABBI device is charging and/or connected with the USB cable
- During 20 seconds after the ABBI is shaken.

At the same time, the application needs to scan for advertising devices and select one of them

4. SCAN for list of available ABBI devices

5. Select ABBI device (check MAC address with sticker in the back of the device)
6. Connect.

Wait until connection is established. This can take 20-30 seconds sometimes. The ABBI device will stay connected with the PC application until the user disconnect by pushing the close button.

ABBI state information and parameters

- **Device**: Device name (name is defined in hardware.xml)
- **Address**: Bluetooth Mac Address (unique for each BLE module of the ABBI device)
- **UniqueID**: ABBI microprocessor unique ID
- **RSSI**: Strength of the connection (decreases with distance)
- **Power**: power state on/off of the device (see below). The Power button is normally disabled.
- **Serial Number**: Serial Number (SN) of the ABBI and firmware version. ABBI2-0032 indicates the SN stored in the EEPROM of the ABBI device. It should correspond to the number printer on the sticker on the circuit and on ABBI enclosure. V1.2 refers to the firmware version. The Update button is normally disabled.
- **Keep awake (s)**: Number of seconds after the end of a movement before the transition from the Awake state to the Stand-By state. The Update button is normally disabled.
- **Data/Time**: Indicate the Data/Time of ABBI Real-Time Clock (RTC). The button Sync PC will synchronize this clock with the PC clock. Note that it takes 30 seconds until the information is updated in the GUI after pushing the SyncPC button.

There are not reasons, a priori, to change the Serial number and the value of the keep awake parameter. The Update button can be enabled/disabled in the ABBI2CFG.exe.config file.

Power button: Pushing the button in the OFF state will put the device in the ASLEEP state. If the ABBI is connected to the USB, this will happen when the device is disconnected from the USB. In the ASLEEP mode, the device will not wake-up until it is reconnected to the USB. Do not forget to put the device back in the Power ON mode otherwise it will go back to the ASLEEP mode when it is disconnected.

ABBI Audio control

- Volume: set volume (default 20000)
- Tone Selection: Select current sound
  - Continuous: set continuous sound
  - Interval: set intermittent sound (metronome)
  - Playback (not implemented)

Interval Sound Editor.

The parameter of the current sound can be changed by pushing the large button with the sliders.

- Sound Trigger Mode

Remote Sound Ctrl	Enable MEMS trigger	State
OFF	OFF	Never generate sound (Mute)
OFF	ON	Movement triggered mode
ON	OFF	Generate current sound
ON	ON	

- MEMS control   (used in Movement triggered mode)
  - ThreshStart: (Default:5460)
  - DurationStart: (Default: 133)
  - ThreshoStop: (Default: 2730)
  - DurationStop: (Default: 133)

When disconnecting, it is important to make sure that audio parameters are correct since the value is automatically updated in the ABBI device when it is changed.

Note: default values corresponds to default values when the syste

Configuration file

The configuration file ABBI2CFG.exe.config allows to enable/disable some buttons on the GUI of the PC application and set maximum value for some parameters. In general, it is not necessary to modify the configuration file.