Hochschule Konstanz
Fakultät Elektrotechnik
und Informationstechnik

HTWG - Hochschule für Technik, Wirtschaft und Gestaltung

Masterprojektarbeit

User Guide UWB GUI

Positionsbestimmung mittels Ultrabreitband

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1 Introduction

Welcome to the Software Guide for the UWB Configurator and Visualiser. This comprehensive guide is designed to help you navigate and enable you quickly to make use of every feature.
In this guide, you will find detailed information about the software's features, functionalities, and how to use them effectively. We will walk you through common tasks.
The UWB Configurator and Visualiser is designed to connect with the UWB tag to update anchor positions and visualise its current position.
To get started, simply navigate through the sections and chapters that interest you the most. We have organized the guide in a user-friendly manner, making it easy to find the information you need quickly.

2 Hardware Requirements

Before you can establish a connection with the UWB Tag, ensure that your computer has a built-in Bluetooth adapter or an external Bluetooth dongle. Most modern laptops and notebooks come equipped with Bluetooth capabilities. If your computer lacks built-in Bluetooth, you may need to purchase a compatible USB Bluetooth dongle, plug it into an available USB port and install corresponding driver software. Make sure that the device is recognised correctly in the device manager.
When you run the file as an .exe on a Windows machine you do not need a Python 3 version to be installed.

3 Getting started

When starting the Software for the first time you are set up with an empty dashboard. However you can plaace, resize or remove the widgeds individually and save/load your own instance of the dashboard.

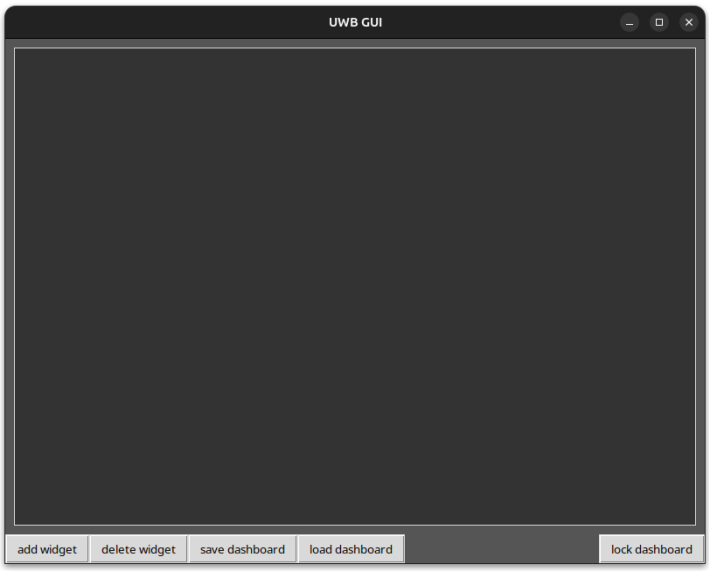

Figure 3.1: Empty GUI after startup

3.1 Add a Widget

Adding a widget is a fundamental action in your dashboard application. Widgets are the building blocks of your dashboard, allowing you to display various types of information and functionality. To add a widget to your dashboard, follow these steps:
Click the "Add Widget" button: Locate and click the "add widget" button on your dashboard's user interface. This action will trigger a dialog or menu to appear like desplayed in Figure 3.2.
Select Widget Type: In the dialog or menu, you'll be presented with a list of available widget types. Choose the type of widget you want to add to your dashboard. Your options include "BleServiceWidget", "BleConfigWidget", "SerialWidget" and "BlePlotPositionWidget".

Confirm and Add: Click the "OK" button to confirm your selection. The selected widget will now be added to your dashboard canvas.
Customize and Position: Once added, you can customize the widget's appearance and content as needed. You can also position it on the canvas by dragging it to your desired location.
Repeat as Needed: You can add multiple widgets to your dashboard following the same process. Each widget can serve a unique purpose and display distinct information.

Figure 3.2: Prompt to add a widget

3.2 Remove a Widget

If you no longer need a widget on your dashboard or wish to rearrange its layout, you can remove it. Here's how to remove a widget from your dashboard:
Click the "Remove Widget" Button: Locate and click the "delete widget" or "remove widget" button on your dashboard's user interface. This action will prompt a dialog or input box.
Specify Widget to Remove: In the dialog, you may need to specify which widget you want to remove. This is typically done by entering the widget's index or selecting it from a list.
Confirm Deletion: Confirm your choice to delete the widget. The selected widget will be removed from your dashboard, and the layout will adjust accordingly.
Optional: You can repeat this process to remove additional widgets as needed.

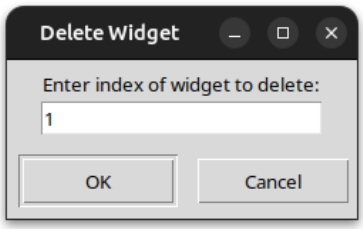

Figure 3.3: Prompt to remove a widget

3.3 Save Current Dashboard

Saving your current dashboard layout and widget configurations allows you to preserve your work for future use. To save your current dashboard, follow these steps:
Click the "Save Dashboard" Button: Locate and click the "save dashboard" button on your dashboard's user interface. This action will initiate the saving process.

3.4 Load a Dashboard

Loading a previously saved dashboard configuration allows you to restore a layout and widget setup. Here's how to load a dashboard:
Click the "Load Dashboard" Button: Locate and click the "load dashboard" button on your dashboard's user interface. This action will load the last saved dashbord onto the user interface.
Continue Editing: You can continue editing and customizing your loaded dashboard as needed.

3.5 Lock / Unlock Dashboard

Locking and unlocking the dashboard is a feature that restricts or enables interaction with the widgets on the canvas. Here's how to lock and unlock your dashboard:

3.5.1 Lock Dashboard

Click the "Lock Dashboard" Button: Locate and click the "lock dashboard" button on your dashboard's user interface. This action will activate the dashboard lock feature.
Widgets Become Static: When the dashboard is locked, all widgets on the canvas become static and unresponsive to user interactions. You cannot move or resize them.
Limited Functionality: Some buttons or features for adding, removing, or configuring widgets may become disabled while the dashboard is locked like the add and remove widget buttons.

3.5.2 Unlock Dashboard

Click the "Unlock Dashboard" Button: To regain full interaction with your widgets, click the "unlock dashboard" button on your dashboard's user interface. This action will deactivate the dashboard lock feature.
Widgets Become Interactive: Once the dashboard is unlocked, you can freely move, resize, and interact with the widgets as needed.
Full Functionality Restored: All buttons and features related to widget management become active and usable when the dashboard is unlocked.
Use the lock and unlock feature as needed to control the level of interactivity and customization available for your widgets on the dashboard. This feature can be especially useful when you want to prevent accidental changes to your layout.

4 Widgets

4.1 BleConfigWidget

The BleConfigWidget is a specialized widget in your dashboard application designed to interact with the tag device, retrieve configuration data from it, and update the configuration remotely.
In order to view the current configuration and change it, go through the following steps.

1. Add the BleConfigWidget widget to your dashboard. Drag and resize it if needed.
2. On the Tag device hit the user button 1 and look for a change in the user LEDs. When the config mode is entered the should blink in a repetetive pattern.
3. Hit the "Refresh" button and wait for a few seconds for your device to scan the vicinity for Bluetooth devices.
4. Select the "ESP32" device from the device list right to the Refresh button.
5. Hit the "Connect" button. After a short time the saved coordinates for each anchor device start to appear in the corresponding text fields.
6. To change the coordinates, define them in your setup physical by measuring thei position in relation to the origin (0,0,0).
7. Simpy change the already displayed coordinates. once the system noticed a change in a certain value the cell will change its color to red.
8. Once you are finished reconfigurating you need to hit the "Upload" button below the displayed coordinates to transfer the new values to the tag device.
9. To initiate the saving process you hit the "Save Config". The Tag device will automatically update the values by writing them into its EEPROM and reboot.

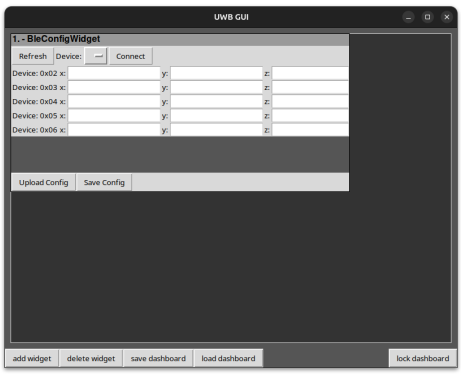

Figure 4.1: Empty configuration widget before connecting.

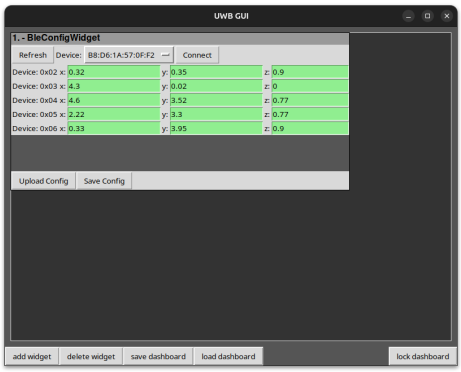

Figure 4.2: Configuration widget is displaying the currently saced coordinates after connecting successfully.

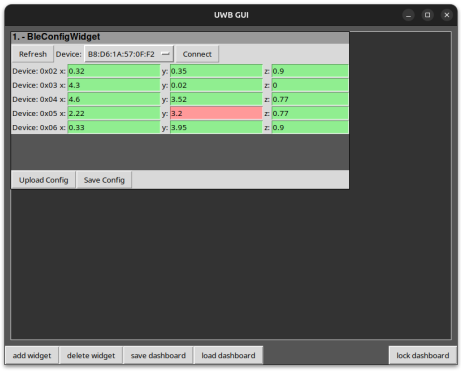

Figure 4.3: Configuration widget is displaying the changed coordinate in red.

4.2 BlePlotPositionWidget

The BlePlotPositionWidget lets you display the current position of the tag in the choosen coordinate system. In order to use it properly use it go through the following steps.

1. Add the BleConfigWidget widget to your dashboard. Drag and resize it if needed.
2. Make sure that all anchor devices 0x02 to 0x06 are up and running properly. Otherwise the estimated position may vary a lot.
3. Make sure the tag device is running and in uwb mode. That state is given if the LED 1 is consistently on and the green RX and TX LEDs next to the DWM3000 chip are blinking repetitively, if activated.
4. Hit the "Refresh" button and wait for a few seconds for your device to scan the vicinity for Bluetooth devices.
5. Select the "ESP32" device from the device list right to the Refresh button.
6. Hit the "Connect" button. After a short time the saved coordinates for each anchor device.
7. Now in the given plot of the widget a dot with the current estimated position is added.

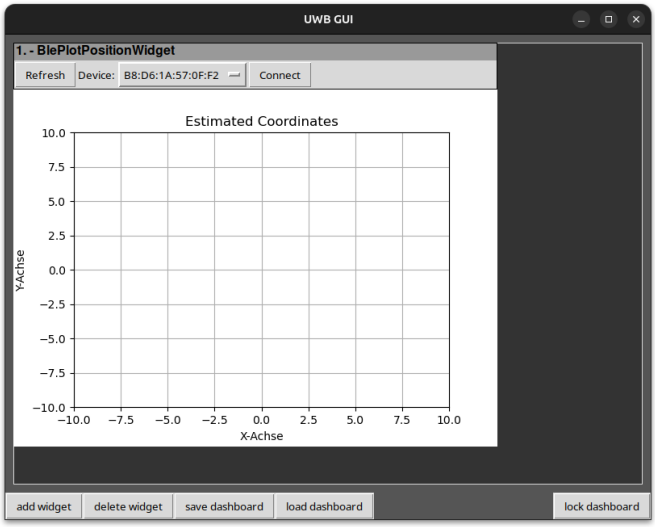

Figure 4.4: Plot Position Widget with no position currently displayed.

5 MQTT

Another way to obtain the current position of the tag is via MQTT. To utilize this feature it is necessary to put the WiFi SSID and Password, as well as the IP address of the device hosting the MQTT server into all the involved devices. This is done by changing the parameters in the respective source code and flashing all UWB devices.

The tag's MQTT messages are published to the topic "tag" and contain the currently estimated X-, Y- and Z-coordinates. It is updated after each new iteration of the EKF.

The anchor's MQTT messages contain the latest information about the UWB communication channel between each individual anchor and the tag. After replying to every UWB request each anchor publishes its device id together with all the channel information to the MQTT server under the "anchor" topic.