KIO RTLS EVALUATION KIT USER MANUAL

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KIO RTLS EVALUATION KIT

USER MANUAL

OÜ Eliko Tehnoloogia Arenduskeskus

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Mäealuse 2/1
Tallinn, 12618
Estonia

Tel: +372 6599 881
Fax: +372 6599 880

info@eliko.ee
www.eliko.ee

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Mäealuse 2/1
Tallinn, 12618
Estonia

Tel: +372 6599 881
Fax: +372 6599 880

info@eliko.ee
www.eliko.ee

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DOCUMENT SCOPE AND PURPOSE

The Kio RTLS is an Ultra Wideband (UWB) based positioning system. It can locate any object that is equipped with a KIO RTLS tag and is within UWB radio coverage from at least four KIO RTLS anchors. With the KIO RTLS evaluation kit software you can see the position of the tag as a dot on your computer screen and verify the X, Y, Z coordinates.

The evaluation kit is designed for quick and simple evaluating and verifying the positioning performance of a KIO RTLS system. The evaluation software is only compatible with the Microsoft Windows operating system (OS). It currently supports 4 anchors and 1-4 tags.

This user manual is designed for helping the user to set up the KIO RTLS evaluation kit. The evaluation kit includes:

- 4 anchors and 1 tag,
- Java-based evaluation software for a MS Windows operated computer.[1]

1. GETTING STARTED

Placing the anchors

First determine a point in the room where you plan to evaluate the system. This is your zero-coordinate point in the XYZ-axes (0,0,0) and helps you identify the location of all the other anchors.

In order to position in 3D, place all the anchors in the corners of the room as shown in Figure 1. Although, in 2D positioning the anchors can be placed at random height, we still recommend to place the anchors on the same height in order to achieve the best results in 2D positioning.
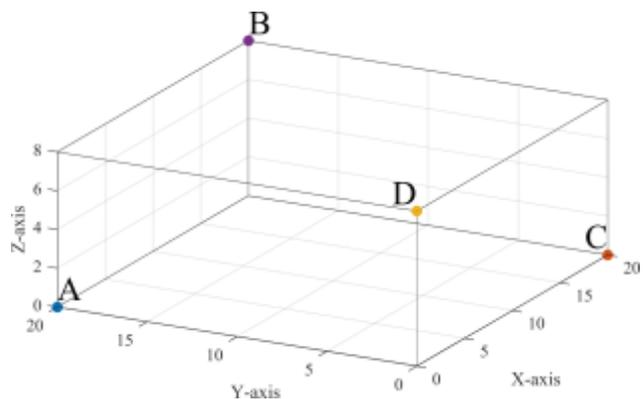

Figure 1: Recommended anchor positions for 3D

There are a few things to consider in choosing the right position for the anchors. The anchors should be placed in a way that they can be connected to the mains power supply. In order to collect the data and do the multilateration or coordinate calculations on your computer, one anchor should be placed close enough to connect it to a computer (via USB). It is also recommended to

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[1] USB chargers and cables are not included in the evaluation kit.

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place the anchors in a vertical upward orientation, avoiding obstacles that can disturb the line-of-sight with the tag.

Please note that metal, solid concrete and liquids are the most difficult obstacles to penetrate for the system. These materials will reduce the positioning accuracy and in some cases, can even block the signal entirely.

Data collection is possible from anchor types B, C and D and also from the tag (except from the battery powered tag). Note that in a multi-tag scenario, it is highly recommended to use an anchor for data collection and not a tag. This is because the tag will only collect its own positioning information and not that of the other tags.

After placing all the anchors, measure the distance of each of the anchors in relation to your zero-coordinate point and determine their X, Y, Z coordinates (in meters). This information is relevant for setting up the Java-based evaluation software.

Connecting the anchors and tags

Connect each anchor and tag to a mains power supply using the micro-B USB cables and 5V USB chargers (power output should be at least 500 mA). Please note that the USB chargers are not included in the evaluation kit. After connecting the anchor or the tag, the upper green led light should turn on. This signals that the device is working and the ranging/polling functionality is activated.

If you are using battery-powered tags, please follow the instructions in the following sections, otherwise continue to paragraph 2.

Battery powered tag setup

Push the tag's upper button to turn it on (see Figure 2). When the upper red led light turns on, release the button. If the lower green led is blinking, the tag is working and the ranging/polling functionality is activated. If nothing happens after pushing the upper button, then the battery is empty (see the next section).

To turn off the tag, push the upper button until the upper red led light turns on and then release the button. When all the lights on the tag are off, the ranging/polling functionality is inactivated.
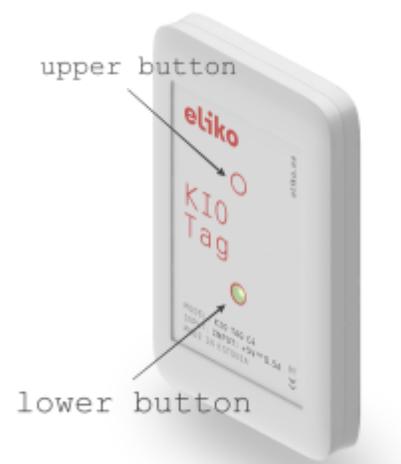

Figure 2: KIO RTLS Battery Powered Tag

Mäealuse 2/1
Tallinn, 12618
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www.eliko.ee

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Charging the battery powered tag

Use the micro-B USB and a 5V USB charger to connect the tag to a computer (or a power socket).[2] The tag battery is charging when the lower led light turns red.

To activate the ranging/polling functionality while charging, push and release the tag's upper button until the upper red led light turns on. The lower red led light should be on and the green led blinking inside it. This means that the tag battery is charging and the ranging/polling functionality is activated.

2. READING THE POSITIONING DATA

The Java-based evaluation software is designed for evaluating and verifying the positioning performance of a KIO RTLS system. The evaluation software is only compatible with the Microsoft Windows OS. It currently supports 4 anchors and 1-4 tags.

In order to use the KIO RTLS Evaluation Kit software in any Microsoft Windows environment, it is necessary to first install the correct virtual COM port driver. The downloadable driver file is available here: http://www.st.com/web/en/catalog/tools/PF257938#.

After placing the anchors, connecting the anchors and tags to a power source and making sure they are working, it is possible to start reading the positioning data.

The only way to visualize the positioning data is to use the Java-based evaluation software.[3] In case the user is only interested in verifying and collecting the distance measurements, it is recommended to use any terminal service. Connect any anchor (except type A) or a regular tag to your computer USB port and run the serial connection in your terminal service.

Tag and anchor setup

First, insert the coordinates and ID-s of each of the anchors and tags. The coordinates are the correct positions in XYZ-axes for every anchor according to the measurements taken when placing the anchors (see paragraph 1 Getting Started).

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[2] USB cables and chargers are not included in the evaluation kit.

[3] If there is a need to test the data integration with a third-party information system, please request for our Linux command line software.

Mäealuse 2/1
Tallinn, 12618
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Fax: +372 6599 880

info@eliko.ee
www.eliko.ee

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There are two options for inserting the coordinates. You can insert them in the slots on the left side panel of the user interface (see figure 3). Note that you have to reinsert them after every software restart.

We recommend writing the anchor ID-s and coordinates in the anchor.txt file found in the evaluation software folder. If the anchor data is there, the software uses it by default and it is not necessary to reinsert the data after every software restart.

In both cases, the measurements should be inserted in meters and using point as the decimal mark.
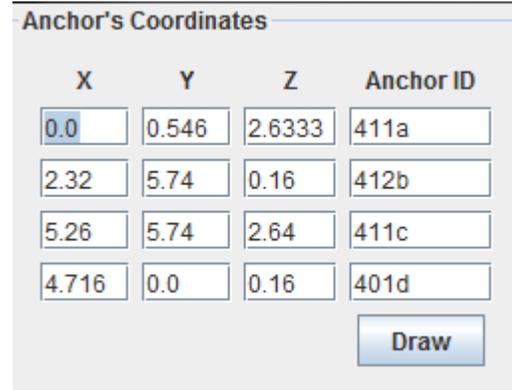
Figure 3: Inserting anchor coordinates

In the example setup on Figure 3, the anchor 411a is positioned on the y-axis, 0.546 meters from the zero coordinate. Therefore, the x-axis measurement is 0 meters. The height of the anchor (z-axis) is 2.6333 meters. The Anchor ID is the three last characters of the serial number combined with the anchor type. Both the ID and the anchor type can be found on the KIO device.

After inserting the measurements, press on the Draw button to visualize the position of the anchors on the grid. Check whether the grid corresponds to the position of the anchors in the room and adjust if necessary.

The tag configuration section is relevant for distinguishing between 2D and 3D positioning. The height of the tag (z-axis) must be filled in for 2D positioning. 2D positioning can be achieved with a minimum of 3 anchors. In order to successfully position in 3D, it is necessary to have 4 anchors and leave the height value to zero (see Figure 4).
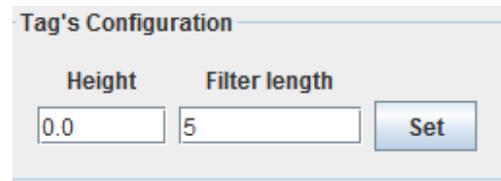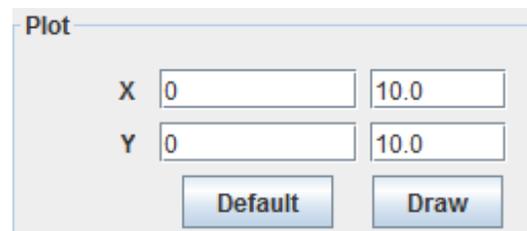

Figure 4: Tag configuration

The filter length value determines how many measurements are used in the algorithm to smoothen the positioning visualization. To minimize the risk of losing relevant positioning data while avoiding tag "hopping" on the screen, it is recommended to use a minimum of 5 measurements. After inserting the values, please press the Set button.

Plot area and Ranging

The default positioning grid or plot area is 10x10 meters (see Figure 5). However, the size of the plot can be adjusted according to the positioning scenario area. By pressing on the Draw button, the software will adjust the grid size according to the new measurements.

It is not possible to insert a room map in the current software version.

Figure 5: Positioning grid area

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After completing the previous steps, locate the ranging section and choose the correct communication (COM) port on your computer and press the Start button to initiate ranging (see Figure 6). The real-time positioning data will appear in the Log window (see Figure 7).
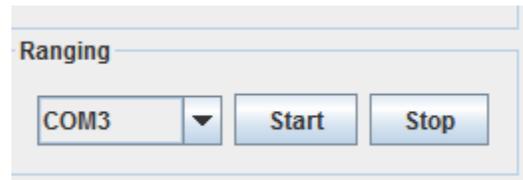

Figure 6: Communication port and ranging

In order to check the positioning accuracy of the KIO RTLS, press the Stop button to read the tag's last position in the Log window. In the example on Figure 7, the last position determines that the tag nr 4023 is located 1.53 meters from the x-axis, 4.06 meters from the y-axis and is positioned at a height of 0.86 meters.
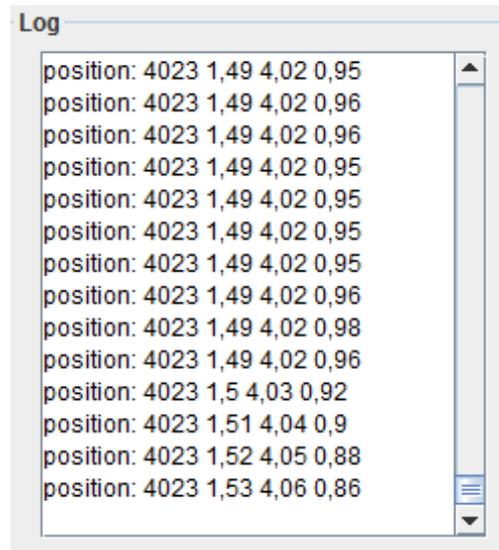
It is possible to save the positioning data into a text file for further analysis. First, press the Save button to initialize the data saving process.

After pressing on the Stop button the data is automatically saved in the KIO RTLS software folder on the computer. The text file can be opened with any text file compatible application. Figure 8 shows the positioning data opened in Notepad++.
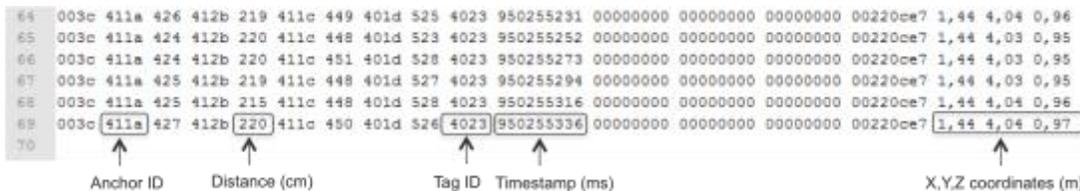

Figure 7: Positioning data

Figure 8: Text file with positioning information

Each anchor ID is followed by the distance measurement (in centimeters) between the anchor and the tag. The three last characters of the timestamp represent the time (in milliseconds) that the specific measurement was taken. The tag's position in XYZ-axes is measured in meters.

3. FCC CERTIFICATION

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Mäealuse 2/1
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NOTICE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

NOTICE: Changes or modifications made to this equipment not expressly approved by Eliko may void the FCC authorization to operate this equipment.

NOTICE: Radiofrequency radiation exposure Information - The radiated output power of the device is far below the FCC radio frequency exposure limits. Nevertheless, the device shall be used in such a manner that the potential for human contact during normal operation is minimized.

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