

KiWaveSonar User Manual

Team Kiwi - Group 13

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Table of contents

Introduction	3
Safety information	3
General safety guidelines	3
Ultrasonic sensors safety	3
Wio terminal safety	3
Maintenance and services	3
Dependencies/System requirements	4
System requirements	4
Dependencies	4
Get started	4
Installing dependencies	4
Building from source	4
Setting up on a server	4
Setting up locally	5
Instructions	6
Connecting the sonar system	6
Loading scene	7
Switching between dark and light mode	7
Starting and Stopping the sonar	9
Starting the sonar	9
Stopping the sonar	10
Changing range	11
Change measuring sector	12
Notifications	12
Using the track mode	15
Hardware Limitations	16
Troubleshooting	17
Connectivity	17
Inaccurate Range	19
Contact Support	20

Introduction

Welcome to the user manual of the sonar system provided by team KIWI. This comprehensive guide is designed to provide you with all the necessary information and instructions to effectively operate and utilise the capabilities of the sonar system. Whether you are a beginner or an experienced user, this manual will be your go-to resource for understanding the system's features, settings, and functionalities. From installation and configuration to troubleshooting and maintenance, we've got you covered. By going through this document, you will be ready to use all the possible features and maximise your usage of the sonar system.

Safety information

General safety guidelines

- 1- Make sure to read the user manual first to get familiarised with the proper way of using the sonar.
- 2- Follow all the instructions provided in the user manual.
- 3- Keep the sonar away from moisture and extreme temperatures.
- 4- Use the sonar for the provided purposes only.
- 5- Keep the sonar away from flammable objects.

Ultrasonic sensors safety

- 1- Avoid touching the sensors while the sonar system is working.
- 2- Do not expose the sensors to excessive force, pressure or temperature.
- 3- Make sure the sensors' surface is clean of dust and dirt.
- 4- Do not expose the sensors to water or any type of liquid.

Wio terminal safety

- 1- Handle the Wio Terminal with care to prevent damage to the radar system.
- 2- Avoid exposing the Wio Terminal to intense temperature and humidity.
- 3- Do not expose the Wio Terminal to water or any type of liquid.
- 4- Use the provided accessories and jumper cables for utilising the Wio terminal.

Maintenance and services

- 1- Do not attempt to repair or service the system yourself unless you are qualified to do so.
- 2- Regularly check the sonar for any damages or loose connections..

3- Ensure that the radar system is connected to a stable 5v power source. Connecting the sonar to a power source that inputs electricity with a voltage higher than 5v will burn the Wio terminal.

Dependencies/System requirements

System requirements

Supported web browsers: Google Chrome 99+, Mozilla Firefox 112+, Safari 16+

Dependencies

To run/build the front-end application, the user needs to have NodeJS version 18+ installed, which should include npm and npx.

Get started

Installing dependencies

To run/build the SonarVisualizer front-end, a number of dependencies (node modules) are required. These can be installed automatically, by following these steps:

1. Install NodeJS (follow OS specific instructions at <https://nodejs.org/en>)
2. Using a terminal navigate to the source directory of SonarVisualizer
3. Install all dependencies by running `npm i`

Building from source

After installing all the required dependencies, the application can be built from source by following these steps:

1. Using the terminal, navigate to the source directory of SonarVisualizer
2. Run `npm run build` to compile the Svelte files and build the project.
3. The final result can be found in the dist subdirectory

Setting up on a server

After the application has been built following the instruction above, the resulting files can be found at the dist subdirectory of the SonarVisualizer project directory. Since the front-end application is a static website/web app, these files can be directly copied to a remote server and served directly using any server application such as nginx or apache.

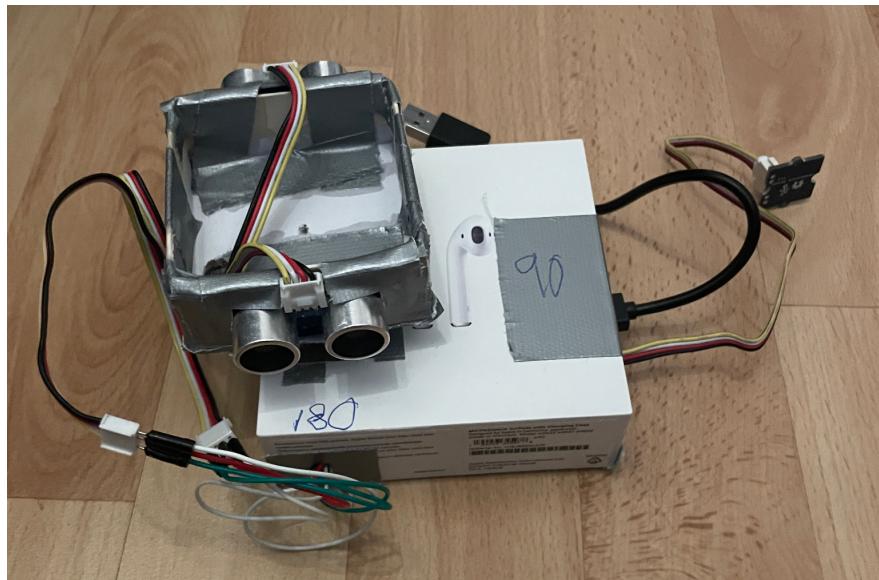
Setting up locally

The application can also be run locally for testing or development purposes. This can be done by running `npm run dev` in the terminal while in the SonarVisualizer directory. After running the command, the application will be accessible at <http://localhost:5173>. To test the application on mobile, or other devices, it can be exposed on the local network by running `npm run dev -- --host`. Following this command the application can be accessed on the local network at the local IP address of the machine it's running on, at port 5173. The exact address will also be displayed in the terminal.

Instructions

Connecting the sonar system

The image below shows what the sonar system looks like. This user manual assumes that you have purchased the sonar system as a whole already. For people wanting to build their own sonar system, we have more precise instructions in our [ReadMe](#).

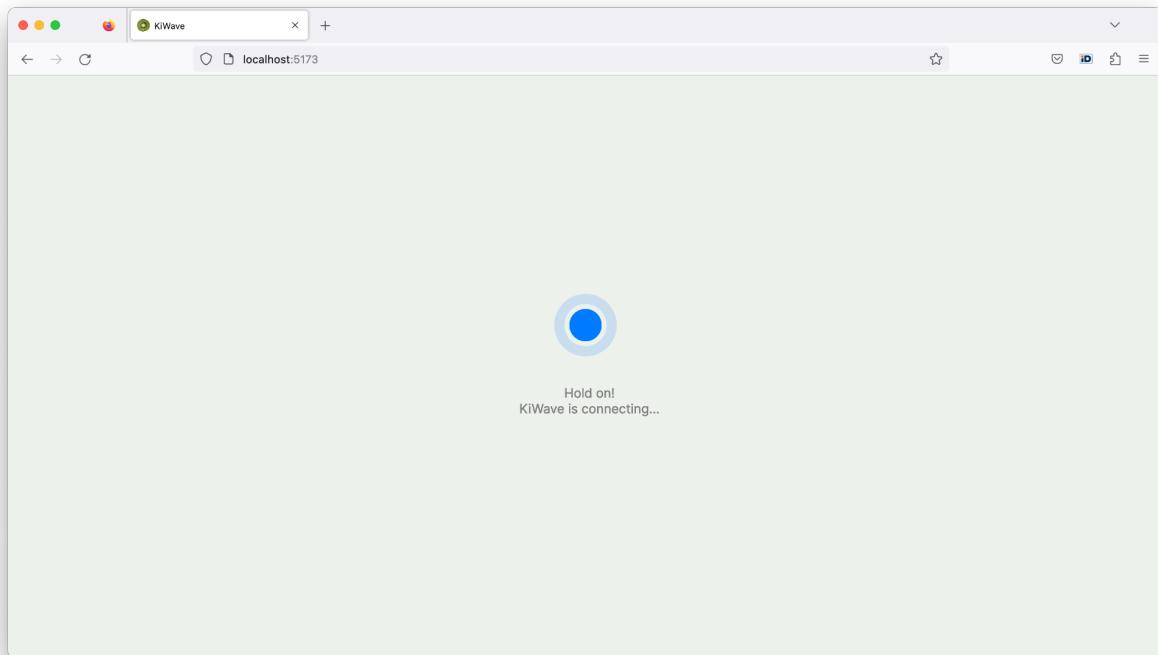


To connect the sonar and start working with it, it has to be connected to a USB port of at least 5V. We would recommend connecting it to a computer via the USB-cable. In addition, the Wio terminal needs a stable Wi-Fi connection to work properly.

KiWave

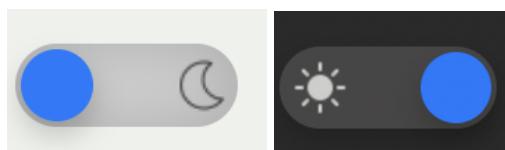
Loading scene

Once the application is opened, the user is prompted with a loading scene. This means that the sonar hardware is not online. The loading scene says: "Hold on! KiWave is connecting...". When the sonar connects to a Wi-Fi network, then the loading scene switches to the main page of the application. If the sonar disconnects at any point, the user is again prompted with the loading scene.



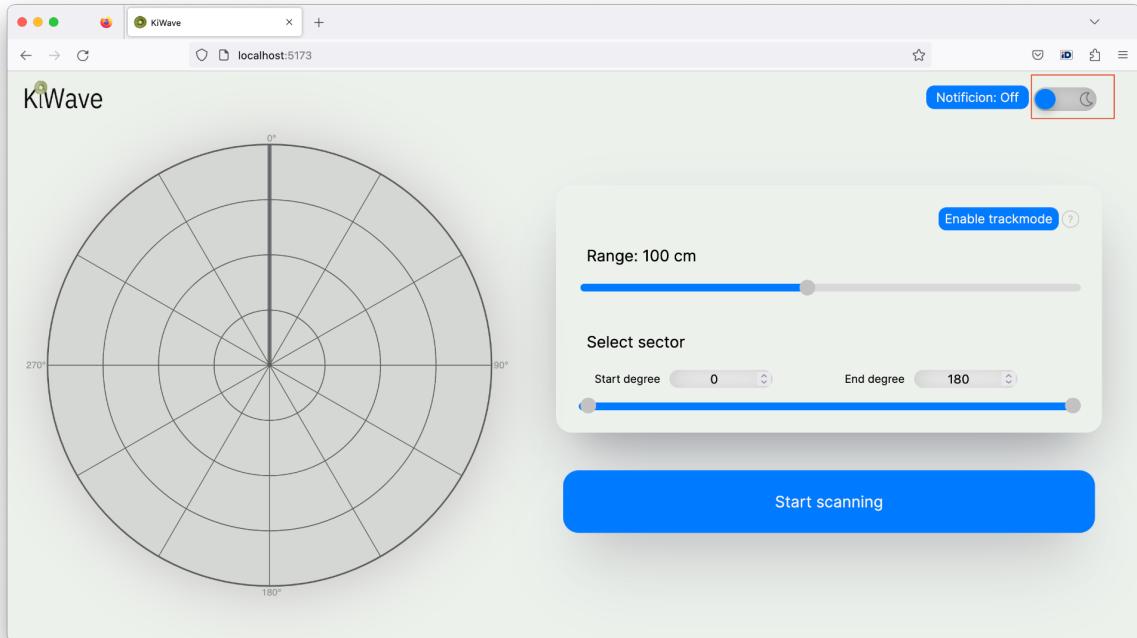
Switching between dark and light mode

On the top right corner of the page, there is a switch which allows the user to choose between a light or dark mode. Click on the switch to enable dark mode. By consequence, the light colours of the website turn dark. The same applies to switching back to light mode.

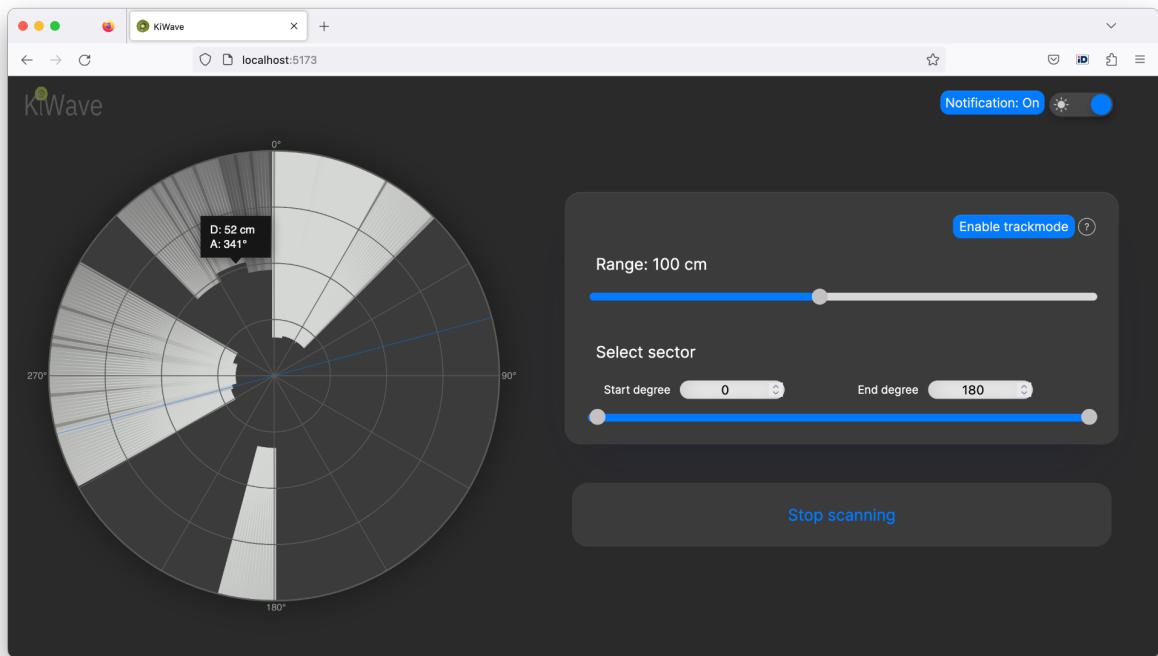


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Light mode:



Dark mode:

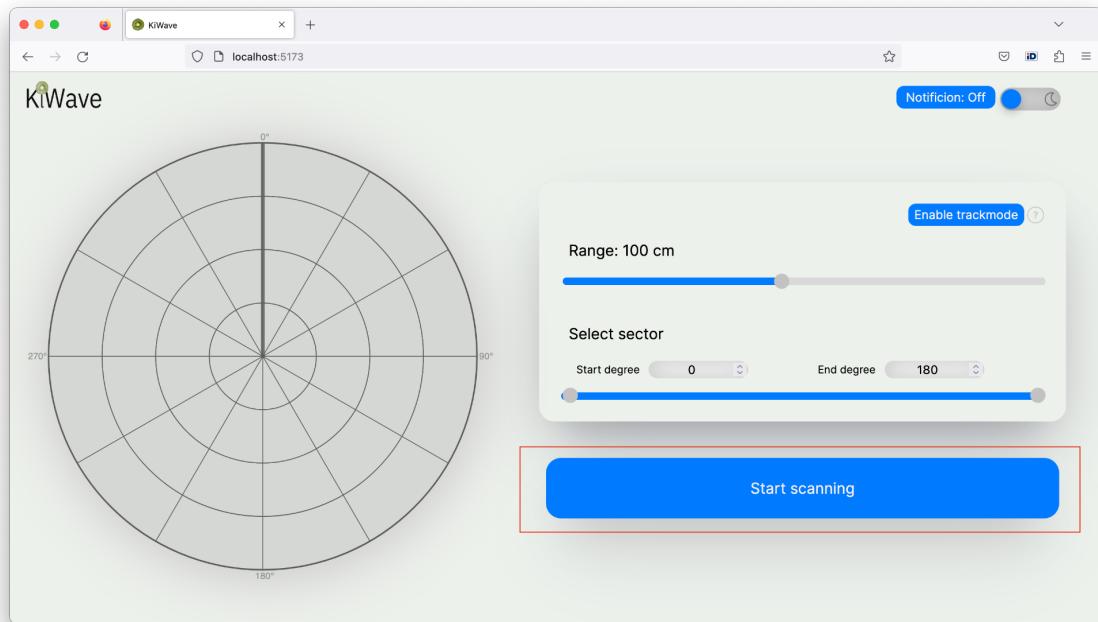


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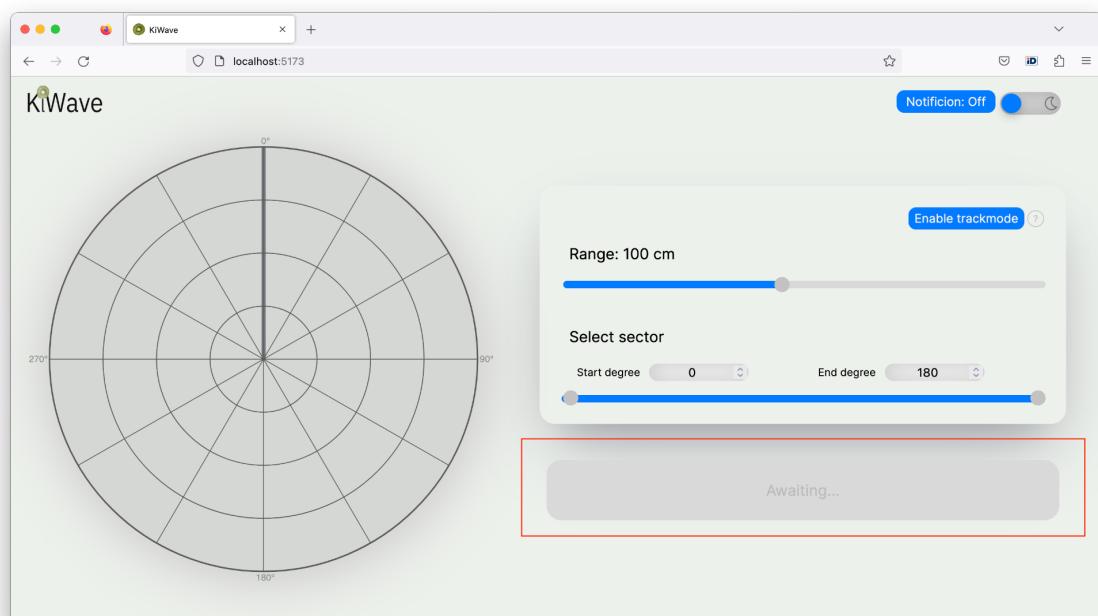
Starting and Stopping the sonar

Starting the sonar

Click on the "Start scanning" button to make the sonar start scanning.



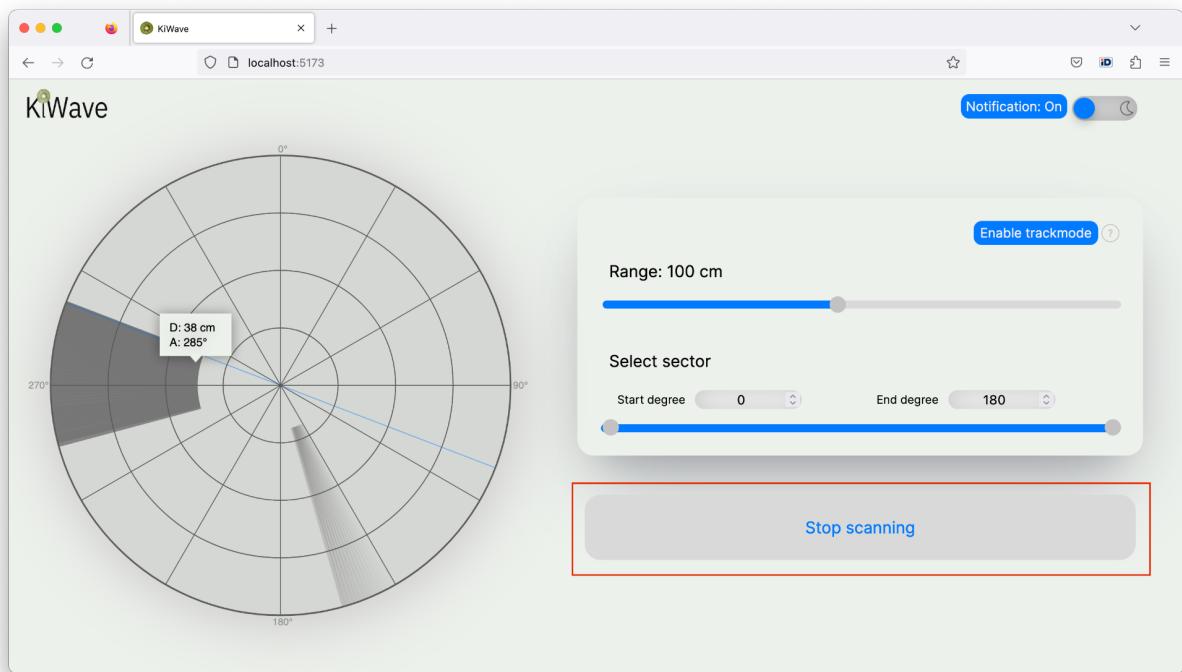
After clicking on "Start scanning", the text on the button text will change to "Awaiting...". This means that the sonar is receiving the starting command. This phase exists in order to avoid sending start and stop commands right after each other and confusing the sonar. In a few seconds, the radar will start displaying results on the screen.



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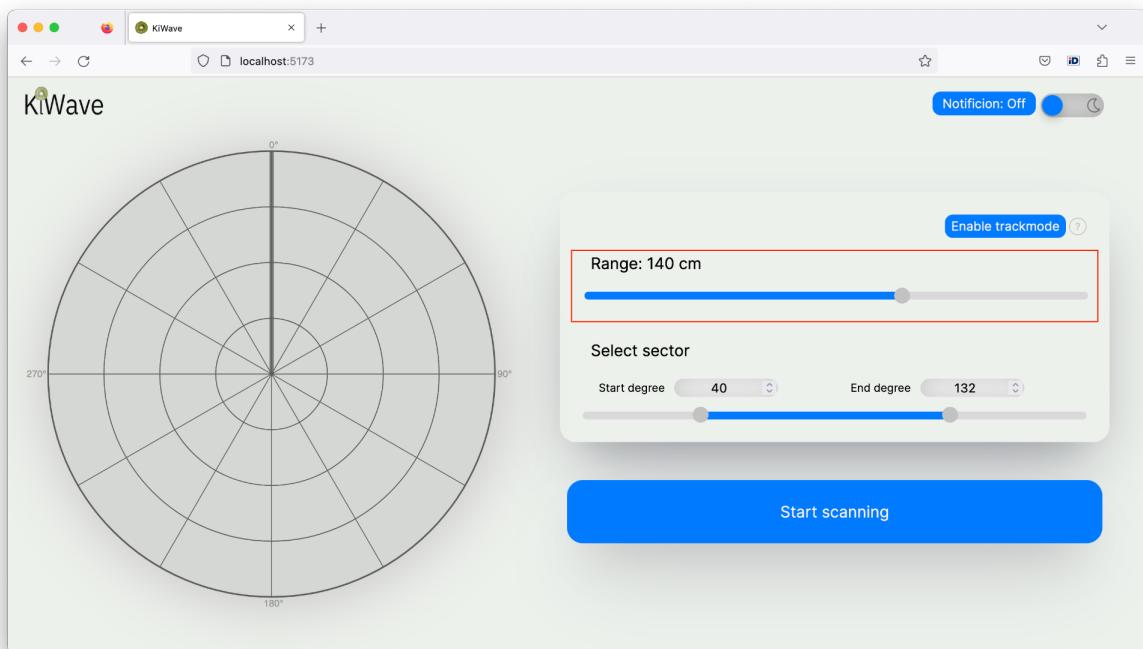
Stopping the sonar

To stop the sonar, click on the button "Stop scanning" and shortly after, there will be no new data shown on the screen and the sonar stops working.



Changing range

The sonar works in the range 1-220 centimetres. Once the sonar is started, the default range is 100 centimetres. The range can be modified by changing the value of the range slider. The selected range is written on top of the slider. The sonar will only detect items in the range that it is given.

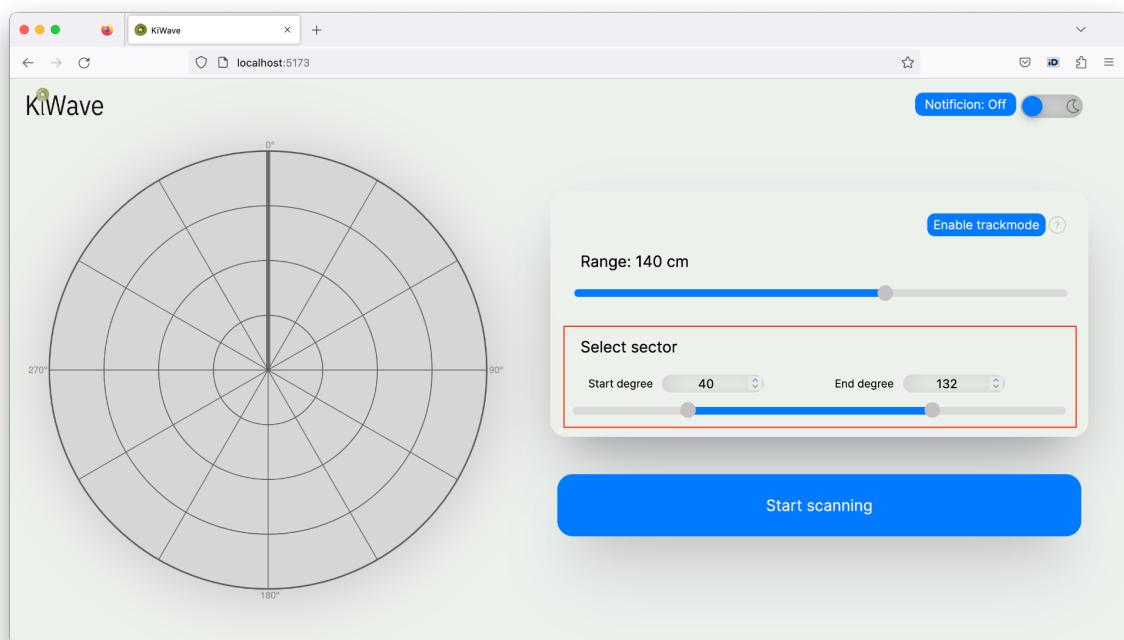


Change measuring sector

By default, the servo motor which the sonar is mounted on, rotates 180 degrees, measuring objects from both sides so objects are detected in the full 360 degree view. To make the sector, in which the sonar detects objects, smaller, the user has to modify the values on the Sector slider. The left point on the slider indicates the start degree and the right one the end degree. Also, the values can be changed by typing in the white input boxes.

NB! The minimum sector that can be chosen is 15 degrees since that is the minimum range that the ultrasonic sensors operate in.

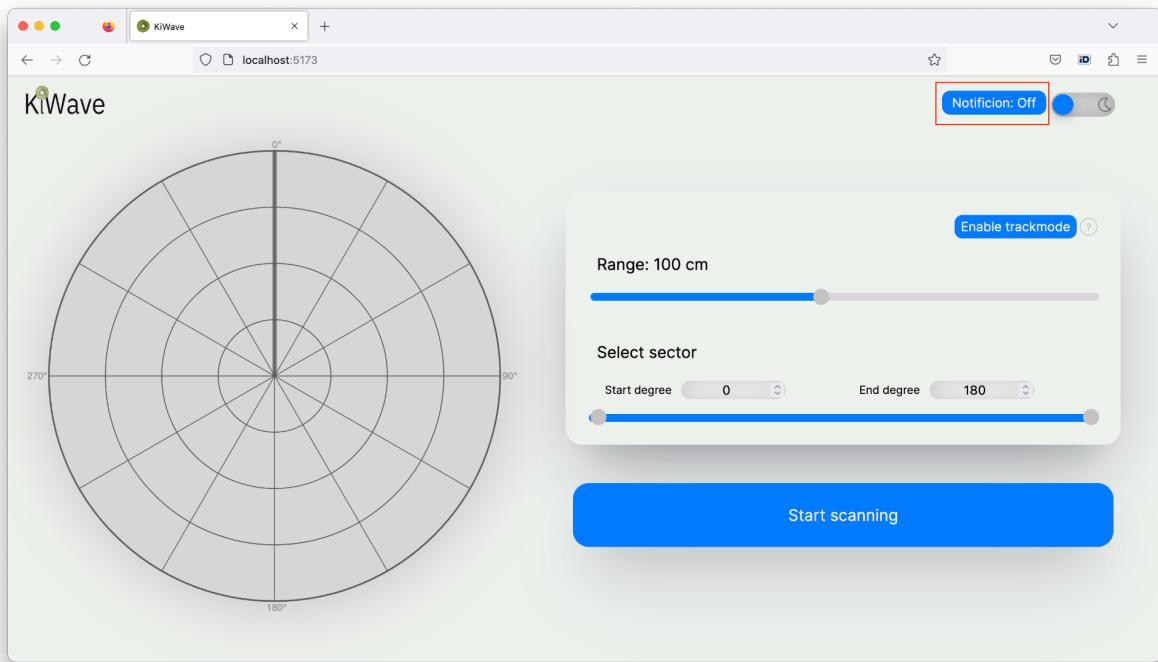
It is also important to note that the sonar will work also in the opposite sector that is chosen. For instance, when the sector specification is 0-90 degrees, the radar will also detect objects that are in the range 180-270 degrees.



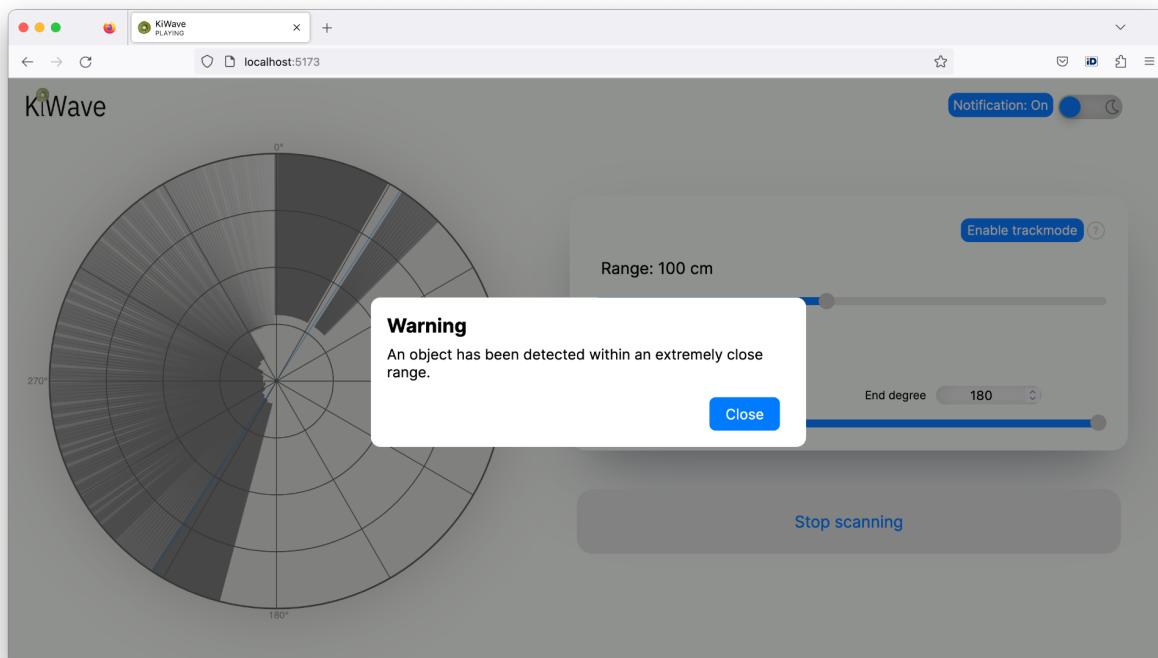
Notifications

The notifications can be enabled by clicking on the "Notifications" button on the top of the screen. By clicking on the "Notification: Off" button, the notifications and sound alarm will be turned on. By clicking on the "Notification: On" button, the notifications and sound alarm will be disabled again.

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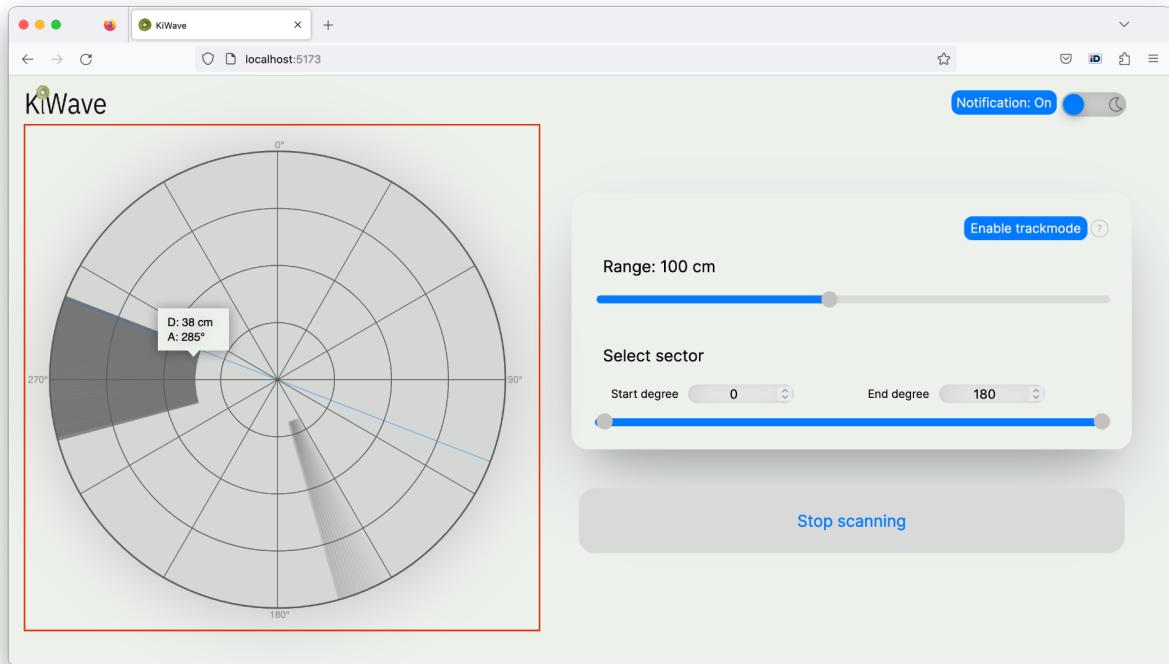


The notifications feature notifies the user once something is closer than 5 centimetres from the ultrasonic sensors. Once an object is detected in that 5 cm range, the user is prompted with a pop-up notification. In addition, there is a sound alarm that plays together with the pop-up. The pop-up notification can be closed by clicking on the "Close" button. The alarm will also go off once the pop-up is closed.



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Reading results from the radar screen



The radar screen displays objects detected by the sonar system. The sonar system scans the surrounding environment based on the range and angles defined by the user. When an object is identified, the sonar system prints the corresponding area on the radar screen and turns it into black, indicating its presence. It is important to note that the sonar system can only identify the front surface of an object and cannot determine its length. Consequently, the entire area behind the detected object appears black.

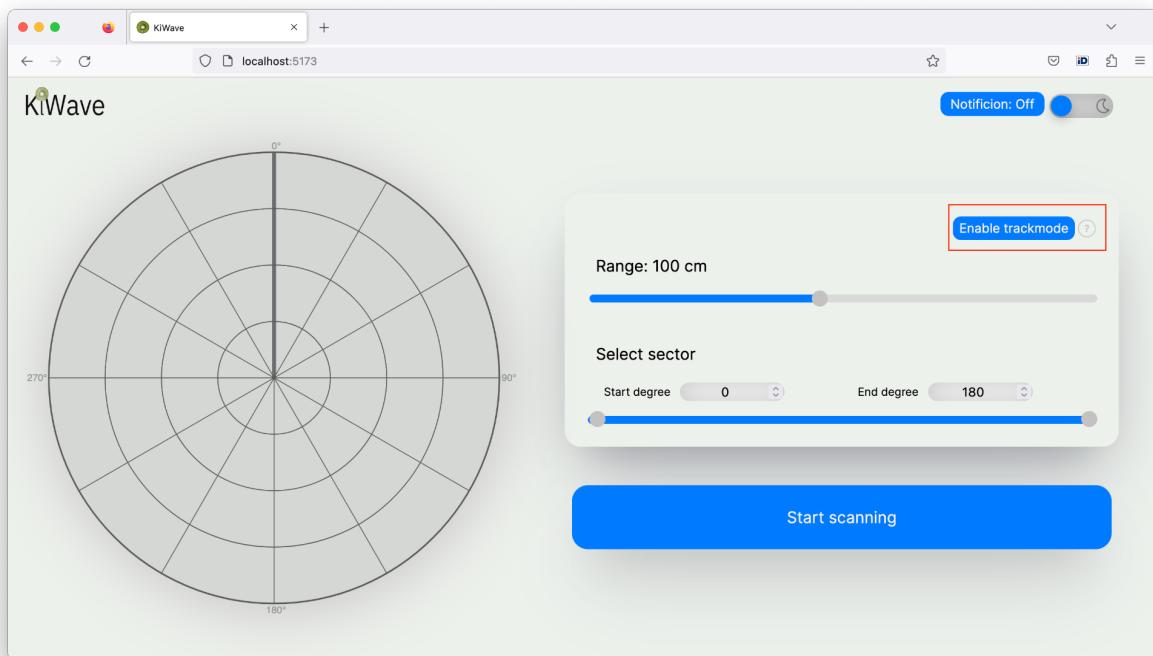
Tooltips are a useful feature that help the users in getting information from the radar screen of the sonar system. By navigating to the radar screen and hovering over it, users can access tooltips that provide details about the angle and distance from the sensors for the selected point. This enables users to gather specific information about the location they are interested in within the radar screen. The picture above demonstrates an actual example on how this feature would look like when using it, the selected point in the radar screen has a distance of 38 centimetres and is at degree 285.

NB! Degrees 0, 90, 180 and 270 are noted on the hardware, thus it is recommended to use that notation to understand at what degree the detected objects are located.

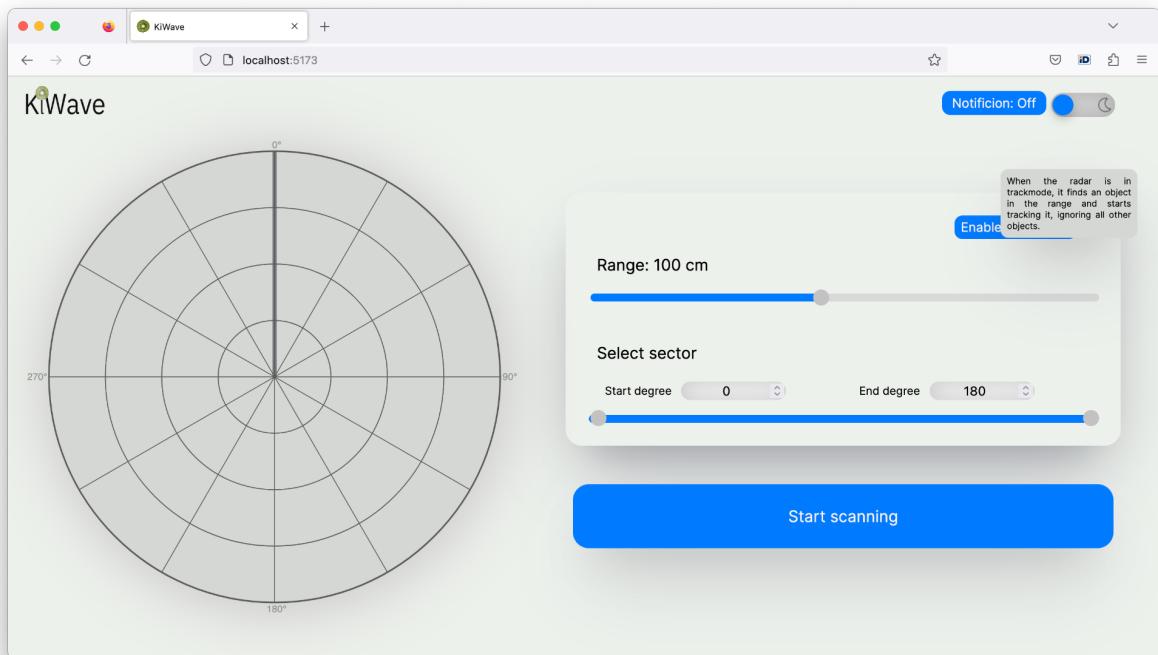
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Using the track mode

In track mode, the radar system identifies and tracks the first object detected during the scanning process within the designated range. Once an object is detected, the sonar ignores other objects in the environment and focuses on tracking movement of the detected object. The tracking mode can be stopped at any point, allowing the sonar to go back to regular scanning. Note that only one of the ultrasonic sensors works as a tracker which is marked with "2".



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Hardware Limitations

To allow data to be shown smoothly on the radar screen, a buffer was used to send clusters of data from the hardware to the web application. This buffer, however, has a downside. The data shown on the radar screen is about 10 seconds behind what the sensors are scanning.

The radar cannot measure ranges further than 220 cm due to the ultrasonic limitation in range measurement. The Ultrasonic sensors cannot measure sectors less than 15 degrees as well.

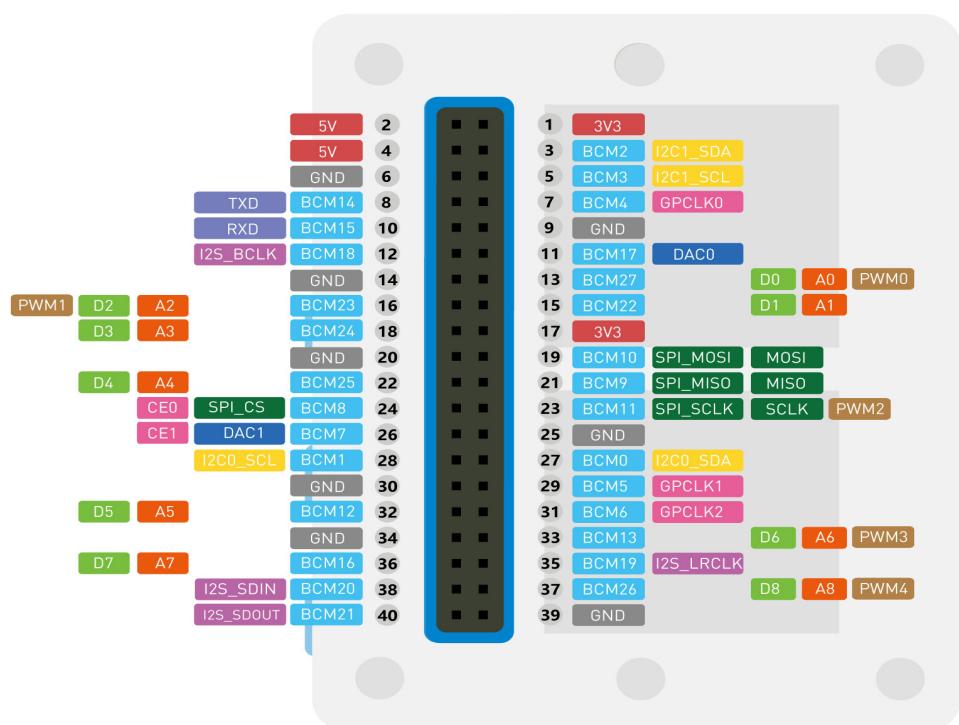
Moreover, the sensors cannot see beyond detected objects (as some advanced radars can), and as a result, the entire area behind the detected object appears black.

The ultrasonic sensors work with sending sound waves and their reception of their echoes after bouncing back from objects in their way. Therefore, the sonar's function and accuracy can be hugely affected in environments with excessive echo presence (small environments).

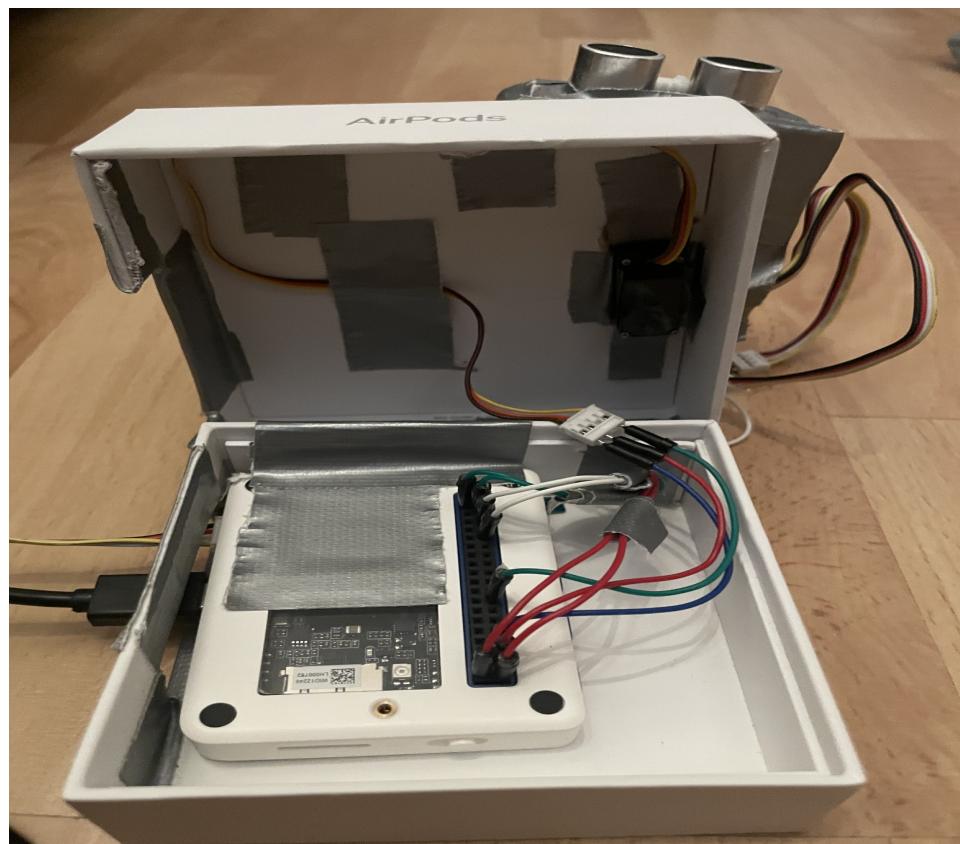
Troubleshooting

Connectivity

You can refer to this section, in case some of the sonar jumper cables are disconnected. Using this section and reading what is written on the sensors you can reconnect the jumper cables and reuse the sonar. In case you do not manage to do what is said next, you can use the contact support section and contact one of the developers.



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To figure which pin is which you can refer to the pictures on top.

Servo motor pinout structure (Servo motor is the small black coloured device that is pasted on the inner top surface of the box using tape):

- VCC connected to 4 (which is 5V) on the Wio
- GND connected to 6 (which is GND) on the Wio
- SIG connected to 16 (which is D2) on the Wio

First ultrasonic sensor pinout structure (Ultrasonic sensors are the devices pasted on the outside surface of the box and have two cylindrical-shape tubes) :

- GND connected to 30 (which is GND) on the Wio
- VCC connected to 1 (which is 3V3 (3.3 V)) on the Wio
- SIG connected to 36 (which is D7) on the Wio

Second ultrasonic sensor pinout structure:

- GND connected to 34 (which is GND) on the Wio
- VCC connected to 2 (which is 3v3 (3.3 v)) on the Wio
- SIG connected to 37 (which is D8) on the Wio

Temperature sensor pinout structure (Temperature sensor is the small sensor that its jumper cables are connected under the joystick of the Wio Terminal):

- Use the grove port (D1,D0) under the joystick.

Inaccurate Range

In some instances, the sonar might produce occasional inaccuracies in range measurement. This is mainly because of the effects of interference encountered in the operating environment. To solve this issue, it is suggested that the user changes the location of the sonar system to a more open area. By doing that, the potential inaccuracies due to the environmental interference (echoes) will be minimised.

Contact Support

In case of any further issues, you can contact anyone from the developing team:

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