

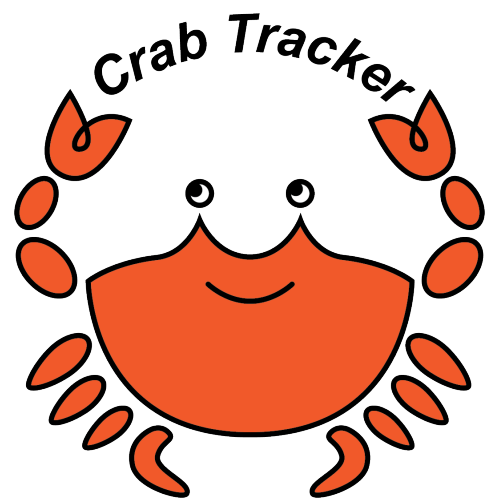
Setup and User Guide

Crab Tracker

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1 Introduction

The Crab Tracker project was designed as a cost-effective means of remotely tracking crabs through acoustic signals. Small piezoelectric transmitters can be waterproofed and attached to crabs, and their intermittent signals can then be received by a set of four piezoelectric receivers configured in a square array.

This document will detail the setup and configuration of various elements of the product as they were originally intended to be used. As of the time of this writing, some of the hardware elements of this project are still in development and therefore details about them will not be discussed in this document.

2 Hardware Setup

2.1 Required Hardware Components

The project was initially built with, and officially supports, the following devices:

- Raspberry Pi 3B
- Raspberry Pi 7" Touch Screen
- Arduino Nano

Additionally, there are transmitters and receivers that were custom designed for this product. Specific details about these components are still subject to change as of the writing of this document, and they will be detailed elsewhere as they are formalized. In order to use the Crab Tracker product, it is necessary to fabricate receiver and transmitter microcontrollers per the specifications detailed in those documents. Additionally, parts of these components, as well as the piezoelectric transducers they are paired with, must be coated entirely in epoxy for waterproofing.

2.2 Hydrophone Array

The Crab Tracker project uses a set of 4 receivers to perform triangulation of underwater transmissions. The configuration of the transmitters is extremely important, as an incorrect configuration of the hydrophone array will lead to incorrect triangulation results. The hydrophone array may be attached to a personal watercraft, such as a kayak.

Hydrophones must be placed in a square, with all sides equidistant. The exact side lengths may vary, but are expected to be roughly 1 meter each. Once put in place, the exact side lengths need to be communicated to the software to ensure accuracy of readings. See Figure 1 for an example of the hydrophone configuration. Note that the side lengths shown are 1 meter, but this is only an example.

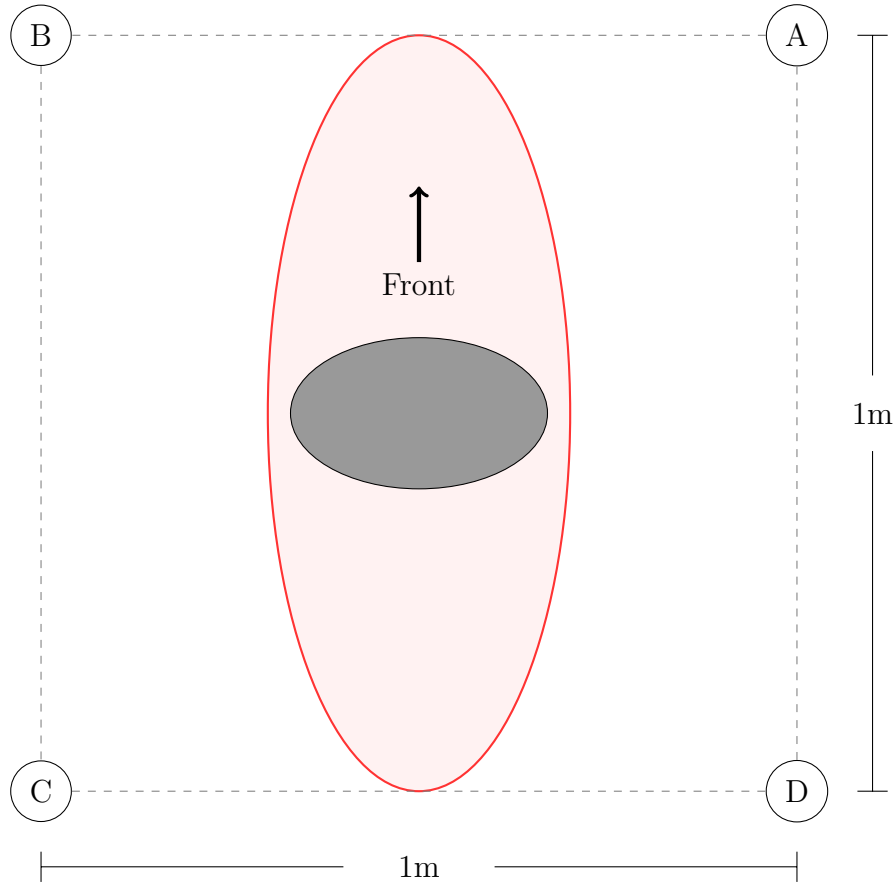


Figure 1: The hydrophone array attached to the kayak.

3 Software Setup

3.1 Loading Software

It may at some point be necessary to add or replace code on one of the devices, such as when new hardware is acquired or the software is updated. To do this, the first step is to download (“clone”) the most recent copy of the **master** branch from the Crab Tracker GitHub repository. It is possible to download a ZIP file containing the contents of the repository from the GitHub website. Another option, however, is to use the **git** command-line utility to make a clone. To see if you have Git installed, open a shell/terminal and type **git**. A usage page should be displayed. If not, look online for instructions on how to install Git on your operating system.

The steps shown in the remainder of this section are meant to be run on a UNIX-like operating system (such as Linux, MacOS, or BSD). However, equivalent commands exist for other systems, such as Windows.

3.1.1 Downloading the source code

The following applies to both personal computers, which may be attached to the Arduino, and to the Raspberry Pi to be used in the field.

If you have not cloned the repository on your computer before, run:

```
$ git clone https://github.com/cabeese/crab-tracker.git
$ cd crab-tracker
```

If you have already cloned the repository at some point previously, `cd` into the project's directory and run `git pull`.

3.1.2 Flashing code to the Arduino

In order to upload binaries to the Arduino, you will need the Arduino software from their website. With the software downloaded, plug the Arduino into your computer.

Next, open the `src/arduino-src/arduino-src.ino` file in the Arduino editor. Under the Tools menu, set the *Board* to *Arduino Nano* and set the *Port* to the port you plugged the Nano in to.

Now click the UPLOAD button. The compile and upload process should finish in a few seconds.

That's it!

3.1.3 Updating code on the Pi

To update the source code on the Raspberry Pi, connect the Pi to power and your network (via an Ethernet cable). Using an external keyboard is highly recommended as well, though it is possible to use the on-screen keyboard if you do not have access to a physical one.

With the Pi connected, open up the Terminal app and use the commands listed in Section 3.1.1 to download a copy of the source code.

Next, run the following commands to make the executable file.

```
$ cd crab-tracker
$ cd src/pi-src
$ make
```

The output of the `g++` commands will be shown. When the shell prompt reappears, you can start the program like so:

```
$ ./crab-tracker
```

3.2 Configuring Settings

The main program on the Raspberry Pi has a few configuration options that can be loaded at runtime (i.e. when the program starts up, as opposed to when the source code is compiled into

an executable file). The configuration options are located in the `/etc/crab-tracker.conf` file. Use your favorite text editor to make changes to this file as needed. The format for this file is simply a set of line-delimited key/value pairs, where each key is an alphanumeric string and each value is an integer. A single space character separates the key and value. Lines beginning with a hash (`#`) character are comments and will be ignored by the program. A sample version of the configuration file is located at `src/crab-tracker.conf.example`. An updated list of possible configuration parameters can be found in the `src/pi-src/README.md` file.

3.3 Configuring a new Raspberry Pi

If starting with a brand-new Raspberry Pi or simply a new Micro-SD Card, follow the instructions found in `doc/model-B-config.md`.