Unmanned Underwater Vehicle Software Documentation

Olympic College Engineering Club

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# Overview

This document serves as a comprehensive reference for all software programs necessary for the operation of Olympic College Engineering Club’s (OCEC) Unmanned Underwater Vehicle (UUV). This document consists only of a list and explanation for the software of the project, and does not contain any source code or compiled binary code. Please see the appropriate section on the project’s GitHub repository for the source code.

Software tasks on board the UUV are handled by two main components: A miniature computer called a Raspberry Pi (RasPi), and a microcontroller called an Arduino. The Raspberry Pi is the more powerful of the two, so the majority of computational tasks are run there. Programs for the RasPi will be written primarily in Python 3.0, which is considered a beginner-friendly programming language. The Arduino is responsible for controlling servos and motors by sending the control signals that those components expect, as well as receive data from sensors and reporting it to the Raspberry Pi. Programs for the Arduino are written in C++, which is a somewhat more advanced language that may be challenging for beginners to learn. Arduinos do not have and operating system to handle multiple programs running at once, so only a single program can be uploaded to and run by the Arduino at any one time. To make the software easier to write, maintain, and understand, the Arduino program will be broken down into smaller parts that the “main” program will compile into a single binary, which will be uploaded to the Arduino.

The RasPi and Arduino communicate over a serial connection between the two. Arduino has built-in functionality to send and receive data over serial, and the Raspberry Pi software will use the Python serial library to read and send data. Messages between the two will be in a standardized form to make communication predictable and modular.

# Arduino

## Overview

The UUV uses an Arduino Mega 2560 for most of the interaction between the software layer and the electronics layer. The digital and analog pins on the Arduino connect to sensors (eg. thermistors, gyroscope, accelerometer, etc), thruster motors via electronic speed controls (ESCs), servos, and any other peripheral devices on board the vehicle. The Arduino communicates with the UUV’s onboard computer (the Raspberry Pi) to report sensor data and receive commands for motor power and servo angle, etc. Programs for the Arduino are written in C++, and the Arduino can only have one program uploaded & running at any time. To make programming for the Arduino easier to manage and more collaborative, its software will be divided into smaller sub-programs, each of which contain the functionality for a single aspect of the Arduino’s responsibilities, and which will be combined into the “main” program at compile time using the “include” keyword in C++.

## List of Tasks

The following is a list of all the tasks that the Arduino program needs to be able to complete. Each item on this list can be partitioned into its own sub-program.

* Send and receive serial data to and from the Raspberry Pi.
* Interpret received commands from the RasPi and call corresponding functions.
* Package data from sensors into messages to send to RasPi.
* Set motors (via ESCs) to a specific speed value.
* Set servo(s) to a specific angle value.
* Read sensor data from analog sensors and digital sensors. Each sensor will have its own sub-program that interfaces with the sensor according to the datasheet and pinout of the sensor.

Each of these tasks is elaborated on below.

# Raspberry Pi

## Overview

The Raspberry Pi is the main computer onboard the UUV.