

When the program initiates a fork occurs. The parent thread communicates with the master arduino and listens for requests from the child. The child thread on the other hand handles the terminal and input from the user. The child sends two integers to the parent, one which conveys a command, and a second optional integer which is used in cases such as show X. Once the user enters an input a data pipe is used to convey this input to the parent which will then convey the operation to the master arduino. The master arduino sends out a request when given certain commands from the terminal. The request between the master and slave is conveyed via I2c wiring. The slave for its part also acts as the master to our environmental sensor, the triple axis magnetometer. Every twenty milliseconds the slave receives the heart rate from the heart rate monitor, while every fifty milliseconds the slave arduino also receives data from our environmental sensor. In addition to this, the slave gets the time from the real time clock every second. As long as the master arduino does not receive an interrupt from the parent thread, the master arduino will receive all of this information once per cycle and display the information on the LCD display. If instead the master was to receive a show X command instead however, the master arduino would instead simply print the given integer to the LCD display rather than request new data from the slave.

Outliers are located using the following algorithm. First all of the heart rates are summed together. Then this summation is divided in half. A loop then iterates through the array to find the precise heart rate at which this halfway point value is reached or surpassed. This heart rate is thusly identified as the median. The same is then done on all of the values below the median, and all of the values above the median. These values separate the array into quartiles and will henceforth be referred to as Q1 and Q3. Any value below Q1 or above Q3 will be noted as an outlier with one exception. If it is the first instance of a heart rate appearing, it will not be noted as an outlier until it appears at least once more. This is to prevent extraneous outliers from being caused during otherwise normal operation.

Practically speaking, there is no time synchronization between the arduino and the host. For every while loop wherein the parent does not receive an interrupt from the child, the master will request data from the slave. If any heart rates or environmental data was recorded during the interval between these events, it would be lost. Furthermore, when the exit command is read, a global variable is changed which terminates the two threads upon the execution of the next while loop, but the arduinos remain functioning. Even when the host processes terminate, data continues to be sent from the sensors to the slave arduino until it is unplugged.

Rather than recording reading pairs for the regression analysis, instead with every reading pair fed into the count command, several running averages are updated which are used to calculate the actual regression analysis. When a reading pair is received, the coordinate to which it would go to if it was to be recorded is found, and then several variables are updated accordingly. The averages include variables such as the summation of all x values, the summation of all y values, the summation of all of the

previous two values but squared, and the summation of the values multiplied together. As these averages are all of the information actually needed to perform a regression analysis, along with the number of data points total, the reading pairs never actually have to be recorded anywhere.

