

Project 1 Lessons

Project 1 Lessons

Functions can be abstractions

- Hide details from their “callers”
- In our case: we are hiding the details of manipulating bits
- But: must only manipulate the relevant bits. Otherwise, the function could interfere with the activities of other functions

Project 1 Lessons

- Documentation is important
 - Three levels: file/project, function and in-line
 - Each has their own purpose
- Integrate code review feedback: your code will be used in subsequent projects (and points will be subtracted for persistent errors)

Project 2: Analog Sensor Processing

Project 2: Analog Sensor Processing

- Each group has two Sharp distance sensors
- Connect to your circuit board & then to the Teensy
- Code: read the raw sensor state
- Collect data and analyze
- Model your sensors
- Write a function that returns calibrated distance values

Component 1: Circuit

Connect each sensor to circuit board:

- Power: +5V power: Vin on the Teensy
- Ground
- Signal: analog input pin on the Teensy

Component 2: Test Function

Loop():

- Read the raw sensor values
- Print out the sensor values

Using the USB Serial Port

- In this context, *serial* refers to the exchange of character-based information
- Setup():
`Serial.begin(57600);`
- Loop():
`Serial.println("Foo");`
`Serial.print(42);`
- Viewing the output:
 - Use the *serial monitor* (upper right corner of the Arduino window)

Reading from an Analog Port

- Define the analog pin at the top of your INO file:

```
const int SENSOR_PIN = 1;
```

- The “1” corresponds to analog input A1

- Read from the pin:

```
int val = analogRead(SENSOR_PIN);
```

The use of the constant is not required by the compiler, but it makes for much more readable code (and this class requires it)

Component 3:

Data Collection and Analysis

- Take at least 5 samples each for: 8, 9, 10, 14, 20, 30, 40, 60, 80 cm.
- Two plots for each sensor:
 - Mean sensor value as a function of distance (cm)
 - Mean sensor value as a function of $1/\text{distance}$ (1/cm)

Component 4: Sensor Model

Fit a *simple* function to your data

- 8cm should be captured well
- Adjust the other parameters of your function to capture the rest of your data as best as possible

Component 5: Implement the Model

- Define a new variable type in "project.h":

```
typedef enum {  
    DISTANCE_LEFT = 0,  
    DISTANCE_RIGHT = 1  
} DistanceSensor;
```

- Implement the function:

```
float read_distance(DistanceSensor side)
```

- Return value in cm

Component 6: Test

- Take at least 5 samples each for: 8, 9, 10, 14, 20, 30, 40, 60, 80 cm.
- Plot sensed distance value as a function of true distance (one curve for each sensor)
 - Your results should be what you expect!

Hints

- The sensors can interfere with one-another
- The different sensors will likely require different model parameters
- Make sure that the signal is reflecting off a vertically-oriented surface and not the table
- Start this project early
- Keep things simple