Lab08 - Sensors and Actuators

In this lab, we explore ways in which the Arduino communicates with the external environment. This lab incorporates one sensor and one actuator. A *sensor* gathers information from the external environment for the Arduino while the *actuator* is a device in which the Arduino affects a physical change to the external environment.

Exploration: Buzzer

The buzzer affects the external environment by introducing a sound that is controlled.
To implement the first test on the buzzer, I connect it to the breadboard, making sure that the + and - are in two distinct rows. The - is connected to ground while the + is connected to +5V on the breadboard. Every time the +5V is touched or released, there is an audible click of the buzzer.
Proceeding with my second test, I wire the + to the TTL input on the breadboard. When the frequency is increased via the TTL, you can audibly hear the buzzer having more rotations thus making more sound. The opposite happens when you decrease the frequency; less sound is heard.
Further, in the third test, I plug the + end of the buzzer in the Arduino pin 13. I wire the Arduino to power and ground on the breadboard respectfully. When writing the code and replacing the p values in the range of 1 to 5, I observe that p = 1 takes less time with a higher pitch sound because the rotations are much faster and end sooner while p = 5 takes more time and the sound is not as sharp because of the rotations being slower.

Exploration: Ultrasonic Sensor

I start with setting up the daughterboard and then mounting it onto the top of the Arduino. I plug the sonar sensor onto the daughterboard. We want it on the daughterboard instead of the breadboard to avoid false echo readings and be able to move around with the sensor. I power my Arduino using a 9V battery thus I do not need to wire my ground and power on the breadboard. I connect the trig pin (output for sonar, input for the Arduino) to pin 2 on the Arduino. I further connect the echo pin (input on Arduino, output on the sonar device) to pin 3 on the Arduino. I write the program and run it. I find out via a scale and a paper how accurate my sonar readings are. I hold the paper up a particular distance on the scale and see it if it matches the readings by the sonar. My sonar device is very sensitive and reads correctly when the distance is more than 10 cm. I do not need to adjust the distance since the reading give is already precise. The sonar is pretty consistent unless I move the paper more than 5 times in 3 seconds. In that situation, it doesn’t give a precise reading because the paper continuously moving. Otherwise, the readings are consistent and stable.

Design Challenge: Audible Distance Indicator

In this part of the lab, I build a robotic distance detector that emits a sound whose pitch correlates with the distance to a nearby object. My device uses a low sound to indicate a distance of more than 300 cm or more while it emits a high pitched sound if the distance is 10 cm or less. I chose 10 cm or less rather than 1 cm or less because of how my sonar worked in the previous test.
I connect the buzzer onto the daughterboard next to my already connected sonar device. I plug the buzzer to Arduino pin 13 and voltage. I then proceed to write my code. My code works in the way that it first obtains the distance and then if the distance is less than 10 cm, it will proceed to run the buzzer at a high pitch. If the distance is 300 cm or more, the buzzer will make a low pitched sound. I upload the code and my sonar device does what it is supposed to do. I disconnect the device from my laptop and check it on a wall in the classroom. My device responds accordingly; when I'm closer than 10 cm to the wall, a high pitch buzz at p =1 is heard. When I'm more than 300 cm away from the wall, the buzzer makes a low pitched sound at p = 5.

Overall this lab deals with teaching us how to use a buzzer and a sonar device individually and then combine them together to make a sensing device. The sensing device can be used individually without the breadboard or your laptop meaning it is portable which makes it more efficient.

Videos and codes are attached for all experiments conducted.