ECE-411
10/14/2020

# Practicum Homework #2

By: Jakob White, Nathan Paul, Ahmad Alothaimin, and James Ross

## Hydroponics System

This system functions as a plant watering system. A capacitive moisture sensor is used to estimate the amount of water in the soil, and an ATmega328P microcontroller determines whether or not the amount of water is below a certain threshold, and if so, it actuates a water pump to water the plant. This system is intended for use by horticulturists, hobbyists, and anyone else growing their own plants.

## Pulse Detector

This device is used to display a person's pulse as well as measure their heart rate. A photodiode and IR LED is placed around an area where blood flows in large quantities like in your fingers. The photodiode takes the changes in blood volume from the pumping of the heart as inputs. As blood goes back and forth inside your fingers, the photodiode measures the light that goes through and produces currents. A transimpedance amplifier converts that input into voltage. Finally, an LED screen displays the pulse and heart rate. This device can be used by anyone, but would most commonly be used by doctors or nurses.

## Music Analyzer

This system serves as the functional inverse of the music synthesizer. Complex audio signals are intercepted by a microphone (sensor), filtered by chromatically-tuned audio filters (processor), and the constituent frequencies of these audio signals are indicated via LED's (actuator). The purpose of this system is to provide musicians with a universal method of decomposing music and easily transposing music compositions. This is particularly useful when there is no easy way of accessing a musical score, but the performance of the score is available (i.e. Renaissance music performances).