Senior Design
ENG EC 463

Memo

To: Professor Pisano, Professor Alshaykh, Professor Kia, Nithin Sivadas, Yue Zhang, Asher McGuffin

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Team: 21

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Subject: Carter School Sensory Walk – First Deliverable Testing

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1.0 Panel Design: Hardware and Software

1.1 Description and Goal

As a proof of concept, we have a prototype of our sensor driven LEDs. The setup of each individual panel consists of one MSP430, one active IR sensor, and one LED driver circuit. The IR sensor emits IR, detects the reflected IR, and outputs an analog signal proportional to the intensity of the reflected IR detected. This analog signal is connected to a pulldown resistor as well as to a capacitor to ground in order to mitigate high frequency noise. The MSP430 then converts it into a digital signal with the use of an analog-to-digital converter (ADC) and averages the values in groups of five to further filter out noise. This averaged value is compared to a set threshold value, and if it is above the threshold, the on-board LED and P1.2 are set to high. P1.2 is connected to the base of our power BJT. This effectively turns it on, sending current to the emitter and powering a set of LEDs.

This system is the first iteration of the basic panel in our final modular design, which will consist of a group of similar panels that communicate with one another in order to detect movement along the school's hallway. The communication between the MSP430s is implemented by connecting the two microcontrollers at their respective P1.5's. Panel 0 sets a flag once it has been triggered. This flag is checked by Panel 1 on every cycle and it will only become active once Sensor 0 has been activated. This will help to prevent people or objects from interfering with the physical therapy session.

1.2 **Procedure**

Ensure both MSP430s are plugged in and power supply is supplying 5 volts. Connect the sensor output to an oscilloscope in order to show its effective range. Demonstrate two modes by loading each mode and then demonstrating. The first mode will allow both LEDs to turn on when an object is detected and off when nothing is detected. The second mode will show that the LEDs connected to Sensor 1 will not turn on until those of Sensor 0 turn on. Walk past the sensors, starting with sensor 0. Reset the system by pressing the on-board button (P1.3) of Sensor 0. Walk past Sensor 1 first, then Sensor 0, and then back to Sensor 1.

1.3 **Verifiable Result**

The MSP430 will constantly collect data from the sensor, convert it to a digital signal, store and average groups of five, and compare the average to a threshold. We can demonstrate the success of this process if the LEDs are activated by objects entering the sensor's view. The distance from the person activating the system to the sensor will be on the order of 3 feet. This distance is more than acceptable to detect a student passing the sensor in a hallway. As the person gets closer, the oscilloscope will show how the sensor outputs a higher voltage. We will also show that once out of range completely, the voltage drops to zero. In the first mode, note that objects in range of 3 feet of either sensor will turn on their respective LEDs. If no objects are in range, the LEDs will turn off. In the second mode, note that Panel 1 is only activated after Panel 0 has been activated. Also note that pressing the on-board button (P1.3) of Panel 1 will reset only Panel 1, while pressing the button on Panel 0 resets both.