Feasibility Testing Report – Low Battery through Zener Diodes

Team: P15001: Active Ankle Foot Orthotic
Engineer: Jared Green –Mechanical Engineer

Test Date: October 20, 2014

Related System: Low Battery Alert

This test was to set up a prototype of a system that would provide a low battery alert. This system will work with an all hardware circuit consisting of resistors and zener diodes. When this system is working, it will set off an LED or a buzzer representing a low battery.

Testing Procedure

After doing some research, the first part of this procedure is doing some software testing. A low battery schematic was designed, built and tested on Multisim circuit designer. A layout of the schematic is shown below consisting of two resistors, two zener diodes, and an LED.
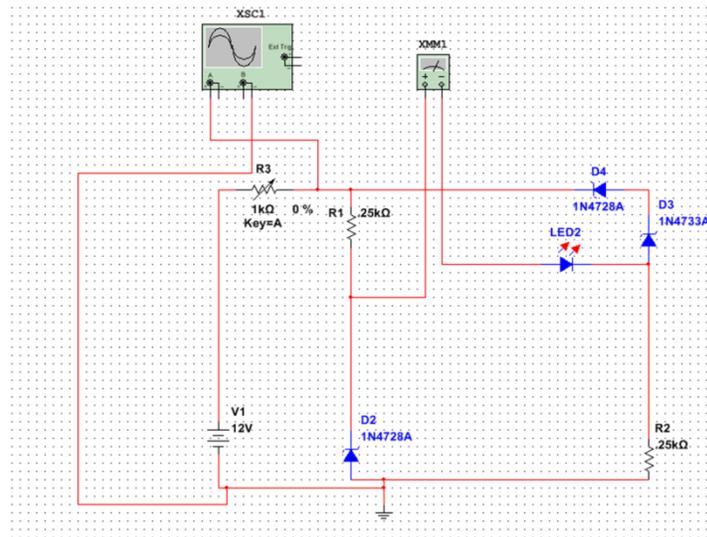

Figure 1: Schematic of the circuit layout for low battery alert

Zener Diode layout

In order to decide how much voltage layout that the LED should light up, a zener diode layout would be used to set a threshold that would allow current to flow. When that threshold voltage is reached, current will flow through the zener diode. At D2, the voltage is rated at 3.3 V. D4 and D3 consist of a 5.1 and a 3.3 volt zener to set an 8.4 volt threshold for current.

Resistor layout

Two .25 K ohm resistors were selected to allow enough current to flow through the LED so that it lights up whenever voltage is between 8.4 and 3.3 volts.

Schematic Results

In order to control the level of the source voltage, a variable resistor was put in series with the voltage source. A built in Oscilloscope and Current source would measure voltage source, and current drop across the LED. When the Software was running, the LED had lit up when the voltage was within Zener diode Range.

Hardware Results

With a working schematic, the next portion of this feasibility test consisted of wiring up the circuit on a breadboard, with the zener diodes, LED, and resistors. An image is shown in figure 2.
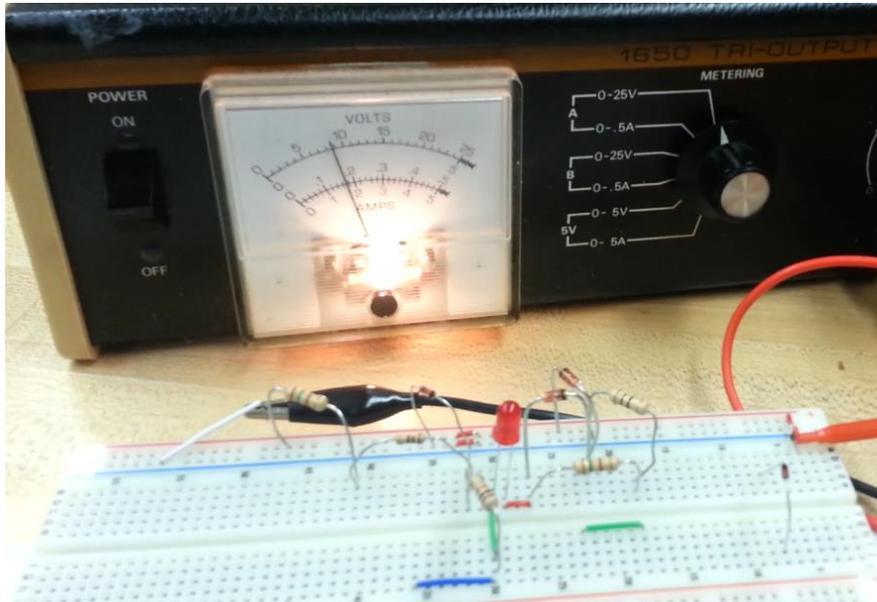
Figure 2: Circuit layout of low battery

In this circuit, the LED started to light, when voltage reached 5 volts, and went off at around 1 volt.

Conclusions

It is very clear that using all hardware for detecting low battery works. Using this method of monitoring a low battery can save some Arduino coding and allow the battery to be constantly detected as opposed to detecting it on and off when using software.

Next Steps

The next step would be to design and test a desired threshold depending on what power source the team plans on using. Additionally, a buzzer going off can be much simpler to detect a low battery as opposed to watching for and LED to light up.