Group 1 – Strain Monitoring System Description

The strain monitoring system uses electronic strain gauges, an Arduino program, signal lights, and an LCD to function as a monitoring system of microstrain when a load is applied to a wooden beam. The wooden I beam is comprised of two flanges and a web. The two electronic strain gauges, which will serve as the input data source for the monitoring system, are placed in the very center of each flange (the very top and bottom of the I beam respectively). To ensure that our limit of 800 microstrains is not overcome, these gauges must be placed at the points where we expect the beam to strain the most. Based on our previous experience in the lab, we determined that the very top and bottom of the beam flanges will endure the largest compression and tension respectively; for this reason, we put our gauges in these locations. Upon starting the system, the monitoring system will zero the gauges and then begin displaying the current strain values of gauges A and B on the LCD. Gauge A shows the tensile strain at the bottom flange of the beam, while gauge B shows the compressive strain at the top of the beam. In ideal conditions, and if placed perfectly, the absolute values of these gauges should be equal. As a load is applied, the gauges will send an electronic signal which is translated to an integer by the Arduino system, allowing the LCD screen to actively display the strain for both gauges in a continual loop. Also while this loop runs, the system checks the strain to ensure it is not approaching pre-defined values. The system will first determine which strain value, A or B, has the higher absolute value. This ensures that the warning system will rely on the highest of the strain values, so the beam's current hypothetical maximum strain is used. After this determination is made, the system will determine which speed the red warning light should blink at. If the strain is less than 600 microstrain, the system determines there is no need for a warning, and the light does not blink. In this case, the green LED is set on to show the system is working as expected, and the red LED is turned off, in case it was previously blinking (For example, if the microstrain was > 600, then fell back down). In the other case, where the strain is above 600 microstrain, the system will check if the strain is equal to or above the limit of 800 microstrain. In this case, the red light will blink very fast, turning on for 50ms, then turning off for 50ms, and repeating as long as the largest absolute value strain is >= 800. For absolute strain values between 600 and (including) 800 microstrain, the light will blink at increasing speed. It will turn on for 50ms, then turn off for a duration determined by the function: ms = 2000 - (absStrain - 600) * 9.75, where ms is the duration the light will remain off before turning on again, and absStrain is the largest absolute strain value. This will create an effect where the red light will start blinking slowly at 600 microstrain (in that case, turning on for 50ms, waiting 2000ms, and turning back on again), and continue blinking faster as strain increases, staying constant after 800 microstrain at 50ms between blinks.