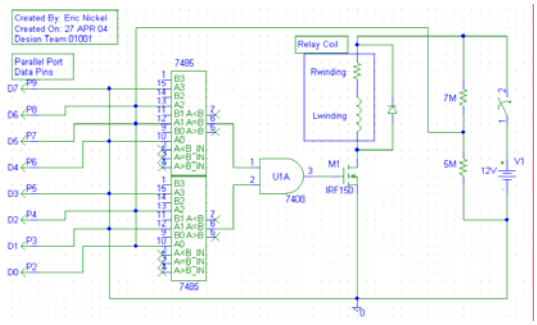
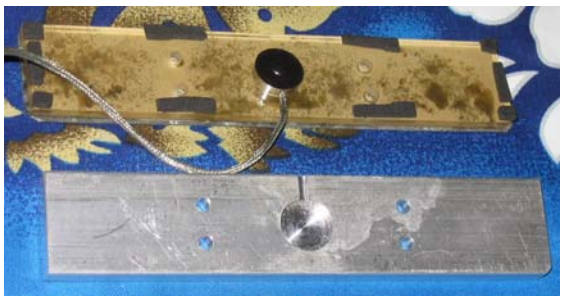
You're Invited to the Annual

# MSOE Biomedical Engineering Design Show

"Psychomotor Performance Evaluation System"

Drunk, drugged out or just tired? This device can keep them off the road and out of the air.



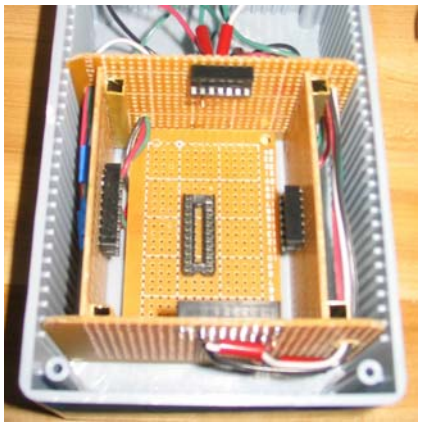



"Versatile Cardiopulmonary Resuscitation (CPR) Evaluation System"

Just how effective are your CPR chest compressions? This device can tell you.

"Micro-Electro-Mechanical System (MEMS) based Motion Evaluation System"

Motion analysis without the cameras. Tiny gyros and accelerometers are used to track position in this device.



"Dynamic Cardiac Computed Tomography (CT) Phantom"

Watch in move. See if the CT machine can keep up.

See the devices and meet the team on the 3rd floor of the Allen-Bradley Hall of Science (452 E. Kilbourn Ave), Milwaukee, WI. on Friday, May 21, from 10:30 to 3:30

# Detailed Project Descriptions

Psychomotor Performance Evaluation System

Our psychomotor performance evaluation system is a hardware and software package designed to assess psychomotor performance deficiencies in high-risk occupations such as commercial drivers, pilots, and heavy equipment operators. It has been designed to detect psychomotor performance deficiencies for any reason (including alcohol, disease, medication and sleep deprivation). It compares the performance of an individual to the population average, permitting performance based safety restrictions to be developed, rather than relying on chemical concentration based limits such as blood alcohol concentration.

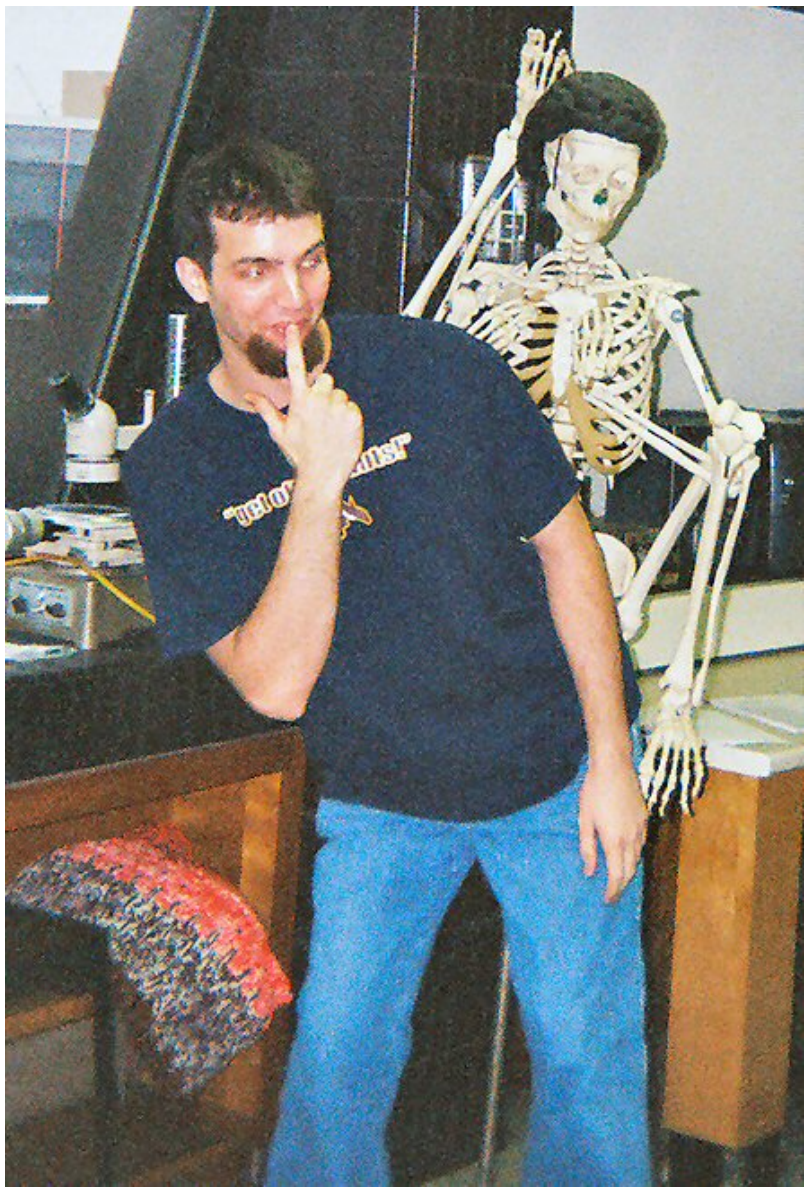
The software package uses a battery of tests that measure a variety of psychomotor functions to relate the performance of a subject to a scale based on blood alcohol concentration. The software is intended for use on a PDA (Palm) or tablet PC type hand-held device.  Upon acceptable test completion, our device sends a signal to the vehicle/machinery that enables the starting mechanism, permitting operation.

Versatile Cardiopulmonary Resuscitation (CPR) Evaluation System

We designed an attachment for a standard CPR mannequin that provides real time performance feedback capabilities. Our device consists of a vest that can be placed on any standard size CPR mannequin. It uses a load cell combined with a matrix of pressure sensitive switches to determine the magnitude and placement of CPR compressions.  The results of these chest compression measurements are displayed on a computer and are intended for use during CPR training. Our device has been designed to be price and performance competitive with special purpose instrumented CPR mannequins already on the market.

Micro-Electro-Mechanical System (MEMS) based Motion Evaluation System

Current motion analysis systems are costly and only available at special testing facilities. We designed a wireless motion analysis system that uses micro-electro-mechanical system (MEMS) accelerometers and gyroscopes to measure the 3-dimensional motion of a human limb. This system should lower the cost of motion analysis and make it more available for use as a diagnostic tool. We have created a prototype device that uses MEMS technology to measure the position of a point as it moves through 3-deminsional space and stores the resulting data in a file for further analysis and graphical display.



Dynamic Cardiac Computed Tomography (CT) Phantom

We have designed an x-ray CT Phantom that simulates both heart motion and coronary vessel calcification. The most important factor of the design was the realistic simulation of left ventricular motion. CT images can be blurred due to motion artifacts, especially when high-density materials like calcium rich plaques are present. Our team has created a phantom with high-density materials, simulating calcium rich arterial constrictions, placed around the exterior of a pumping heart component. The pumping component is composed of an elastic bag that is connected to a powered syringe that was sized based on the ejection volume of the human heart. In addition, the phantom was designed to send pulses indicating cardiac contractions to interface with the ECG triggering capabilities of some CT machines. The pumping component can be imaged with a CT machine and the amount of blurring qualitatively analyzed. The phantom can be used for research purposes to improve imaging quality thereby reducing the chances of a false or inaccurate diagnosis.