ELECTRICAL AND COMPUTER ENGINEERING

Session Chair – John Gesink
Room D-204/05

Conference on Senior Engineering Design Projects

You are invited to attend the fortieth Conference on Senior Engineering Design Projects. The conference will be held from 9 a.m. to 2:30 p.m., **Tuesday, April 17th, 2007** at the College of Engineering and Applied Sciences on the Parkview Campus of Western Michigan University. The College of Engineering and Applied Sciences sponsors the conference to showcase the work of its graduating seniors, who are required to complete a capstone project that puts into practice what they have learned. Many of the projects are sponsored by business and industry. The conference is **free** and open to the public. You are welcome to attend all or part of the day's events. Reservations are not necessary.

Parking is available in the ramps behind the College of Engineering and Applied Sciences. There is no charge for parking for those attending the Conference.

Presentations begin on the hour and half hour. Please do not enter a room after a presentation has begun.

A **lunch** break is scheduled from 12 p.m. to 1 p.m. There is a café available on site.

WIRELESS MULTINODE MOTION DETECTION SYSTEM

by Chintan Dagli, Michelle Guthaus, and Nathan Short
Sponsor: John Fahrenbruch, Texas Instruments, Inc.
Faculty Advisor: Liang Dong
9:00 a.m. to 9:25 a.m., Room D-204/05

A low power and low cost home security wireless motion sensor system was designed using passive infrared and microwave sensor technologies along with low power microcontrollers and RF communication devices to complete a system consisting of multiple nodes and a base station. Through qualitative analysis of the sensors, circuits were designed and microcontrollers were programmed in order to conserve power and eliminate false alarms created by animals. Wireless communication was achieved by programming the microcontrollers to communicate with the RF chips in order to send signals between the nodes and base station.

EMERGENCY ALARM FOR HEARING IMPAIRED
by Kooi Seng Huee, Leo Luckose, and Alfred Wong
Sponsor: John Fahrenbruch, Texas Instruments, Inc.
Faculty Advisor: Hossein Mousavinezhad
9:30 a.m. to 9:55 a.m., Room D-204/05

An affordable, low-powered, and portable device which alerts a hearing impaired individual in case of an emergency was designed, constructed, and tested. The alarm signal was filtered and processed in a microcontroller and the appropriate outputs, in the form of tactile stimuli (vibration) and flashing light emitting diodes (LED), was produced.

LOW POWER RANGE SENSING SYSTEM
by Jason Bence, Jordon Steele, and Prabin Subedi
Sponsor: John Fahrenbruch, Texas Instruments, Inc.
Faculty Advisor: Massood Atashbar
10:00 a.m. to 10:25 a.m., Room D-204/05

Currently, there is a need to develop a low power compact range sensor for sanitary equipment. To meet this need, a range sensing device was designed using an ultra low power microcontroller. This sensing device was designed using an infrared emitter and detector diodes. The distance, color, and surface of the object that reflects the infrared light were considered in this design. If an object is detected, the system will active. This sensing system operates for years with a 3V battery. To ensure a long battery life, system components were carefully chosen and a low power mode of the microcontroller was used when in dormant mode.

ROBOTIC ARM CONTROL SYSTEM
by Brittany Bockstanz, Brandon Bouwman, and Trevor Francis
Sponsor: Bill Forshey, TechCare-TronLabs
Faculty Advisor: Joseph Kelemen
10:30 a.m. to 10:55 a.m., Room D-204/05

A robotic arm control system was designed, programmed, and constructed that controls a kinematic chain of stepper motors. This system applies Denavit-Hartenberg parameters to describe the geometry with up to eight degrees of freedom and a pull-to-position method for the movement. Multi-layer PCBs were designed and constructed using RoHS compliant surface mount components. Microcontrollers were used for the primary processor and programmed using C++. This system can be used on multiple robots without regard to the number of motors.

USB-DAQ – UNIVERSAL SERIAL BUS DATA ACQUISITION SYSTEM
by Todd Adams, Wen Chen, Daniel Jacobs, and Ronald Spicher
Faculty Advisor: Bradley Bazuin
11:00 a.m. to 11:25 a.m., Room D-204/05

There is a need for a low cost data acquisition (DAQ) system that can remotely collect real-time sensor measurements and communicate them to a PC through a Universal Serial Bus (USB) port. While a range of commercial DAQs are available, they are very expensive and use proprietary software. An open source, microcontrolled DAQ system using surface mount technology was designed, constructed, and demonstrated. A wide range of sensors and sensor measurements were incorporated and are available, including pressure, temperature, distance, and position, with sample rates from 1 Hz to 1 kHz.

CHAOTIC CLOCK DITHERING TO REDUCE ELECTROMAGNETIC INTERFERENCE
by Andrew Cochran, Richard Courtade, and Daniel Mulkey
Faculty Advisor: Bradley Bazuin
11:30 a.m. to 11:55 a.m., Room D-204/05

The electromagnetic interference (EMI) generated by digital electronics can conflict with nearby electronic devices. One major source of EMI is due to high clock rate microprocessors and digital logic found in nearly all modern products. External chaotic signals were developed and demonstrated to randomly dither the fixed frequency clocks, thereby reducing the EMI radiated by the clock circuitry found in many devices. The chaotic signals are generated by multiple chaotic oscillators that have been prototyped. A chaotic oscillator, with minimal component count, could easily be incorporated in future integrated circuit, along with existing clock circuitry, to provide low cost EMI reduction.

ELECTRONIC INSPECTION AND VERIFICATION VISION SYSTEM
by Joseph Arnold, Daniel Caswell, and Tareq Saleh
Sponsor: Tim Gardner, Alticor, Inc.
Faculty Advisor: Ikhlas Abdel-Qader
1:00 p.m. to 1:25 p.m., Room D-204/05

An automatic electronic label verification system was designed to perform label placement verification, skew, and mix-up prevention on products. To meet specific requirements, this system utilized a programmable logic controller, specialized imaging software, image processing cameras, human machinery interface, and a reject mechanism. Once completed, this system was able to verify misplaced labels and prevent skew and mix-up labeling to improve production quality and increased efficiency.

ROBOT VISION SYSTEM
by Faris Khawaldeh, Michael Podsiad, and Noumoussa Tounkara
Faculty Advisor: Ikhlas Abdel-Qader
1:30 p.m. to 1:55 p.m., Room D-204/05

An imaging system integrated into a FIRST (**F**or **I**nspiration and **R**ecognition of **S**cience and **T**echnology) robot was needed. The FIRST competition is comprised of remote controlled robots that compete in a game similar to basketball. A robotic vision system was built, calibrated, focused, programmed, and tested to recognize specific colors that allow the Robot Controller (RC) to react based on the analyzed data of the vision system. The RC made all decisions based on the integrated vision system calculations, whether to turn right, left, continue straight, or to score when close enough to the illuminated target.

BRONCO-MOUSE ROBOT
by Lawrence Kalisz and Carrie Sutton
Faculty Advisor: Frank Severance
2:00 p.m. to 2:25 p.m., Room D-204/05

The MicroMouse Competition is an international event where small robots, called mice, explore and map a maze in search of cheese. Robots must determine an optimal trajectory from a starting point to the cheese, then transit the path as quickly as possible. The BroncoMouse was designed using an integrated microprocessor unit for control based on data acquired from five infrared sensors used to detect surroundings. Locomotion was provided by two stepper motors for precise handling and light-weight lithium-polymer batteries.

THANK YOU