SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

Sault College

COURSE OUTLINE

COURSE TITLE: **Embedded Controller Applications/Robotics**

CODE NO. : CST 304 **SEMESTER:** 5

PROGRAM: Computer Engineering Technology

AUTHOR: Fred Carella

DATE: Fall 2008 **PREVIOUS OUTLINE DATED:** Fall 2007

APPROVED:

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CHAIR **DATE**

TOTAL CREDITS: 5

PREREQUISITE(S): CST240

HOURS/WEEK: 4

I. COURSE DESCRIPTION:

This course develops a students ability to design and build a complete embedded controller application. The application will bring computer hardware, software development, interfacing and mechanical and electrical systems together in one project. The student will design, build and program a small mobile robot that incorporates a MC6811 embedded controller.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. Build and test an embedded controller system and the mechanical platform it will control.
   Potential Elements of the Performance:
   - Demonstrate soldering and troubleshooting skills by building an embedded controller from kit form, in particular the Handy Board system.
   - Test the system by writing small programs that exercise the hardware.
   - Describe and understand the embedded controller and the handy board architecture.

   Build a motorized, wheeled platform that will serve as the mobile robot base.
2. Interface and control various input sensors, control electronics, motors and actuators.
   Potential Elements of the Performance:
   - Evaluate various input sensors, motors and mechanisms that will enable the mobile robot to fulfill its overall objective.
   - Understand and measure various electric motor parameters such as torque and speed and the gearing required to match them.
   - Understand motor speed control electronics and write programs to control those electronics to implement motor speed control through pulse width modulation techniques.

   Understand position control systems and interface and write programs to control those systems.
3. Control system behaviour.
   Potential Elements of the Performance:
   - study various process control mechanisms and evaluate their use in systems. The mechanisms include:
     - proportional feedback control
     - proportional derivative feedback controller
     - sequential control
     - reactive control

   write programs that control the robot using one or more of the

mechanisms described above.

4. Advanced Sensing
   Potential Elements of the Performance:
   - Evaluate various advanced sensing techniques including:
     - quadrature shaft encoding
     - infrared proximity sensors
     - ultrasonic distance sensing
     - optical distance sensing
     - interpretation of sensor data
5. Implement a robotic application
   Potential Elements of the Performance:
   - demonstrate a working mobile robot that implements a pre – defined goal including but not limited to maze traversal.

   Potential Elements of the Performance:

III. TOPICS:

1. Building an embedded controller system and a motorized platform.
2. Interfacing sensors.
3. Controlling System Behaviour
4. Advanced Sensing.
5. Build a working mobile robot.

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

V. EVALUATION PROCESS/GRADING SYSTEM:

Robotic Explorations
Fred G Martin
Prentice Hall, ISBN 0-13-089568-7

The following semester grades will be assigned to students:

Grade	Definition	*Grade Point Equivalent*
A+	90 – 100%	4.00
A	80 – 89%	
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 – 59%	1.00
F (Fail)	49% and below	0.00

CR (Credit)	Credit for diploma requirements has been awarded.
S	Satisfactory achievement in field /clinical placement or non-graded subject area.

U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
NR	Grade not reported to Registrar's office.
W	Student has withdrawn from the course without academic penalty.

VI. SPECIAL NOTES:

Special Needs:
If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Special Needs office. Visit Room E1101 or call Extension 2703 so that support services can be arranged for you.

Retention of Course Outlines:
It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Communication:
The College considers ***WebCT/LMS*** as the primary channel of communication for each course. Regularly checking this software platform is critical as it will keep you directly connected with faculty and current course information. Success in this course may be directly related to your willingness to take advantage of the ***Learning Management System*** communication tool.

Plagiarism:
Students should refer to the definition of “academic dishonesty” in *Student Code of Conduct*. Students who engage in academic dishonesty will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Course Outline Amendments:
The professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

VIII. ADVANCE CREDIT TRANSFER:

Students who wish to apply for advance credit transfer (advanced standing) should obtain an Application for Advance Credit from the program coordinator (or the course coordinator regarding a general education transfer request) or academic assistant. Students will be required to provide an unofficial transcript and course outline related to the course in question.