NSERC
2013
Undergraduate Student Research Award

For further information:
http://www.nserc-crsng.gc.ca/Students-Etudiants/UG-PC/USRA-BRPC_eng.asp

Scholarships are valued as follows (amount shown includes $4500 from NSERC):

Students who have completed Level 1: $5625
Students who have completed Level 2: $7300
Students who have completed Level 3: $8100
Students who have completed Level 4 or 5: $8500

The **Department of Computing and Software** is accepting applications for the following projects. Applications must be received in the CAS Departmental Office (ITB/202) no later than **Friday, February 8, 2013**. Applications must include Part 1 of Form 202 (Application for an Undergraduate Student Research Award), available on the NSERC website, and official transcripts. The form must be completed electronically by logging into the NSERC website, then printed and signed prior to submission to the departmental office. Please also include a brief separate statement indicating which project(s) you are applying for. We do not guarantee that a candidate will be selected for every project.

Project #1: Scale and Games (J. Carette)

Project #2: Library Development for a Mechanized Mathematics System (J. Carette)

Project #3: A Web Tool for Managing Inconsistent Data (F. Chiang)

Project #4: Code Generation for Arduino board from Visual Specifications (E. Sekerinski)

Project #5: FPGA Based Implementation of Verifiably Correct Safety Critical Systems (M. Lawford)

Project #6: Analysis of Timing Requirements in Controller Area Networks (CAN) for Automotive Applications (M. Lawford)

Project #7: Model Based Development of Hybrid Electric Powertrain Software (M. Lawford)

Project #1: Scale and Games (J. Carette)

Project Description:

Games are now played one devices of wildly varying size: from the wall-of-screens seen in ITB 225 to iPods and smartphones. Naturally, one cannot use the exact same game at all scales, but one can nevertheless be remarkably uniform - as witnessed say by Plants vs Zombies. Nevertheless, some things must change.

This project consists of two parts: 1. continuing the development of a "language of scale", which describes constraints associate to screen size, and 2. applying this language to component specialization (like status display). As screen size varies, different real estate can be used for 'status display'; as screen real estate gets cramped, decisions must be made to restrict (and potentially eliminate) all permanent display of current status. The crux of the project is to understand what are the main decision factors involved, and to continue the development of an existing prototype, by adding more components which can be specialized.

Qualifications:

Solid programming skills and the willingness to learn new programming languages are required.

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Project #2 Library Development for a Mechanized Mathematics System (J. Carette)

Project Description:

The mission of mechanized mathematics is to develop software systems that support the process people use to create, explore, connect, and apply mathematics. MathScheme is a long-range project being pursued at McMaster University that seeks to develop the next generation of a mechanized mathematics system. MathScheme is developing an implementation of a new language for expressing mathematics. The language is intended to serve as the logical basis for the development of an experimental library of mathematical knowledge. We are looking for a student who can contribute to the development of the library by using the new MathScheme language to specify and implement simple data structures and model-building tools from mathematics. These data structures and tools will be used to carefully build up mathematical knowledge in the library.

Qualifications:

1. Good programming skills; knowledge of OCaml or other ML programming languages is a plus.

2. Good background in mathematics, particularly in logic and discrete mathematics.

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Project #3 A Web Tool for Managing Inconsistent Data (F. Chiang)

Project Description:

Poor data quality is a serious problem for organizations leading to incorrect decision making, inefficient daily operations, and ultimately wasting both time and money. It is estimated that having poor data costs US businesses over $600B a year. With an increasing amount of data available online and in databases, and more being generated daily, there is an increased need for tools for detecting data anomalies and improving the quality of information.

In this project, we will work with data from online shopping sites and from enterprises. This project has two goals:

1) To enhance our existing data quality tool, either by improving its performance or by adding new functionality. For example, large datasets can take a long time to process depending on the type of inherent inconsistencies (a spelling error in your name is easily corrected versus missing address information). What can we do to improve the tool's performance?
2) Design a web interface. This will involve implementing a graphical tool that interfaces with the backend code. You will make design decisions on the interface layout, ease of use, and visualization parameters.

Qualifications:

Experience in: (1) web interface design and development, and (2) C and Java programming. Knowledge or experience with databases is a plus.

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Project #4 Code Generation for Arduino board from Visual Specifications (E. Sekerinski)

Project Description:

Embedded programs can be conveniently visually specified with extended state machines. The task is to compile one specific form of extended state machines that have been developed at McMaster, pCharts, for Arduino boards. This is part of the macwater.org project, which develops sensor boards that are being placed in buoys in the Great Lakes to test recreational beaches for pathogens, with test results being wirelessly transmitted. While pCharts support probabilistic transitions that allow power consumption and reliability of transmission to be analyzed, the focus of this project is on code generation for Arduino boards.

Qualifications:

COMP SCI 4TB3 or equivalent

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Project #5: FPGA Based Implementation of Verifiably Correct Safety Critical Systems (M. Lawford)

Project Description:

This project involves investigation of the design and implementation of safety critical systems for the nuclear industry using FPGA based platforms. The focus will be upon construction of pre-verified functional blocks that can be used to implement verifiably correct systems.

Qualifications:

The candidate should have experience with FPGAs, embedded systems design and knowledge of Verilog and/or VHDL. Experience with related CAD tools is considered an asset.

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Project #6: Analysis of Timing Requirements in Controller Area Networks (CAN) for Automotive Applications (M. Lawford)

Project Description:

This project involves simulation of CAN networks to experimentally verify new results on when end to end timing requirements can be implemented with guarantees of correctness. The goal is to help automotive companies implement new features while reducing CAN bus utilization in current vehicles. The work may involve travel to work with our industry partner, GM, in Warren, Michigan.

Qualifications:

The candidate should have experience with Matlab/Simulink and know the basics of CAN. Experience in C programming for embedded systems and control systems design is an asset.

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Project #7: Model Based Development of Hybrid Electric Powertrain Software (M. Lawford)

Project Description:

This project will involve working with an interdisciplinary team at McMaster and Chrysler on software next generation powertrains applying new development processes using supporting tools to create robust, high quality, software.

Qualifications:

The ideal candidate should have experience with control systems design, Matlab/Simulink, and embedded systems programming in C.

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