La Trobe University
Department of Electronic Engineering

2009 Mid-Year Start Student Project List

A prospectus of projects available to final year undergraduate students enrolled in ELE4EPA for 2nd semester, and as major projects for suitably qualified masters students

22 June 2009

Introduction

This document is a prospectus of projects proposed by industry and staff in the Department of Electronic Engineering, La Trobe University mid year start in 2009. These projects are available to students in the final year of the Bachelor of Electronic Engineering (and associated double degrees) as well as suitability qualified masters by coursework students in appropriate courses offered by the Department of Electronic Engineering. This list is not exhaustive and may be updated from time to time.

Students may also propose their own project and discuss their project idea with a member of staff whose interests overlap with the proposed project area. Should the member of staff accept the proposed project as being of appropriate academic and technical merit then the student may sign up to undertake the proposed project with the member of staff as their supervisor.

Members of staff can only supervise a limited number of students (masters and final year). Some staff have already reached their limit, due to the number of students they are already supervising this year, while others may reach their limit before all projects offered by them (in this document) have been taken. Individual staff can advise on their current availability to supervise projects.

It is highly recommended that students sign up for projects and start work on them before the start of semester. University tests have shown that students who get an early start on their project generally perform better, make more substantial achievements, learn more and hence, obtain better grades for their project work.

ELE4EPA and ELE4EPB

These two units make up the 45cp project for students in the final year of the Bachelor of Electronic Engineering (or 4th or 5th years of associated double degrees). For students starting their project mid-year they will normally enrol in ELE4EPA for 2nd semester 2009 and ELE4EPB for 1st semester 2010. It is the responsibility of ALL students enrolled in ELE4EPA for second semester 2008 to sign up for a project and supervisor. This is done by discussing a proposed project with a suitable member of staff and having the member of staff agree to supervise the student and project. To formalise this agreement the "ELE4EPA/EPB Engineering Project Administration Form" must be filled out, signed and submitted to the Department of Electronic Engineering Reception, BG 432. Any student enrolled in ELE4EPA for 2nd semester 2009 who has NOT sign up for a project and supervisor by the start of semester, will have a project and supervisor assigned to them!

Key Dates for ELE4EPA/EPB Projects Starting 2nd Semester 2009

Friday, July 24, 2009:	Last day for submission of ELE4EPA/EPB Engineering Project Administration Forms
Monday, July 27, 2009:	Start 2nd Semester 2009
Friday, July 31, 2009, 1pm:	"Introduction to Major Project Work" important meeting for all project students (venue BG 445)
Monday, August 10, 2009:	Project Plan Draft to be provided to Supervisor

Monday, August 27, 2009: Project Plan Due
Friday, October 30, 2009: End 2nd Semester 2009
Week commencing Monday, November 2, 2009: Mid Project Presentations
Wednesday, November 4, 2008:Mid Year Progress Report (Project Journal) Due
Monday, March 1, 2010: Start 1st Semester 2010
Wednesday, June 2, 2010: Final Thesis Due
Friday, June 4, 2010: End 1st Semester 2009
Week commencing Monday, June 7, 2010: Final Project Presentations/Demonstrations

Major Projects for Masters by Coursework Students

Suitably qualified masters by coursework students may be offered the opportunity work on a major project as part of their masters course. To undertake a 45 or 60 credit point (as appropriate to the course being studied) major project, students are normally required to have achieved average results of 75% or greater in their studies at La Trobe University so far. A student will also be required to demonstrate that enrolment in a major project will not compromise their ability to complete required units in their course.

Masters students interested in undertaking a major project should seek out a prospective supervisor from the members of staff in the Department of Electronic Engineering. Should an agreement to supervise the student be granted by the member of staff, the "Major Project – Postgraduate Coursework Administration Form" must be completed and signed by both the supervisor and the postgraduate coursework co-ordinator. Key dates for major projects starting in 2nd semester 2009 will be the same or similar to those listed for the ELE4EPA/EPB projects, above.

Projects offered by staff not listed in this document

At time of printing not all staff in the Department of Electronic Engineering had provided project outlines. If you are interested in working on a project under the supervision of a member of staff not listed in this document please approach them directly. Some members of staff may have reached their quota of students to supervise. Individual members of staff will be able to advise on their current availability to supervise students.

Questions

Please contact the Department of Electronic Engineering Project Co-ordinator, Jim Whittington (BG436) j.whittington@latrobe.edu.au if you have any questions on the allocation of projects.

INDUSTRY PROJECTS

Integrated Debugging Environment (IDE) for Mobile Phone (Industry Project)

Sponsoring Company:
Softronics www.softronx.com

Industry Supervisor:
Dr Anthony Overmars
ao@softronx.com
0417 328 112

Abstract:
Based on previous work this project will use the Eclipse IDE to develop a code building and code testing interface for a real mobile phone accessing it via the JTAG port.

The project skills will require some aptitude for interfacing to undocumented hardware (hacking) of the highest order and will require mapping of memory and input output address maps. The project will form part of a much larger phone development platform which is currently being developed.

Special interests or skills in determining undocumented firmware using software probing techniques would be an advantaged, but not necessary.

On site training will be provided and all hardware and platforms will also be provided.

Required Student Skills:
C/C++ Software development;
An interest embedded processors and systems;
Some experience with FPGA design and VHDL is an advantage.

Confidentiality:
Because of the complex nature of the phone development platform a Non-disclosure agreement will need to be signed.

Uni Supervisor and contact:
Jim Whittington
Office: BG436
Email: j.whittington@latrobe.edu.au

Generic Firmware Porting on a Mobile Phone (4G)
(Industry Project)

Sponsoring Company:
Softronics www.softronx.com

Industry Supervisor:
Dr Anthony Overmars
ao@softronx.com
0417 328 112

Abstract:
Based on previous work this project will use existing working firmware to port to other phone vendor platforms and to develop code which automates the rapid porting of firmware to various phone platforms for real mobile phones accessing it via the JTAG port.

The project skills will require some aptitude for interfacing to undocumented hardware (hacking) of the highest order and will require mapping of memory and input output address maps. The project will form part of a much larger phone development platform which is currently being developed.

Special interests or skills in determining undocumented firmware using software probing techniques would be an advantaged, but not necessary.

On site training will be provided and all hardware and platforms will also be provided.

Required Student Skills:
C/C++ Software development;
An interest embedded processors and systems;
Experience with Linux OS an advantage.

Confidentiality:
A student working on this project will be required to sign a legal confidentiality agreement (NDA) as a number of trade secrets and methods will need to be disclosed. All the necessary training and support will be provided by Softronics.

Uni Supervisor and contact:
Jim Whittington
Office: BG436
Email: j.whittington@latrobe.edu.au

Telephone Exchange & SIP Server for Nation wide deployment (Industry Project)

Sponsoring Company:
Softronics www.softronx.com

Industry Supervisor:
Dr Anthony Overmars
ao@softronx.com
0417 328 112

Abstract:
A small pilot will be built and deployed in Melbourne, Adelaide and Perth.

The telephone system will be required to terminate phone numbers and route calls between each of the capital cities based upon their dial codes.

All hardware will be provided but potential candidates will need to explore what hardware will be best suited to the task and then program and deploy and test.

The project skills will require some aptitude for interfacing to undocumented hardware of the highest order and will require some aptitude for telephony systems. The project will form part of a much larger phone development platform which is currently being developed.

Special interests or skills in determining undocumented features using software probing techniques would be an advantaged, but not necessary.

On site training will be provided and all hardware and platforms will also be provided.

Required Student Skills:
C/C++ Software development;
An interest embedded processors and systems as applied to telephony systems;
Knowledge and interest in packet switch servers and networking an advantage.

Confidentiality:
Because of the complex nature of the phone development platform a Non-disclosure agreement will need to be signed.

Uni Supervisor and contact:
Jim Whittington
Office: BG436
Email: j.whittington@latrobe.edu.au

Impressed Current Cathodic Protection Control System using a Fuzzy Logic Approach (Industry Project)

Sponsoring Company:
M. Brodribb Pty Ltd

Industry Supervisor:
Richard Brodribb

Abstract:
Impressed current cathodic protection systems operate by passing current from an anode through a conductive path (soil, water etc) and to the protected structure. The protected structure often has an additional coating of epoxy or plastic. The steel in the protected structure must be held to such an electrochemical potential that the steel enters the passive region and rusting cannot occur. If the structure is under protected, rusting will occur. If the structure is overprotected then hydrogen gas may be evolved from the steel, leading to embrittlement of the steel and delamination of the protective coating. The electrochemical potential is usually measured by a reference electrode with one end connected to the protected structure.

2. Determination of protection criteria.
Various methods are used to determine if the steel is suitably protected. Three common criteria are potential shift, on potential and rest potential.

(i) The potential shift measurement is carried out by switching off the rectifier and seeing the level of anodic shift (positive voltage movement) of the structure potential. Often a value of 100mV potential shift is used to determine if the structure is sufficiently protected.
(ii) On potential is measured when the rectifier is in operation. The potential then is taken as a measure of how far into passivity the steel is. A value of -1.4V against a Cu CuSO4 electrode is often taken as showing protection.
(iii) Off or rest potential is measured when the rectifier is switched off. Various methods are used to determine how quickly the potential falls to the rest potential and the slope of this depolarisation curve provides a measure of the protection.

These three protection criteria are based on different attributes and it is quite possible to have a structure with a 100mV potential shift, showing protection for criterion (i), not being in the passive region for on potential as shown in criterion (ii). There is not general agreement in the industry as to which protection criterion is best, but no one criterion is universal.

3. Fuzzy controller.
We propose that it is possible to make a controller that combines these three protection rules to make up a fuzzy control. The controller would determine how close to protection each of the criteria were and provide a linear dc output to our phase control system. The controller would also take other priority signals in, such as maximum voltage and current limits and recognise these as hard limits. The controller would interface with other parts of the rectifier so that off potential and potential shift can be measured by switching off the rectifier. The controller would also recognise when over protection was occurring. The weighting of each rule would be adjustable in software.

Desirable Student Skills:

Embedded systems, hardware & software development
Interest in practical applications control systems

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Industry contact:
Richard Brodribb
M. Brodribb Pty Ltd
15 Carroll Crescent
Glen Iris, 3146
Victoria, Australia
Ph: + 61 3 9832 0222
Fax: + 61 3 9824 7372
www.brodribb.com.au

Uni contact:
Jim Whittington
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Vehicle Independent Speedometer (Industry Project)

Sponsoring Company:
Howard Instruments Pty. Ltd.

Industry Supervisor:
Rodger Howard

Abstract:
Howard Instruments is involved in the calibration of original equipment instrumentation and the installation of aftermarket instrument and control systems as well as complementary products in automotive and commercial vehicles.

The history of the accuracy of vehicle speedometers has always been related to a number of variable factors which require instrument manufacturers to calibrate speedometers to read more than the actual speed of the vehicle. These variables include: tyre circumference; differential ratio; gearbox output; tyre pressure; tyre temperature; and vehicle weight.

The current Australian Design Rule for speedometers, ADR 18/03 requires that all vehicles sold in Australia, whether locally produced or imported should have a speedometer that does not read less than the true speed of the vehicle and can read more than the true speed of the vehicle by up to +10% plus 6 kilometres per hour. At a true speed of 100km/hr the speedo can therefore read up to 116km/hour. Clearly, in this age of advanced technology it must be possible to provide better performance.

Howard Instruments has made a submission to the State Government Committee reviewing the Australian Design Rules and we have stated that the Federal Government should see the speedometer as a safety device in all motor vehicles.

This project involves the development of an electronic speedometer that does not rely on any variable inputs, such as those listed above. This speedometer could have a number of speed related inputs that compare one against the others. We have a number of ideas, but see the determination of the inputs as part of the student's design process. Development of an effective means of testing and calibration (ideally static) will be a significant part of this project.

Desirable Student Skills:
Embedded systems, hardware & software development
Interest in market research
Interest in automotive mechanics and electrical systems

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Industry contact:
Ian Howard
Howard Instruments
110 Northern Road, Heidelberg Heights. Vic 3081
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Uni contact:
Jim Whittington
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Email: j.whittington@latrobe.edu.au

Smart Water Usage Management System with Persuasive Technology
(Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
Water conservation, along with increased recycling and boosting supplies, is a key part of the plan of the Federal Government of Australia to secure the country's water supplies. Given water is a very scarce resource, there is an increasing need for an improved method to manage and conserve water. One effective approach to conserve water is to have real-time information on water consumption available at consumers' end, through a smart water metering and water usage management system.

The aim of this research and development (R&D) project is to develop a consumer responsive and intelligent water usage management system, including the required hardware, networking and software as an integrated system. More specifically, the project will involve design and implementation in two key areas: (i) an intelligent low power chip (integrated circuit) for water metering, and (ii) an effective and secured networking method for monitoring and management of information related to water usage.

Up to four (4) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background communication and electronic engineering and/or computer science/computer engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
Prof Jack Sigh or Dr Harris Le
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Email: Jack.Singh@latrobe.edu.au or h.le@latrobe.edu.au

Design and implementation of an RF front-end for a WiMAX receiver
(Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
Worldwide Interoperability for Microwave Access (WiMAX) technology provides fixed, nomadic, portable and mobile wireless broadband connectivity. Theoretically, WiMAX can support data rate up to 70 Mb/s and maximum coverage of 50 km. To achieve the benefits of WiMAX systems, high performance RF transceiver is required and is one of the major challenges in WiMAX system implementation. There are typically two types of transceiver architectures used for WiMAX, namely low-IF and zero-IF architectures. A Low-IF architecture relieves the DC offset and flicker noise problems encountered in a zero-IF receiver, but it induces higher power consumption and cost due to the need of extra IF filter and down conversion of IF to DC. High level of integration and low power consumption suggest the zero-IF architecture as the best choice for WiMAX transceiver. In this architecture, the down conversion process is done using I/Q mixer, which is one of the most critical components. This project aim is to design and implement a low cost low power consumption RF front-end for a (fully on-chip) for a WiMAX receiver.

Up to four (4) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good knowledge of digital design, receiver and communication system fundamentals.

Confidentiality:
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Design and implementation of a baseband section of a WiMAX receiver
(Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
Worldwide Interoperability for Microwave Access (WiMAX) is increasingly gaining interests as an alternative "last-mile" technology to DSL lines and cable modems. This technology has the potential to support up to 70 Mbps of data per channel cell distance up to 50km. For WiMAX systems, its delay spread is typically over several micro-seconds which is easily longer than the guarding interval. It is very challenging to maintain the system BER performance for non-line-of-sight (NLOS) channels at high data rate transmission with high bandwidth. Therefore, the design of the baseband section is very important to ensure the proper system performance.

The scope of this project is to design and implement a baseband section of a WiMAX receiver on Application-Specific Integrated Circuit (ASIC). This project will investigate the possible implementation of the ASIC, the optimisation of the design, validation of the gate count, determination of power consumption, etc of the designed ASIC.

Up to four (4) students can work on various components of this project. Work can also include integration of various parts to produce final baseband design

Required Student Skills:
Good knowledge of digital design, receiver and communication system fundamentals;

Confidentiality:
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Design and implementation of a receiver for a radio telescope application
(Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
Radio astronomy demands receiver systems of exquisite sensitivity to detect the faint signals emitted by distant astronomical objects. This sensitivity is achieved by building low-noise, low-power, broadband receivers. In order to achieve these specifications, the receiver systems will need to be built from highly-integrated components to convert the incoming signals from the universe and transfer it to digital systems for analysis. The scope of this project is to design and implement a low noise, low power, broadband receiver for radio telescope application. The big challenge is to overcome the inherent noise in an integrated circuit while achieving broad frequency band and high system gain.

Up to four (4) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background communication and electrical/electronic engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
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Design and implementation of a 2.4GHz transceiver (Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
The current trend is moving toward wireless communication for home/consumer products due to the convenience and portability of wireless technologies. Some of the application includes consumer electronics, wireless game controllers, wireless audio, wireless keyboard and mouse, etc. All of these devices typically work in the 2.4GHz frequency band of, which falls under the license free ISM (industrial, scientific, and medical) band. Single chip low cost low power 2.4GHz RF transceiver is, therefore, important to efficiently enable the industrial and domestic wireless communication applications

The scope of this project is to design and implement a 2.4GHz transceiver, using 0.25-micron SOS technology. The transceiver will be direct conversion architecture, which has been proved to be the most suitable architecture for ISM wireless systems. This project will involve the design of both RF front end and digital backend, together with the design optimisation, validation and layout implementation. This project will provide invaluable design experiences for students perusing degrees in electronic. microelectronic and/or telecommunication engineering.

Up to ten (10) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good knowledge of digital design, receiver and communication system fundamentals.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

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Automatic Meter Reading Project
(Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
Current trend of energy management is changing toward real-time monitoring and control. There is an emerging trend to use powerline communication (PLC) technology to send and receive data over existing power lines, which is a very low cost solution for automatic meter reading (AMR) and advanced metering as no additional infrastructure is required for the data communication. With the increasing pressure on electricity utilities to reduce cost, provide excellent customer service and accurate billing, AMR has become an integral part of a strategic plan to offer better service and convenience while increasing the level of control and maintenance over the entire system. The aim of this project is to develop real-time AMR using PLC technology. Applications on automatic control and management of home appliances, lights will also be developed and tested in this project.

Up to four (4) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good knowledge of PLC, receiver and communication system fundamentals.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

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Reliable and Secure Wireless Ad-Hoc Network for Vehicle-to-Vehicle Communication using DSRC
(Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
The emergence of the Dedicated Short Range Communications (DSRC) standard, that is a short to medium range wireless protocol specifically designed for automotive use, has paved the way to implement a wireless ad-hoc network for vehicles, which can be

used for communication among vehicles (vehicle-to-vehicle) and between vehicles and roadside equipments (vehicle-to-infrastructure). This, therefore, will facilitate the development of an intelligent network, which will provide solutions to improve vehicle safety, intelligence and efficiency. For example, vehicles will be able to "see" the traffic congestions, hazard of accidents (even out-of driver sight), produce less emission (more efficient on high way), encourage behavioural change (of drivers), etc. One of the major issues with the vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications is the reliability and security of such network, especially at high speeds. This project will involve the research into novel architectures, protocols and algorithms to increase the efficiency, reliability, security of the V2V/V2I communications.

Up to six (6) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background in communication and electronic engineering and/or computer science/computer engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
Prof Jack Sigh or Dr Harris Le
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Wireless Technology for Reliable In-Vehicle Communication (Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
The amount of in-vehicle electronic has increased significantly. Mature wireless technologies can be adapted for developing a wireless network that can link-up in-vehicle electronics and systems to offer a universal interface to all electronic devices while reducing the cabling required in the vehicle. Such wireless network will offer a greater flexibility and portability to car industry as well as improve safety, value to end-users and reduce cost. In order to achieve these benefits, in-car wireless network will need to be integrated to the current network. This research will access the potential of employing wireless technologies to in-car environment.

One of the major issues with the wireless in-vehicle network is reliability, security and the error rate of the wireless communication, due to ambient noise in the automotive environment. Unexpected communication errors or device failure in receiving data can have major safety and implications especially when vehicles are travelling at high speeds.

Up to six (6) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background in communication and electronic engineering and/or computer science/computer engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
Prof Jack Sigh or Dr Harris Le
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Design and implementation of an on-board unit (OBU) for vehicle communication based on DSRC standard (Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
This project aims at the development of an on-board unit (OBU), both hardware and software, for the vehicle communication based on DSRC standard. The OBU will be implemented based on the integration of vehicle's electronic and sensor systems with multiple wireless technologies, including DSRC and GPS. Necessary interfaces between the vehicle's system, radio transceiver, application processors, sensors, human-machine interface (HMI), etc, will be developed to allow a seamless communication inside vehicle as well as outside vehicle (i.e. communication to infrastructure and other cars, trains, trams, truck). Necessary methodologies and algorithms will also be developed to effectively collect, manage and process data throughout the system. The data transmission across the wireless network will need to be very selective due to the high volume of data traffic. Interpretation, selective storage and analysis will be required to map raw data to knowledge useful to the cars, trains, etc. Comprehensive testing will be performed to ensure the proper functionality of the developed OBU.

Up to six (6) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background in digital design, receiver, communication system fundamentals and electrical/electronic engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
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Design and implementation of a roadside unit (RSU) for vehicle communication based on DSRC standard (Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
This project focuses on the development of a roadside unit (RSU), both hardware and software, based on integration of multiple technologies. Appropriate algorithms and interfaces will be developed to improve the performance of the RSU. The data transmission across the wireless network will need to be very selective due to the high volume of data traffic. Interpretation, selective storage and analysis will be required to map raw data to knowledge useful to the cars, trains, etc. The project will also focus on embedded design, software, data management and data security. Comprehensive verification will be performed to ensure the proper functionality of the developed RSU.

Up to six (6) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background in digital design, receiver, communication system fundamentals and electrical/electronic engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
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Accurate Urban Navigation and Localisation System (Positioning & Tracking) (Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications via dedicated-short-range-communication (DSRC) devices will enable active safety applications such as cooperative collision warning. However, a major challenge for the cooperative collision warning is to accurately determine the location of vehicles. The DSRC based V2V and V2I communication systems rely upon GPS (Global Positioning System) to co-ordinate for vehicle tracking and positioning. This technology, however, does not offer accuracy of the horizontal position error less than 1 meter, which is required for accurate vehicle localisation. In addition, currently available tracking algorithms are slow and require extensive computation to increase accuracy.

This project will focus on integration of various vehicle signals (like GPS, GSM, WiMax, WiFi, satellite, etc) to develop an accurate urban navigation and localisation (positioning & tracking) of vehicles. The proposed outcome is a fast, accurate and multi-stage feedback vehicle tracking and positioning algorithm with improved accuracy. Such a tracking system will improve the reliability of cooperative safety applications for vehicles.

Up to six (6) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background in communication and electronic engineering and/or computer science/computer engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
Prof Jack Sigh or Dr Harris Le
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Integration of mature smart technologies to facilitate the development of a low cost fire management system (Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
The research project will involve the integration of mature and smart technologies to facilitate the development of a low cost fire management system. This will include addressing the design and implementation issues of at the physical layer, including the integration and optimisation of existing technologies, such as smart sensor network, WAVE, GPS, smart suit, satellite, radio (wireless) architecture, and the development of necessary interfaces between the integrated technologies. A major concern is the cost and the reliability of such hardware platform. In order to address these issues, embedded intelligent properties will be developed to reduce the system complexity and cost while improving the system accuracy and reliability.

Up to six (6) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background in communication and electronic engineering and/or computer science/computer engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
Prof Jack Sigh or Dr Harris Le
Office: Centre for Technology Infusion; phone: 9479 3763
Email: Jack.Singh@latrobe.edu.au or h.le@latrobe.edu.au

Low cost intelligent traffic management network to improve emergency response time (Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
An important application of the proposed cost effective fire management system based on the integration of smart technologies is the potential implementation of an

intelligent traffic management network to improve response time to fire emergencies, which will be developed in this research project. With this network, fire-trucks can wirelessly communicate with the roadway infrastructure (using WAVE technology), allowing complete, real-time traffic information for the entire network, as well as better traffic management and shortest route search for the emergency location. Fire emergency vehicles, equipped with longer range (1-kilometer) WAVE systems, will be able to warn vehicles ahead to let them pass and to control traffic lights to give them the right of way. GPS devices can be installed on fire-trucks and/or fire-fighter's smart suits to locate the exact location of the emergency team to efficiently guide them to the fastest possible direction to response to fire. Exactly identifying the location of fire-fighters and emergency vehicles will allow the fire management system to warn and prevent possible dangerous situations which can cause casualty for the emergency team. Sensors can be embedded on fire-fighters and fire-trucks to continuously monitor different environmental parameters such as temperature, oxygen levels, pressure level, wind velocity, vision, fire-fighter's wellbeing and appropriate decisions or responses can be made faster and more effectively. This intelligent traffic control network will not only reduce the response time to fire emergency situations but also significantly improve the efficiency and effectiveness of the fire management and the safety of the individuals.

Up to six (6) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background in electronic engineering and/or computer science/computer engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
Prof Jack Sigh or Dr Harris Le
Office: Centre for Technology Infusion; phone: 9479 3763
Email: Jack.Singh@latrobe.edu.au or h.le@latrobe.edu.au

Data management in the emergency management system (Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof Jack Sigh & Dr Harris Le

Abstract:
Data management is a very important aspect in intelligent emergency response system, based on the integration of smart technologies. This is because the system, once in place, will receive large volume of data from sensors, camera, intelligent transport system, GPS, satellite, etc. This project will investigate and develop the

necessary methodologies and algorithms to effectively collect data generated by the devices inside the fire management system, as well as, manage and process data throughout the system. The data transmission across the wireless network should be very selective due to such high volume data traffic. Information/data, therefore, will need to be managed at both the device level and the system level. Interpretation, selective storage and analysis will then be required to map raw data to knowledge useful to the fire management system, which can then be reasoned with and acted upon. In order to accomplish this task, a hybrid data analysis and knowledge based technique will be developed to assign concepts to analysed raw data, using ontology of relevant concepts related to emergency situations of the environment.

Up to six (6) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good background in communication and electronic engineering and/or computer science/computer engineering.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
Prof Jack Sigh or Dr Harris Le
Office: Centre for Technology Infusion; phone: 9479 3763
Email: Jack.Singh@latrobe.edu.au or h.le@latrobe.edu.au

Development of data collection system for ZigBee-based Wireless Sensor Networks (WSN) (Industry Project)

Sponsoring Company: Centre for Technology Infusion (CTI)

Industry Supervisors: Prof J. Sigh, Dr H. Le & A. Desai

Abstract:
This project will involve the development of a WSN hub board for Zigbee technology based WSNs. ZigBee is fairly limited by its data rate and communication distance, but offers very efficient low power of operation which is ideal for implementation of WSNs. To create the ability to merge and manage such network over long distances, a sensor hub will need to be designed. The hub will provide a bridge between ZigBee sensors over IP based communication using Wi-Fi and/or Ethernet. In addition to provide a communications bridge, this hub will also provide intermediate data storage and network configuration persistence information. The project involves development of the following:

- Hardware board Design and Implementation

- Sensor Profile/Configuration (Core Protocols) - Design and Implementation
- Data Collection Service and Synchronisation Policy Configuration
- Synchronise/Upload with parent WSN Node
- Sensor and Node Management Software for Implementation/Autoconfiguration of the Sensor Network.

Up to six (6) students can work on various components of this project. While each student will work on an individual part, work may also include integration of various parts to produce final system.

Required Student Skills:
Good knowledge of digital design, PCB design, and programming.

Confidentiality:
A students working on this project may have access to commercial material of a confidential nature, as such, a legal confidentiality agreement may be required.

Contacts:
Prof Jack Sigh or Dr Harris Le or Aniruddha Desai
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Model Auto-Documentation System (Industry Project)

Sponsoring Company:
NEC Australia. www.nec.com.au

Industry Supervisor:
T.B.A.

Abstract:
Develop a software tool to extract documentation strings from Acacia model, and present the documentation in a well organized HTML file, or a set of files. Note: Documentation strings are already available in the acacia source code, but some may need to be updated.

Required Student Skills:
Python, HTML

Uni Supervisor and contact:
Song Wang
Office: BG442
Email: song.wang@latrobe.edu.au

Optimisation of 4x4MIMO demodulation. (Industry Project)

Sponsoring Company:
NEC Australia. www.nec.com.au

Industry Supervisor:
T.B.A.

Abstract:
This project contains work for 2-3 students, and consists of:
- research to compare size/performance tradeoffs of the published methods.
- selection of the best candidate or propose original ideas.
- modelling to verify performance
- architecture development
- FPGA prototyping.

Required Student Skills:
As per above activities

Uni Supervisor and contact:
Song Wang
Office: BG442
Email: song.wang@latrobe.edu.au

Scalable architecture for matrix inversion (Industry Project)

Sponsoring Company:
NEC Australia. www.nec.com.au

Industry Supervisor:
T.B.A.

Abstract:
This project consists of:
- research to compare size/performance tradeoffs of the published methods.
- selection of the best candidate or propose original ideas.
- modelling to verify performance
- architecture development
- FPGA prototyping.

Required Student Skills:
As per above activities

Uni Supervisor and contact:
Song Wang
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Email: song.wang@latrobe.edu.au

Acoustic Modelling of Interior Trim Materials
(AutoCRC Industry Project)

Sponsoring Company:
Futuris

Industry Supervisor:
T.B.A.

Abstract:
Evaluate SEA and other known acoustic technologies for predicting transmission and absorption of automotive acoustic material assemblies against measured material and assembly data. Build up a database on interior and seating product sound absorption and transmission loss (rear seats). Futuris' objective is to build up awareness and understanding of capability of SEA as a CAD tool as well as some of the acoustic modelling techniques.

Uni Supervisor and contact:
David Tay
Office: BG440
Email: d.tay@latrobe.edu.au

Acoustic Signatures for Seat Rattles
(AutoCRC Industry Project)

Sponsoring Company:
Futuris

Industry Supervisor:
T.B.A.

Abstract:
Working with Futuris create a database of sound recordings of distinct product rattles. Investigate various signal analysis (both time and frequency domain) techniques for differentiating and identifying each known individual rattle problems when several may occur in the same seat simultaneously. Make recommendations for diagnostic process for identifying product issues based on acoustic signature.

Uni Supervisor and contact:
David Tay
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Email: d.tay@latrobe.edu.au

Audit of Electrical Loading in Vehicles
(AutoCRC Industry Project)

Sponsoring Company:
Futuris

Industry Supervisor:
T.B.A.

Abstract:
Present estimates show that around 4% of a car's fuel consumption can be directly attributed to the electrical loading on a vehicle. This project will establish where Holden stands in the competitive landscape with respect to electrical energy consumption by: (i) Determining how much energy is consumed by each subsystem in a VE Holden Commodore; (ii) Determining how much energy is consumed by each subsystem in a range of competitor vehicles; Exploring, comprehending and explaining any different technologies used in key subsystems across competitors where energy consumption is found to differ significantly.

Holden will provide a car for measurements and comparison to existing specifications to help develop the audit methodology and so provide a means of an initial (baseline) validation. A list of Competitor vehicles will be formulated by the student(s) in conjunction with the supervisor and Holden.

Required Student Skills:
A strong automotive interest is highly desirable but not essential;
Proficiency with hand tools;
Proficiency using test/measurement equipment;
Note: It is anticipated that there will be regular face to face contact with Holden representative/s throughout the project (e.g. brief fortnightly progress meetings). Some of these may be at Holden's Headquarters in Port Melbourne.

Uni Supervisor and contact:
Jim Whittington
Office: BG436
Email: j.whittington@latrobe.edu.au

ENGINEERING & RESEARCH PROJECTS

Train Velocity Control using Matlab (Research Project)

Abstract:
The project aims to design a system for velocity control of a train that ensures that the actual velocity is within a specified percentage of the desired range. The project involves:

- A continuous-time model of the DC motor and the train in the form of mechanical and electrical equations.
- Open-loop analysis in both time and frequency domains.
- Control configuration.
- Velocity controller design and evaluation.

Required Student Skills:
Strong Matlab (and in particular Simulink) programming skills
Theoretical research
Familiar with feedback control theory

Supervisor and contact:
Song Wang
Office: BG442
Email: song.wang@latrobe.edu.au

Wavelet Filter Bank Design and Evaluation (Research Project)

Abstract:
This is a research type of project to implement design algorithms on a GUI driven user-friendly platform. Both Matlab and web-browser based platforms will be considered. User-friendly platforms for evaluation in applications such as denoising will also be considered. Algorithms such as Zero Pinning, developed by A/Prof. Tay, will be implemented. The outcome of the project will be a user friendly software platform that can be accessed by anyone through the web for design and evaluation.

Required Student Skills:
Good knowledge in DSP and mathematics.
Good programming/debugging skills in Matlab and C.
Web-based programming utilizing (Java) applets.

Supervisor and contact:
David Tay
Office: BG440
Email: d.tay@latrobe.edu.au

Digital Watermarking using Quantization Index Modulation (QIM) (Engineering Project)

Abstract:
This is a research type of project which will first involve reviewing watermarking algorithms based on Quantization Index Modulation. The second part of the project will involve implementing several of the algorithms in Matlab for testing the performance of the algorithms and for demonstration purposes. The outcome of the project will be a software platform that implement the algorithms and enable the user to test and perform watermarking.

Required Student Skills:
Good knowledge in DSP and mathematics.
Good programming/debugging skills in Matlab.

Supervisor and contact:
David Tay
Office: BG440
Email: d.tay@latrobe.edu.au

Adaptive and real-time signal re-quantization techniques (Research Project)

Abstract:
A problem with many digital image/video applications is that the dynamic range of the signal usually does not match with the capability of the display devices. For example, the dynamic range of image/video signals acquired in low light conditions is low compared to that of the sensors and the display. Another problem is that the dynamic range of the signal is higher than that of the display. In both cases, it is desirable to adjust the dynamic range of the signal automatically.

This research project can be divided into 3 parts: literature survey and learning basic image processing techniques, simulation and develop new techniques, implementation using the Blackfin processor.

Required Student Skills:
You need to be self motivated, interested in DSP and prepared to learn new and cool technologies. Programming experience in assembly/C language will help.

Supervisor and contact:
Dennis Deng
Office: BG439

Email: d.deng@latrobe.edu.au

Real-time DSP-based audio signal spectrum analyser (Engineering Project)

Abstract:
This project will use the ADSP-BF548 DSP development board from Analog Devices (http://www.analog.com/en/embedded-processing-dsp/blackfin/BF548-HARDWARE/) to build a real time spectrum analyser for audio signals. The basic system will take an analog audio signal as the input, perform the FFT, and display the spectrum. Once the basic system is working, you will explore code optimization and fast algorithms for sliding DFT. You need to use assembly/C languages.

Required Student Skills:
You need to be self motivated, interested in DSP and prepared to learn new and cool technologies. Programming experience in assembly/C language will help.

Supervisor and contact:
Dennis Deng
Office: BG439
Email: d.deng@latrobe.edu.au

Audio signal recognition (Research Project)

Abstract:
The human brain can recognize many different types of audio signals. For example, we can tell if the audio signal is from "The Simpsons" or from the news reader without watching the television program. The aim of is research project is to develop techniques that can perform the same task.

This research project can be divided into 3 parts: literature survey and learning basic pattern recognition techniques, simulation and develop new techniques, implementation using the Blackfin processor.

Required Student Skills:
You need to be self motivated, interested in DSP and prepared to learn new and cool technologies. Programming experience in assembly/C language will help.

Supervisor and contact:
Dennis Deng
Office: BG439
Email: d.deng@latrobe.edu.au

Image noise filtering using CUDA
(Engineering Project)

Abstract:
Interested in getting programming experience using a Graphics Processor which has hundreds of process cores? Have a look at CUDA. A practical problem with some digital cameras is that at high ISO settings (say 1600) the image is usually corrupted by sensor noise which appears as color blocks. Some cameras have built in noise reduction function. In this project, we will implement effective noise filtering techniques to tackle this problem. You will learn how to program in the CUDA environment which is C language and certain specific functions related to the hardware.

Required Student Skills:
You need to be self motivated, interested in DSP and prepared to learn new and cool technologies. Programming experience in assembly/C language will help.

Supervisor and contact:
Dennis Deng
Office: BG439
Email: d.deng@latrobe.edu.au

Design and Evaluation of Digital Transceiver Hardware for HF Radar System
(Research Project)

Abstract:
The TIGER Radar research group is involved in the design, development, installation and use of HF radar systems. The Tiger group is interested in the design, evaluation and refinement of digital transceivers and/or sub blocks of digital transceivers for potential installation at one of its radar sites. Xilinx FPGAs are used as the digital hardware platform for implementation of the transceivers are Xilinx FPGAs.

This project will initially involve the evaluation of current digital transmitters and receivers through modelling and laboratory experimentation. Followed by an investigation of adaptations and refinements required to incorporate digital receivers into the current radar systems (hardware and software). Should the project progress well some studies in the field may be possible.

This project would be particularly suited to students in the Bachelor of Electronic Engineering/ Master of Telecommunication Engineering program.

Required Student Skills:
There may be scope in this project to support more than one student. Skill coverage of one or more of the following will be essential.

- FPGA Design and testing;
- DSP, digital design and communication system fundamentals;

- Good programming/debugging skills in Matlab and C/C++..

Supervisor and contact:
Jim Whittington
Office: BG436
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