CURTIN UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

UNDERGRADUATE PROJECTS

MID 2004 SELECTION

2005 SELECTION

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THE PROJECT SELECTION PROCESS

WHY THE PROJECT

The project is one of the most important parts of your degree program for two reasons. One follows from the project’s principal objective:

*To demonstrate your potential as a professional.*

The second relates to your career. When you leave Curtin, how will potential employers judge you? Through an interview they will assess your personality. However, professionally all they have is your academic record - meaningless to most - and the thesis you write as part of the project. If your intentions are to progress to postgraduate studies, then again your thesis is the primary proof you have the ability to do so. Thus your thesis is the means to advance yourself.

THE FIRST STAGE: CHOOSING A PROJECT

You have three options for choosing a project:

- **Staff option**
  Select one of those nominated by a staff member. (The topics are listed ahead.) You will need to see the staff member concerned and discuss the project. Given that several students may be interested, you will need to find out if the selection process is ‘first come first served’ or whether the staff member intends to wait, and then select one person from those interested.

- **Industry option**
  Through vacation employment or other means, you may be aware of an industry project you can do. The Department encourages that, but be aware of the conditions that apply:

  * It is not a case of any project; the project must be approved by the Projects Coordinator.

  * Your project must be supervised. There must be someone who is prepared to supervise and they need to be a qualified professional engineer or equivalent. Equivalent in this case means, say, a research scientist or similar person who can offer technical support.

  * The Department has no interest in whatever financial arrangements exist between you and the organisation concerned. However, there is a legal issue that does concern us. Regardless of whether you are paid or not, then all intellectual property rights of the work you do probably belongs to them. They may ask you to sign a document to that effect. Because of that, you may NOT use university facilities to develop the project. Of course you may still access the library, but you may NOT use laboratories, equipment or the Internet via the campus as part of your project work.
If you or they wish to use University facilities, then you will need to speak with the Division’s Consultancy Officer and a formal contract will be drawn up. Doing work for charitable or non-profit organisations is a gray area; speak to the Projects Coordinator on what is proposed to gain a ruling.

* From the Department’s point of view, while you are doing a project unit elsewhere, you still need to present a thesis at the end of the second project unit. That is a public document, although in practice it only exists within the Department and usually only other students read it. You need to make sure, however, that your industry partner is aware of that and accepts it. We may restrict access for a short time, but not indefinitely. There can be NO statements on a thesis of the form “confidential”. What can you do if they do not agree to this? In some cases, you can make your project different to what you are actually doing for industry by, say, focussing on a particular aspect. Otherwise, very little.

* You need to check with the organisation on whether their insurance policy covers you. The University policy can cover you but conditions apply.

Given the above:

* we need a letter from the industry supervisor stating their qualifications to supervise plus that they accept the thesis resulting will be on public display;

* we also need a description of the project;

* if we accept the project, then we will write back to the organisation advising of the conditions of the project and what we expect.

* you will also need to find a co-supervisor within the Department to assist you in writing the thesis.

**Student Option**

You can nominate your own project. You need to do two things:

* Sketch out what you propose to do outlining what you see as the major challenges. This includes things you will need to learn and any additional skills you will have to gain.

* From the following pages, identify a staff member who might be interested in that topic and then approach them. If they are willing to accept the project – possibly subject to modification – then fine, if not you will need to find someone else. If you cannot, then you will just have to change the project.
AFTER SELECTION

Once you have a project – a staff member or industry person has agreed to supervise – then what do you do? The answer is the following:

- You need to fill in a project approval form and you will find a copy at the rear of this document.
- Make a copy for yourself and your supervisor, and then hand the original or a copy to the Projects Coordinator.

BY WHEN MUST YOU SELECT A PROJECT

For students beginning their projects in semester 2 of 2004, you MUST have selected your project by the first week of semester.

For students beginning their projects in semester 1, 2005, you MUST select your project before the semester starts and preferably before the end of 2004.

If you do not meet these conditions, then you will automatically be withdrawn and not permitted to re-enrol until the next semester.

FOR STUDENTS IN 2005

Remember the semester is now only 12 weeks and project for most it is a 50 credit point unit. That is, half your time each week should be devoted to project. If you don’t do anything in the first week, that is about 8% of the time you should have been spending wasted. This demands you spend that time effectively and that requires you to spend some time over the next semester and the long vacation on project.

In particular you need to do three things:

- Read
  As part of your project, you will be identifying a problem then suggesting a solution to that problem. How can anyone have confidence in your solution if there is no evidence you are aware of current practice, technology and so forth? You need to search the web, haunt the library and take other actions so that you know what others have done to solve this problem and what tools and resources you need to do so.

- Plan
  The project’s principal objective is to demonstrate your potential as a professional. Now a key feature of engineering is that it is a planned activity. Of course there are unknowns, but you can plan for that. Boeing does not commit billions of dollars for developing a new jet on the basis it might be better; they make very sure they know well before they start. You need to do the same. So identify:
  
  * what information you need to solve this problem and what you have to learn;
* what skills you need to develop to do so and how long that might take;

and then create a **project plan** showing how you will spend at least two days per week to come up with the solution in 12 weeks and verify it. Identify in the plan what resources you need. If you are unsure how to plan, then visit the library and borrow a book on project management.

**Log book**

Integral to engineering is keeping a log book. You enter critical information – design sketches, ideas, test results and so on. So, begin by entering your plan and then your summaries of your reading. **Date everything.** In the professional arena, your log book can be presented as evidence in a court of law, particularly for patent priority claims, but if it isn’t properly dated it is worthless.

**MORE INFORMATION**

You will find in the student section of the Department’s web pages a section “Program Home” that is a home page for project units. You will find there a detailed document on how project should be conducted, assessment and how to write a thesis.

Please note this document has changed from previous years. Those changes will more clearly define some aspects of the project and also see some alteration to assessment processes.

The unit outlines will contain further information, but that is not very different to these documents.

**HONOURS AND PROJECTS**

Previously, the Department had separate honours and pass projects. As of 2004, we are reverting to a single project. Thus you will receive honours if your course weighted average is high enough. Project has quite an impact on that, thus in general terms a good project usually leads to honours.

**HOW WILL YOU BE ASSESSED IN THE PROJECT UNITS?**

There will be some changes to assessment in 2004. In basic terms, assessment will shift to follow general AVCC guidelines and be based on the overall body of work you do.

For the first semester, you will be judged on the technical quality of your work plus how well you keep to your project plan.

For the second semester, you will be judged on how well your thesis communicates technical information and your ideas on solving the problem presented. In addition, that semester will see a mark awarded for an oral presentation.

As a broad indication of the assessment guidelines, you may note the following, although these criteria largely apply to the thesis. However, it is evident what you need to do for the first semester. Then:
• **High distinction Grade 85**
  Overall, a work of exceptional quality showing a clear understanding of the subject matter and a strong appreciation of the related issues. There is evidence of strong intellectual ability with arguments sustained.

There is a balance to the work with appropriate emphasis given to the key issues and a structure that binds them together well.

The need to solve the problem is well justified.

A critique showing great insight into the problem, and the means by which attempts have been made to solve it and which may.

A solution showing a deep understanding of the relevant techniques and strong evidence of creative ability and originality. Excellent use is made of graphics, tables and other aids to make clear decisions made.

Implementation of a solution shows an excellent grasp of accepted practices.

Verification showing a grasp of appropriate procedures.

Conclusions demonstrating clear insight into the problem and its ramifications and a well-argued position for further development.

Evidence of wide reading and investigation.

A work that could be published as a contribution to practice.

• **Distinction Grade 70**
  Overall, a work of high quality showing a strong grasp of subject matter but not necessarily to the finer distinctions and a good appreciation of the related issues. Presentation is of a superior standard.

There is evidence of an ability that marks the student as one of superior ability. Good logical thinking with some flaws.

There is a reasonable balance to the work but the balance is not quite right and the structure does not assist the student’s cause to best effect.

There is clear evidence of some thought given to why the problem needs to be solved.

The critique demonstrates a good appreciation of the problem and the means by which attempts have been made to solve it and which may.

The solution shows a good understanding of the relevant techniques and some evidence of creative ability. It shows a superior ability in employing accepted techniques. The solution is well prepared and presented, and understood by an expert in the field.
Implementation of a solution shows an excellent grasp of accepted practices.

Verification showing a grasp of appropriate procedures.

Conclusions are sound and a good case is presented for further development.

The relevant literature is referenced.

- **High pass  Grade 55**
  Overall, a work of solid quality showing competent understanding of subject matter and appreciation of main issues. There are, though, some lapses and inadequacies. Presentation is good,

  There is evidence of an ability that marks the student as a capable practitioner. In the context of a team, errors in the student’s logic should not prove a problem. There may be some lack of maturity.

  The balance of the work is acceptable and the structure adequate, but again there are lapses and inadequacies.

  Why the problem needs to be solved does not appear to have troubled the student too much.

  The critique shows a reading of the obvious literature but a limited exploration beyond that. There is evidence the student has accepted the opinions of others a little too much at face value.

  The solution is competent and has largely employed the relevant techniques. There are one or two flashes of creativity. There is a sound ability in applying standard techniques. The solution is competent, but how it was arrived at may not be entirely clear.

  Implementation of a solution shows a broad understanding of accepted practices.

  Verification showing a grasp of appropriate procedures.

  Conclusions are straightforward. The case for further development is moderately obvious.

  Most of the relevant literature is referenced.

- **Pass Grade 40**
  Overall the work is adequate, but it shows a minimal understanding of the field with major deficiencies in certain areas. The presentation just meets a professional standard.
There is evidence of an ability that suggests the student can be a practitioner, but some doubts remain that may relate to maturity, ability or commitment.

The balance of the work is just acceptable and the structure adequate. However, there are major flaws and inadequacies in places throughout the work.

No real observation on why the problem needs to be solved is given.

The critique suggests only a limited reading of the obvious literature. There is evidence the student was only seeking the work of others.

The solution is a simple adaption of others work. There is no obvious creativity. There is evidence of an ability to apply standard techniques. The student does not seem entirely sure of why the solution is acceptable.

Implementation of a solution shows a restricted understanding of accepted practices.

The student does not seem to have fully grasped the need for verification or have a good understanding of appropriate procedures.

Conclusions are obvious. The case for further development is not made.

Much of the literature referenced seems to have limited relevance to the work.

- **Fail grade 20**

  Overall the work shows a failure to grasp key concepts of the field. This may be a result of a poor presentation that fails to communicate ideas.

  There is evidence the student should not considering this profession. The work suggests an individual who does not have the abilities needed to succeed.

  The work is imbalanced with emphasis given to areas the student believes he or she understands alone. The structure is disjoint.

  The student is simply trying to solve a problem without any more thought to it than that.

  The critique suggests the student has focused on a small set of references with no desire or interest going beyond those.

  The solution is inadequate and clearly inappropriate. There is evidence of lack of ability in applying standard techniques. The student does not seem able to appreciate why the solution is unacceptable.
Implementation of the solution shows no real understanding of accepted practices.

The student either has failed to verify, chosen an inappropriate procedure or failed to use an appropriate procedure correctly.

Conclusions are trite and little better than a summary. The case for further development is not made.

Much of the literature referenced seems to no relevance to the work.
PROJECT RECOMMENDATIONS: Prof. S. Islam

AREAS OF INTEREST
Projects can be offered in:

- Utilisation
- Power quality

PROJECT RECOMMENDATIONS: Dr M. Massoum

AREAS OF INTEREST
Projects can be offered in:

- Electric machines and drives

PROJECT RECOMMENDATIONS: A/Prof. W. Lawrance

1. Design, simulation and construction of a solar powered air conditioner.
   A simple evaporative air conditioner has two small electric motors for the pump and fan. These could be driven by a PV module mounted on the A/C unit. Design involves sizing, availability of suitable devices, cost etc. A software model is to be devised plus a prototype constructed. (Some hardware already exists). Suitable for 2 students.

2. Shaft speed and position detection using bar codes.
   Using a simple emitter-detector plus a bar code taped onto the shaft it is possible to monitor shaft speed and display it. Adding another tape will allow shaft torsion to be detected and hence torque measured.

3. Capturing PV module characteristics
   Using a large capacitor and a digital CRO it is possible to record instantaneous values for I-V as the capacitor charges up. These can be displayed as plot along with temperature. This work would involve building a suitable circuit and producing a lab experiment for RE students.

4. Cancellation of dominant harmonics from multiple SCIMs.
   Running similar, large SCIMs in pairs, leads to partial cancellation of the 5th and 7th harmonics. The scheme is to be investigated from a theoretical and practical viewpoint – including a simulation, then extended to multiple drives.

5. Solar PV demonstration
   One of the displays for solar PV is a field of “turning heads”. This is very impressive and immediately captures peoples attention. How can we develop something similar?
   The system I have seen used pivoted heads rotated by a stepper motor – there are a number of interesting concepts involved in building such a system. This is the basic idea it can be further developed – you need to be imaginative (plus be able to build it – at least a demo version).
6. **Greenhouse gas gauge**  
A low cost display is to be developed suitable for domestic use, which shows clearly the greenhouse gas emissions associated with using grid based electricity. The display could also show energy cost based on current demand.

7. **Pool pump controller**  
A pump controller which measures, and displays, the chlorine level of a pool and runs the pump when required. Can take into account off peak tariff to minimize operating costs.

8. **Amorphous PV applications**  
The large area of the modules can be put to use by constructing some form of shelter with PV as the roofing material. Another application is as an awning material on buildings. What happens to the energy collected?

**AREAS OF INTEREST**

Projects can be offered in:

- Photovoltaics
- Power quality

**PROJECT RECOMMENDATIONS: Prof. Chem Nayar**

**AREAS OF INTEREST**

Projects can be offered in:

- Renewable energy systems.
- Power Electronics.
- Power quality.

**PROJECT RECOMMENDATIONS: Dr Halit Eren**

**AREAS OF INTEREST**

Projects can be offered in:

- Instrumentation
PROJECT RECOMMENDATIONS: Dr D. G Myers

1. **An execution trace tool (up to 2 students)**
To test a new computer design, the standard practice is to create a software model of that design then execute sample software traces on it to gain data on performance. That means traces are needed. This project involves writing software to gain trace data by monitoring the execution of programs. The monitor is probably best written for the Unix OS as that allows a broader range of professional software to be examined.

There are several ways of creating a monitor. Step by step execution is exact, but difficult and slows execution. Modifying a compiler like the GCC is better, but that assumes source software is available.

This project should appeal to any student interested in improving their general and systems programming skills.

2. **A computer emulation suite (up to 8 students)**
In a recent report to the NSF (National Science Foundation), a group of leading computer engineering researchers identified the lack of high end simulators as a major problem. Current simulators like superscalar (http://www.superscalar.com) basically are high end functional simulators. What is needed is a simulator where users can define busses and attach functional elements like FPUs to them to gain data on timing, clashes and so forth. However, such a simulator is far more complex to construct.

This project will look at developing such a simulator and, depending on the number involved, begin the development of some functional elements like caches, FPUs and so on. Students undertaking this project will gain a very good insight into modern computer design.

3. **An electronic vermin control system (1 or 2 students)**
Vermin such as foxes and rabbits are a major problem in Australian agriculture and indeed the environment. As an introduced species they have no natural enemies. Traditional methods of vermin control – baiting, shooting, trapping, etc – are almost always failures for the reason that these vermin can breed very rapidly. Thus even when reduced to quite small numbers, they will rapidly rebound.

The aim of this project is to examine the feasibility of a robot for vermin control. It is a little like a Dalek – it simply sits in the bush and when it recognises a rabbit or a fox, it exterminates it. The essential issue here then, is being able to recognise a rabbit or a fax and make sure it is not a bandicoot, bilby or other desirable species. Thus the problem is one of pattern recognition. This project will appeal to anyone interested in 3D shape recognition.

4. **Detecting inflection points in an image (1 student)**
While edges are important in human recognition of objects, it is the inflection points – the discontinuities in the edges – that enable us to distinguish one object from another. Thus detecting inflection points is a critical – and it must be admitted difficult – part of image processing.
The aim of this project is to examine current methods of detecting inflection points and create software to test their value.

5. **3D reconstruction (1 student)**
This is a tough project, but if you think you might like to move on to graduate studies or know what they are like, or just enjoy a real challenge, this may be for you.

There is a lot of interest in 3D imaging. So far some clever graphics techniques have been used so that in motion pictures objects are tracked and the parallex observed so that a 3D image can be created. The results are remarkable. However, there is another related problem of interest. Creating 3D scenes from photographs. That will be the focus of this project.

**AREAS OF INTEREST**

Projects can be offered in:

- Image processing and pattern recognition
- Computer structures
- Multimedia, including watermarking and image compression
- Graphics, including virtual reality.
PROJECT RECOMMENDATIONS: Prof. K Chung

AREAS OF INTEREST

Projects can be offered in:

- Wireless modem - design and implementation.
- Wireless networking including adhoc fixed and mobile networks.
- Very high resolution channel sounding using wavelet transform and OFDM.
- Error resilient wireless compressed image transmission.
- Broadband power line communications.
- Receiver architecture for system-on-chip solution.
- Fast synchronisation in spread spectrum applications.
- Voice over IP in IEEE802.11
- Applications with IEEE802.11 and IEEE802.16 standards.

PROJECT RECOMMENDATIONS: Dr Stephen Ho

1. Investigation of New Algorithms for Image Processing, Coding and Data Compression.
   Description: Image processing is an established discipline. It is the basis of modern digital television, particularly image coding and compression. In order to achieve even higher compression ratios, many new approaches had been proposed in recent years, including wavelets, fractals and chaos. In this project, we would study the techniques behind these new approaches and investigate the possibilities of further improvements.

2. Innovative Applications of GPS
   Description: GPS is now finding more and more civilian applications, such as navigation and agriculture. In this project, we would examine some new applications using GPS, e.g. in the location of objects and animals, and to find better algorithms in vehicular navigation.

3. Intelligent Battery Analyser/Charger
   Description: All portable equipment requires batteries for its operation. As more electronic portable devices become common place, the requirement for small size, yet powerful batteries become very important. Many different technologies have emerged in recent time. In this project, we would study the current status of battery technologies, define their various characteristics, and then proceed to the design of a universal battery analyser, reviver and charger under the control of a PC.

4. FIR Filter Design Methodologies
   Description: While the design of IIR filters is well established using classical filter approximations and transformations, the design of FIR filters is not so. However, FIR filters offer many advantages and there is still a lot of interest in the design methodologies for FIR filters. In this project, we shall investigate the design methodologies of FIR filters, with particular emphasis on the Frequency Response Masking technique.
5. **Software for the self-paced learning of Circuit Concept**

Description: The study of engineering units is now frequently supplemented by software packages including self-paced tutorials and simulations. In this project, we shall study the impact of the use of such packages on the effectiveness of engineering education. In particular, we shall examine PSPICE for circuit simulation and CKTUTOR for self-paced learning of circuit concepts.

**AREAS OF INTEREST**

Projects can be offered in:

- Image Processing and Image Coding (including JPEG and MPEG)
- Microprocessor Applications, particularly innovative and unusual areas.
- Circuit Theory and Simulations.
- Engineering Education, with particular reference to the impact of the internet.
PROJECT RECOMMENDATIONS: Iain Murray

The majority of the projects listed are in the area of rehabilitation engineering and assistive technology. If you want a brief outline of those areas go to:

http://www.ece.curtin.edu.au/~iain/at-re.htm

This is a particularly useful area of research, with most projects based around building real products (not simulation) that may benefit disadvantaged members of the community. Students interested in these projects should have a good understanding of digital design and C/ Objective C/ Assembler programming. The current projects are listed below, but several others are available and I am happy to discuss any ideas students may have for research in this area.

1. CCTV System for Vision Impaired
These devices will utilise a rotating camera design that enables people with low vision to perform daily tasks more effectively. By rotating the camera head, the user can read, write, and view magnified images at any distance. This requires the use of a CCD camera, digital zoom and contrast enhance/invert video software.

2. Cisco Access for the Vision Impaired (CAVI)
In conjunction with the Association for the Blind W.A (ABWA), a benchmark CCNA course is in the process of being scheduled. This study aims to research two main areas in the fields of rehabilitation engineering and learning environments;

- The human computer interface.
- The effectiveness of e-learning technical and conceptual skills for those with vision impairments.

As a side effect of this research we (Cisco Systems & Curtin University) expect to have a unique program that will teach the vision impaired general IT skills as well as an in depth knowledge of network design.

3. Cisco router simulator
A software simulator of a Cisco 2600 series router is required. Whilst there is a simulator available, it does not function with screen review software. This simulator will act as a training tool for the CAVI project (described above).

4. Speech friendly packet sniffer and/or cable tester
As part of the Cisco Access for the Vision Impaired project, there exists a requirement for a speech friendly packet sniffer and/or cable tester. This could be based on the open source application ethereal or similar.

5. Currency Identification for the Blind
Polymer notes, recently replaced Australia’s decimal paper currency. The denominations of the new notes, while very distinctive in their colour and design, are very difficult to differentiate for a vision-impaired person. All notes are of equal width and increase only slightly in length with increasing value.
This project continues the design and development of a prototype device to identify Australian polymer banknotes, which indicates the denomination to a vision impaired person using a digitally recorded voice output. Use is made of a charge-coupled device (CCD) linear array and a Digital Signal Processing (DSP) chip. Identification is performed by imaging and recognising the contents of the clear window found near the lower corner of each note which is unique for each denomination. This development is of significance in Australia to people who suffer a large degree of vision impairment, and possibly also to the vision impaired population of the European Union, which also plans to adopt polymer note technology.

6. Braille Keyboard
This item would replace the standard PC keyboard with a Braille version. Functional compatibility with a standard win95 keyboard is of course necessary but additionally the device must be capable of “forward translation” of Braille codes. Braille uses 7 keys, including the space bar, to form a cell of 6 dots (2 columns of 3 rows). See baille translation project below.

7. Braille Translation – Grade 2 forward and back translation.
Braille is a form of shorthand used by the vision impaired in written communications. It consists of raised dots on paper, in two columns of 3 dots, meaning there are 64 possible combinations that may be represented. Grade two braille uses contractions to represent numbers, common words and letter combinations and some words in an effort to reduce bulk and speed of reading and writing. (64 combinations << 26 upper case + 26 lower case letters + 10 digits + punctuation)

There is, under development within the School, a portable device for the optical recognition of grade one and two braille. The development at this point scans and converts braille cells into a byte, with dot positions represented by bit positions, ie bit1=dot 1 - bit 2 = dot2 etc. The software to translate this binary braille code now needs to be developed. (It should be noted that grade two braille is context sensitive, ie a cells meaning is dependant on the preceding and following cells.)

The development platform is the Mitsubishi MC16 and the application should be developed in ANSI C. Nfptrans and turbobraille are good starting points.

8. Voice Recording on TMS320C50 or TMS320C5402
This device is intended for use in conjunction with other projects presently in development. It is envisaged that the device will record to Flash which can then be transferred to other devices.

9. Translation of sign language to speech
Communication between the deaf and hearing community can, at times, be difficult and/or embarrassing. A person with a hearing impairment is quite often conscious of the quality of their speech and is therefore happier using sign language. By the use a data glove interfaced to a speech synthesiser, the gestures of the user may be translated to speech. This would mean the hearing impaired would be able to communicate easily and comfortably with persons who do not understand sign language. One interesting issue is the communication between the deaf and the blind as discovered at the paralympic games in the USA.
10. Embedded controller for a Braille typewriter.
We had a mechanical engineering student working on a Braille embosser. The prototype has been completed, but we still require an embedded controller to activate the solenoids and stepper motors. This device is somewhat similar to a standard printer/typewriter in its operation with paper feed and print head stepper motors. The print head itself is quite different in that it requires activation of a “golfball” style head and impact solenoid in its printing. The input to the unit would be via a Braille keyboard. Some temporary hardware, to test the mechanical aspects, would need to be undertaken this semester.

A prototype Braille recognition system has been developed. At present this device captures the image of the Braille dots and recognises their position within the Braille cell. A system for decoding grade two Braille has also been developed. The work required is to complete/improve the recognition, probably with fuzzy logic, and interface the unit to a LCD display. Other improvements to the system are also proposed.

12. Screen Review Software for Specific Applications
Blind computer users rely on synthesized speech prompts to replace visual prompts. These prompts speak only the relevant part of the displayed screen, not all information displayed and is event driven. Initial packages to work with are Msword, Netscape or Access.(students choice) This software project would utilise Creative Labs “Text Assist” engine, MS speech API or IBM Via Voice.

13. Protocol Development for Wireless Communication Headsets
This project aims to define and implement a simple protocol stack for use in wireless communications headsets. It will need to include audio compression algorithms and collision avoidance mechanisms. There is a need for 3 audio channels with the capability of expanding to a (switchable) selection of 5 channel conferencing.

Compatibility should be maintained with the IRDA standards (tiny TCP). Some aspects of IEEE 802.11 wireless ethernet may also be included. There also exists a need for communications to be secure, therefore allowance for an encryption method must be made, although not necessarily implemented at this point. Bandwidth may be limited, in the case of IRDA to 4Mbps

14. Apple OSX Screenreader project (Parakeet)
See www.ece.curtin.edu.au/~iain/accessibility
The project involves designing, building and testing a screen reader application for Mac OS X operating system. A screen reader is an application that allows a vision-impaired person to use a graphical user interface by providing audible feedback in the form of speech. The screen reader interrogates the actions of the user via the Accessibility APIs and produces speech output using the text-to-speech (TTS) APIs. Both of these APIs are provided by Apple as part of Mac OS X.

The application is being developed using Apple's Project Builder software and coding is done in Objective-C. Objective-C is a superset of ANSI C with some syntax and runtime extensions to make object oriented programming possible. The screen reader application is Cocoa based.
15. Haptic Displays, Non Visual Representation of Graphical Information, Multimodal Human Computer Interaction, Tactile Graphical Displays

The following applies to several proposed projects.

This project focuses on the design of computer-based haptic (and other) graphs for blind and visually impaired people. Since visual impairment makes data visualisation techniques inappropriate for blind people, we need to develop a system which can make graphs accessible through haptic and audio media. We would like to tackle these problems by using computer technology, such as force feedback devices, 3D sound and computer assistance to help blind and visually impaired people to access graphs and diagrams.

16. Talking Signs (MIRSIGS)
This is a continuation of a previous project. Multilingual Infra Red Sign Identity and Guidance System (MIRSIGS) consists of two devices and is a specific communication system to be used in buildings and public places as a navigational aid for the vision impaired. The concept consists of a sign add-on device that allows signs to communicate with vision impaired users through hand held devices. These sign add-on devices will give the signs the ability to identify themselves upon request, and to transmit a guidance tone. The hand held device will allow the user to hear if a sign is within the vicinity through the use of the guidance tone played to the hand held devices earphone. The identity of the sign can be requested by pressing the ‘Request’ button, located on the users hand held device. The sign responds to this ‘Request’ by transmitting its unique 8-bit identity code word modulated into the same waveform as the guidance tone using Binary Frequency Shift Keying (BFSK). The guidance tone will amplitude modulate this BFSK signal.

17. Implementation of “Earcons”
Earcons were first proposed in 1989. They are abstract, musical tones that can be used in structured combinations to create auditory messages. Blattner defines earcons as "non-verbal audio messages that are used in the computer/user interface to provide information to the user about some computer object, operation or interaction". They are based on musical sounds, they are an effective means of communicating information in sound for the vision impaired. The objective of this project is to create an implementation of earcons (available from http://www.dcs.gla.ac.uk/~stephen/research.shtml#earcons) that we may use within Curtin in our HCI research.

18. The White Hat Hacker
One of the best ways to know how to defend a computer network, is knowing how to attack one. By knowing how an attacker will attempt to breach your system, you will be better prepared to defend it.

This project will set up a game environment, like capture the flag, where one team will try to defend their network whilst passing messages to one another (the flag) and attempting to shut down the other team(s) network and capture their message. This project will be run on real network hardware in our Cisco labs.
Attacks will include the simple tasks such as DoS, ping attacks, known exploits as well as advanced methods such as packet capture/modification and header/IP masquerading. **Expected Outcomes:** A set of tools that will allow participants to piece together a strategy for attacking the other teams networks.

19. Ultrasonic White Cane
The white cane is used by the blind and vision impaired as a mobility aid. It is by far the most economical and efficient method employed to aid users to move about independently. However, it has several drawbacks. Canes make no allowance for overhangs, eg branches hanging over walkways, and is poor at detecting drop offs, eg stairs leading down. By use of either sonar or infra red and audio feedback, the cane may be modified to warn of these obstacles. The device must be integral to the cane, compact and unobtrusive.

20. Gnopernicus Project
The Gnopernicus project will enable users with limited vision, or no vision, to use the Gnome 2 desktop and Gnome/GTK+-2 applications effectively. By providing automated focus tracking and fullscreen magnification, Gnopernicus will aid low-vision Gnome users, and its screen reader features will allow low-vision and blind users access to standard GTK+2 and Java-based GUI applications via speech and braille output. By leveraging Gnome 2's built-in accessibility framework, Gnopernicus will make interacting with applications more efficient for these users, and enable use of the Gnome 2 desktop for some users who otherwise would have no access to Gnome.

**Note:** This project is part of the Gnome accessibility project. See http://developer.gnome.org/projects/gap/AT/

21. Gnome Onscreen Keyboard (GOK)
GOK aims to enable users to control their computer without having to rely on a standard keyboard or mouse. Many individuals have limited voluntary movements and must control the computer using alternative input methods. These input methods may be controlled by actions such as blowing and sipping to activate a pneumatic switch, an eye blink and/or directed gaze with an eye tracking system, head movement, muscle contractions or limb movements.

Using innovative dynamic keyboard strategies, and leveraging Gnome 2's built-in accessibility framework, the GOK will make control more efficient for these users, and enable use of the Gnome 2 desktop for some users who otherwise would have no access to Gnome. With the right hardware support and the GOK these individuals will have full access to applications that support the AT SPI, and therefore, full access to the functionality these applications provide.

**Note:** This project is part of the Gnome accessibility project. http://developer.gnome.org/projects/gap/AT/

22. Dasher for OSX
Dasher is an information-efficient text-entry interface, driven by natural continuous pointing gestures. It is a competitive text-entry system wherever a full-size keyboard cannot be used. Dasher is highly appropriate for computer users who are unable to use a two-handed keyboard. One-handed users and users with no hands love Dasher. The only ability that is required is sight.
Dasher can be driven using a **mouse**, a trackpad, a touchscreen, a rollerball, or a joystick - any two-dimensional pointing device that can take over the role of a mouse. A foot mouse and a head mouse are additional options.

It can also be driven using an **eyetracker**, giving a completely-hands-free writing system. After one hour's practice, some users are able to write at more than 20 words per minute using Dasher with an eyetracker.

This project aims to improve the functionality of Dasher as a keyboard replacement for Apple hardware running OS X.

**23. Multichannel Amp**
There is a requirement for a multi channel audio amplifier for blind telephonists. The required amp would have a minimum of 4 channels with independent volume controls. There would need to be software control of mixing, AGC and priority of the fully separated channels.

**24. Music Scanner for the low vision Musician**
This software application would allow the low vision user to scan written music (score) into a computer. The PC would the enlarge and display the score bar by bar, enlarged (must use variable magnification) on the monitor. The display of the music must be able to be controlled, i.e. the score must scan across the screen at the rate the musician is playing.

**25. Optical Recognition of Seven Segment Displays**
Seven segment displays are everywhere, however the blind (obviously) cannot use these. The objective of this project is to develop a handheld device to scan and recognise the basic 7 segment display and then output the result via recorded speech.

**OTHER PROJECTS**
Other projects that may be considered are:

- Colour Sensor for the Blind
- Cisco Laboratory Packet Sniffer
- Speech Friendly Network Discovery tools
PROJECT RECOMMENDATIONS: James Goh

1. **Tele-Sense Tracking System.**
   This project involves the control of a tracking system to mimic the pan and tilt movement of a remote operator. A two or four channel wireless transceiver will be used to provide the link. The scope of the project requires the fabrication of a prototype tracking system.

2. **Mobile Energy Retriever.**
   For outback travellers on campervans, caravans, etc, the energy sources usually comes from the stand-by batteries to power the luxury of life eg a mini-fridge and light. Re-charging the battery is possible only at powered camping site and when this is unavailable, a major inconvenience arises. However, this can be overcome by harnessing the elements of the sun, wind and moving vehicle inertia. This project looks at harnessing these available energy sources and converting it into a suitable form to charge the batteries.

3. **DIY “Intelligent” Lighting units.**
   This project makes use of Passive Infra Red (PIR) sensors to trigger the system. When activation is detected by the PIR, the lighting for that particular zone will be turned on and the light intensity will be set to its preset maximum brightness. After an adjustable elapsed time with no further activation, the light intensity level at that location should be reset to its ambient pre-set level or switched off depending on the device setting.

   This project calls for the design and fabrication of a prototype unit with the following minimum requirements:

   - It should turn on a light globe when an activation is detected.
   - It should adjust the lighting intensity after a predetermine period of inactive time.
   - Both lighting intensity and inactive time period should be adjustable.
   - It should contain a unique ID, which should be transmitted each time it is triggered. It should be suitable for DIY installation.

4. **Self-Learning Mobile.**
   The project involves the design of an electronic control unit to record the path or movement taken by a mobile and then repeat the sequence of actions on request. Actual fabrication of the mobile is not required. The project is to be conducted in two phases. During the first phase, a uni-direction movement is required to be repeated. The second phase involves involve multiple paths and directions.
PROJECT RECOMMENDATIONS: Clive Maynard

• Generally, the application of intelligent control systems in the Health and Medical environments through interests in perception, action, reasoning, and learning, both in humans and in machines, with a special emphasis on research on and development of complex and intelligent systems.

• Computer Clusters and their applications.

• Development of PLC and SCADA lab demonstrations.

• Fire sensing and protection systems. Fire protection in the bush often depends on a limited water supply/water pressure/pumping systems so that a sensing and deployment system which can maximise protection within these constraints has considerable potential in the Australian environment. The ability to deal with various hazard levels within the protection zone and to be able to switch between mains water and local supplies when necessary is critical. (1 Student)

• Develop a program for realtime scheduling analysis similar to but simpler than Timewiz which will run on Windows, Linux & Mac computers. (1-2 students)

• Create a ROMable version of microCOS plus CLIC board libraries for the 68HC11 (with some modifications) which may be easily used under IAR. (1 student)

• Create a Bluetooth based “activity monitor” for a home. Sensors to detect power consumption for items such as kettles and transmit info to a basestation. This in turn is to send a text message to a specified phone if definable criteria are met. (2 students)

• Develop a trainable “audible remote control” for visually impaired persons (VIPs) generating appropriate IR outputs from an audible menu hierarchy. Include the provision for reading “barcoded CDs” with audible names for selection etc. (1 student)

• Create a set of CORE ROMable routines for the CLIC board and its additional boards together with the header and code files to make them accessible to the IAR development environment.

AREAS OF INTEREST

Projects can be offered in:

  adaptive systems,
  autonomous systems
  co-design of embedded systems
  decentralized systems
  distributed systems,
human cognition
infrastructures for agent execution and control
intelligent agents
intelligent control,
knowledge representation
knowledge systems
learning and aiding environments
learning, multi-agent systems
natural language processing
neo-cybernetics
planning
problem solving,
real-time systems
robotics
speech
soft computing – neural nets, etc
vision
simulation of the above systems.

PROJECT RECOMMENDATIONS: Michael Darby

AREAS OF INTEREST

Projects can be offered in:

• Artificial Intelligence.
• Simulation and modelling.
• Technology-based learning environments.
• Learning through gaming.

PROJECT RECOMMENDATIONS: Dr Roy Howard

AREAS OF INTEREST

Projects can be offered in:

• Modelling of stochastic noise.
• Low noise amplifier design.
PROJECT RECOMMENDATIONS: Dr Wei-Yong Yan

AREAS OF INTEREST
Projects can be offered in:

• Control Systems.
• Signal processing.

PROJECT RECOMMENDATIONS: Dr King-sun Chan

AREAS OF INTEREST
Projects can be offered in:

  - computer networking
  - simulation of networks
  - ad hoc and wireless networks.

PROJECT RECOMMENDATIONS: Dr Yee Hong Leung

Dr Leung can assist students in undertaking projects with WATRI.

AREAS OF INTEREST
Projects can be offered in:

  - telecommunications
  - adaptive and robust signal processing
  - DSP.
LATE PROJECTS

Any late projects will be put on the student noticeboard on level 3 of building 204.

INDUSTRIAL PROJECTS

Ms Helen Jordan (jordan@iinet.net.au) has approached the Department for help in a project.

She wishes a small device similar to a pocket calculator for knitters, especially when for help in undertaking complicated patterns. It should be able to count the knitting rows, the increase rows, decrease rows and total number of stitches made. It would need to save the data when turned off and can only be cleared when the reset button is pressed. She has some suggestions on how this may be done.

Ms Jordan is a knitter. A student who wishes to undertake this project will also need to organise a Departmental supervisor.

Creative On-line Technologies is a company developing some novel electronic funds transfer systems. They can offer projects in various software areas involving Unix, LAN’s, Java, HTML, XML and Oracle to assist in the development of their systems. Students need to have a good understanding of Unix, preferably Solaris. Contact the Chief Executive, Mr Micheal Ong (mong@co-it.com) or see their web page at http://www.co-it.com for more details on their activities.
CURTIN UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

REGISTRATION OF PROJECT

Project Unit: _______________________________________________________
Semester ( 1/2) ______________________________________________________

Student: Family name: ___________________________ ID ________________
First names: _______________________________________________________
Email: ___________________________________________________________
Tel: ______________________________________________________________

Supervisors; Principal: ______________________________________________
Co-Supervisor: ____________________________________________________
Associates: ________________________________________________________

Project Title: _______________________________________________________

Project Objectives: _________________________________________________
( Describe briefly what the project is )
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

Expected Outcomes: _________________________________________________
( What will result )
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

Resources required: _________________________________________________
( Parts, computers, etc)
_________________________________________________________________
_________________________________________________________________

Meetings: Frequency: ________________________________________________
Time: ______________________________________________________________

Agreed to by: Student: ________________________________________________
Supervisor _________________________________________________________