

FYP Proposals for AY 2001/2002

Group	Centre of Wireless Communication
Project No	CW-SEAHW-1
Project Type	normal
Student's userID	
Title	Analysis of TCP Performance over General Packet Radio Service (GPRS)
Supervisor 1	W Seah(CWC)
Supervisor 2	Joshua Liew (CWC)
Supervisor 3	
No. of student	1
Synopsis	<p>GPRS, as a major component of GSM Phase II+, aims at providing public packet-switched data services over the existing GSM wireless network infrastructure. GPRS is mainly intended to provide better services for Internet applications compared to the existing circuit-switched data services of GSM.</p> <p>GPRS defines two retransmission mechanisms to ensure an acceptable level of data transmission reliability. One retransmission scheme is used at the RLC/MAC layer, between the Mobile Station (MS) and Base Sub-Station (BSS). The second retransmission policy operates at the LLC layer, between the Service GPRS Support Node (SGSN) and the MS</p> <p>An evaluation of TCP performance over GPRS with unacknowledged LLC mode showed that TCP and GPRS could be harmonized as shown in "TCP performance over GPRS" by M. Meyer.</p> <p>In this project, the student is required to develop simulations using NS-2 for analyzing TCP performance over GPRS. Numerous NS-2 simulations for similar purposes are widely available and can be used with some modifications. From the results obtained, the student should draw conclusions on TCP performance with respect to different system parameters.</p>
Nature	Analytical, discovery, theoretical, software
Pre-requisite	A basic understanding of TCP/IP protocols and C programming skills; do-it-yourself attitude;
AMP	yes
CPE	yes
Supervisor 1 email	eleskg

Group	Centre of Wireless Communication
Project No	CW-SEAHW-3
Project Type	normal
Student's userID	
Title	Design and Implementation of a QoS Service Provider for LINUX
Supervisor 1	W Seah(CWC)
Supervisor 2	Santhosh K. Pilakkat (CWC)
Supervisor 3	
No. of student	2
Synopsis	<p>There exist a number of QoS technologies in the Internet, both Layer 2 and Layer 3, with IntServ, DiffServ and 802.1p being some of them. In addition, the multitude of access technologies, both wireless and wireline, tend to have their own QoS mechanisms (E.g. 802.x, ATM, GPRS, UMTS, 802.11 Wireless LAN etc.). Currently, these QoS mechanisms are invoked by the applications (if possible) with different APIs and no uniform standard exists.</p> <p>To ease the development of QoS aware applications that are able to function in different QoS environments it is necessary to have a uniform QoS model presented to them and a uniform API provided to access the QoS facilities, irrespective of the underlying technology. Microsoft has defined a GQoS API and QoS Service Provider Component as part of their Winsock2 specifications and is being incorporated into Win2000 and other OS platforms. Another effort is the AQoS API being defined as part of ACE (The ADAPTIVE Communication Environment) in the AMASE project in CWC.</p> <p>This project aims to develop a similar QoS Service Provider Component and enhancing the Socket interface. Various QoS APIs (RAPI/SCRAPI, Traffic Control) and QoS Agents (RSVP Agents etc.) will be analyzed and extended to design the API and QoS Service Provider Component. The design shall be implemented supporting at least IntServ and DiffServ on LINUX.</p> <p>References</p> <ol style="list-style-type: none"> 1. Winsock Generic QOS Mapping (draft): ftp://ftp.microsoft.com/bussys/wINSOCK/winsock2/gqos_spec.doc 2. Yamuna Krishnamurthy, Vishal Kachroo, David A. Karr, Craig Rodrigues, Joseph P. Loyall, Richard Schantz, and Douglas C. Schmidt, Integration of QoS-enabled Distributed Object Computing Middleware for Developing Next-generation Distributed Applications, Proceedings of the ACM SIGPLAN Workshop on Optimization of Middleware and Distributed Systems (OM 2001), Snowbird, Utah, June 18, 2001. 3. SCRAPI - A Simple "Bare Bones" API for RSVP, Lindell, B., Internet Draft, February 1999. (Text/Postscript). 4. RAPI -- An RSVP Application Programming Interface Braden, R. and Hoffman, D., Internet Draft, August 1998. http://www.isi.edu/rsvp/DOCUMENTS/rsvpapi.txt 5. Design, implementation and test of a RSVP Agent based on a generic QoS API, Esteve Majoral-Coma, Xavier Martinez- Álvarez, Angel Luna- Lambies, Jordi Domingo- Pascual Advanced Broadband Communications Center (CCABA) Universitat Politècnica de Catalunya
Nature	Survey, Analysis, Design and Implementation
Pre-requisite	TCP/IP, LINUX Programming
AMP	no
CPE	yes
Supervisor 1 email	eleskg

Group	Centre of Wireless Communication
Project No	CW-SEAHW-4
Project Type	normal
Student's userID	
Title	TCP Protocol Tester/Analyzer
Supervisor 1	W Seah(CWC)
Supervisor 2	Liaw Yong Shyang (CWC)
Supervisor 3	
No. of student	1
Synopsis	<p>TCP/IP is the default protocol suite used for the Internet today. Though TCP specification is defined by the Internet Engineering Task Force (IETF) in the RFCs (i.e. RFC 793, 2001, 2581, etc), there are many existing variant implementations of TCP with different default system parameters. This may give different performance throughput for a given test environment (as an example, an implementation of TCP may give a very good throughput, whereas another may give a poor throughput in GSM environment). Worse, some implementations may not implement the correct behavior of TCP as specified in the RFCs. Currently, there is no known tool that can test a given TCP implementation for conformity to the RFCs. Very often, the only way to check for the conformity of an implementation is to read the code (if it is available), which is time-consuming.</p> <p>The objective of this project is to develop a TCP protocol tester to test the conformity of an implementation of TCP to the RFCs. There are 2 main tasks in this project as followed:</p> <ol style="list-style-type: none"> To define a set of procedures to probe different behavior of TCP as defined in the RFCs. This will really require a thorough understanding of TCP. To implement and verify the procedures with different implementation of TCP in different operating systems.
Nature	Innovative
Pre-requisite	A thorough understanding of TCP/IP protocol, and basic programming skill in C and socket
AMP	no
CPE	yes
Supervisor 1 email	eleskg

Group	Centre of Wireless Communication
Project No	CW-SEAHW-5
Project Type	normal
Student's userID	
Title	Improving TCP Performance over Wireless Links with Forward Acknowledgements
Supervisor 1	W Seah(CWC)
Supervisor 2	Joshua Liew (CWC)
Supervisor 3	
No. of student	1
Synopsis	<p>TCP/IP is currently the most widely used transport/network protocol today and there are many research topics into this area. One of the main research topics is to improve the performance of TCP/IP over wireless links.</p> <p>Wireless link characteristics contribute many problems to the existing TCP protocol. This includes high bit error rates (BER), long variable delays and low bandwidth. Many solutions have been introduced such as the Snoop Protocol, Split TCP, Selective Acknowledgement, Forward Acknowledgements, etc.</p> <p>The objective of this project is to understand the characteristics of TCP over wireless links and analyse the difference when Forward Acknowledgements are introduced. This is to be supplemented by a comparison of the performance with other TCP enhancement schemes.</p>
Nature	Analytical, Theoretical, Discovery, Software
Pre-requisite	A basic understanding of TCP/IP protocols and Linux programming skills.
AMP	no
CPE	yes
Supervisor 1 email	eleskg

Group	Centre of Wireless Communication
Project No	CW-SEAHW-6
Project Type	normal
Student's userID	
Title	Improving TCP Performance over Wireless Links with Delayed Duplicate Acknowledgements
Supervisor 1	W Seah(CWC)
Supervisor 2	Joshua Liew (CWC)
Supervisor 3	
No. of student	1
Synopsis	<p>TCP/IP is currently the most widely used transport/network protocol today and there are many research topics into this area. One of the main research topics is to improve the performance of TCP/IP over wireless links.</p> <p>Wireless link characteristics contribute many problems to the existing TCP protocol. This includes high bit error rates (BER), long variable delays and low bandwidth. Many solutions have been introduced such as the Snoop Protocol, Split TCP, Selective Acknowledgement, Delayed Duplicate Acknowledgements, etc.</p> <p>The goal of this project is to understand the characteristics of TCP over wireless links and analyse the difference when delayed duplicate Acknowledgements are introduced. This is to be supplemented by a comparison of the performance with other TCP enhancement schemes.</p>
Nature	Analytical, Theoretical, Discovery, Software
Pre-requisite	A basic understanding of TCP/IP protocols and Linux programming skills.
AMP	no
CPE	yes
Supervisor 1 email	eleskg

Group	Centre of Wireless Communication
Project No	CW-SEAHW-7
Project Type	normal
Student's userID	
Title	Graphical Network Analyser for TCP
Supervisor 1	W Seah(CWC)
Supervisor 2	Joshua Liew (CWC)
Supervisor 3	
No. of student	2
Synopsis	<p>TCP/IP is currently the most widely used transport/network protocol today and there are many research topics into this area. One of the main research topics is to improve the performance of TCP/IP over wireless links. However, one difficulty faced by researchers is the collection and analysing of traffic information on the network.</p> <p>Currently, most graphical network analysers are very costly and also require special equipment to monitor traffic on the network. The object of this project is to develop a graphical network analyser for a Linux or Windows based PC. The analyser should be able to provide real time data analysis or a non-real time back-end process.</p> <p>The analyser should be able to provide a graphical display of TCP/IP packets traversing on a network link. It should also show the details of the packet headers (i.e. TCP and IP headers), the sequence numbering of the packets, the timing details and also an indication lost packets and retransmitted packets.</p> <p>Another graphical display should plot the sequence numbering of packets over time. This would give a overall picture on retransmission timeout values, retransmission sequence.</p> <p>The goal of this project is to develop a graphical network analyser for Linux (one student) and/or Windows platform (one student).</p>
Nature	Software, Analytical
Pre-requisite	Excellent programming skill in C. Basic understanding of TCP/IP protocols.
AMP	no
CPE	yes
Supervisor 1 email	eleskg

Group Communications & Information Engineering

Project No CIE-KASSIM-5

Project Type normal

Student's userID

Title Orthodontic analysis using computer vision techniques.

Supervisor 1 A Kassim

Supervisor 2

Supervisor 3

No. of student 1

Synopsis The aim of this project is to develop algorithms for automatic feature detection and geometric measurements of three-D models of dental casts. These three-D computer models will be produced from dental casts of patients using a 3D scanner. The algorithms will be used in the analysis of the palatal development to view and classify the severity of the certain orthodontic problems.

Nature Innovative

Pre-requisite Familiar with C/C++. Some knowledge about computer vision will be helpful.

AMP no

CPE yes

Supervisor 1 email eleashra

Group	Communications & Information Engineering
Project No	CIE-KASSIM-3
Project Type	normal
Student's userID	
Title	Video motion estimation and compensation in the transform Domain
Supervisor 1	A Kassim
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Traditionally, motion estimation and compensation (MEMC) is performed using fixed block sizes (as in MPEG-1 and MPEG-2). Each block is estimated from the previous frame within a certain range in the spatial domain.</p> <p>This project involves studying the possibility of performing MEMC in the wavelet transformed domain.</p> <p>Student is encouraged to come up with different strategies, analyze the pros and cons as compared to traditional methods.</p>
Nature	Innovative
Pre-requisite	Good in C/C++.
AMP	no
CPE	yes
Supervisor 1 email	eleashra

Group	Communications & Information Engineering
Project No	CIE-KASSIM-1
Project Type	normal
Student's userID	
Title	Using Human Visual System Models for better quality assessment of compressed monochrome and color images.
Supervisor 1	A Kassim
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Traditionally, quality measurements of digital images are accomplished using the peak-signal-to-noise ratio (PSNR). However, it is widely known that PSNR measurements do not correspond accurately to how the human visual system (HVS) perceives image quality.</p> <p>In this project, the student will study the different HVS models and experiment with different ways of incorporating these models into the numerical quality measures. This area of research is in its infancy and holds promise for improving image/video coders.</p> <p>Students will have the opportunity to continue this research to the graduate level.</p>
Nature	Computational
Pre-requisite	Good in C/C++.
AMP	yes
CPE	yes
Supervisor 1 email	eleashra

Group	Communications & Information Engineering
Project No	CIE-KASSIM-2
Project Type	normal
Student's userID	
Title	Introducing Resolution-Scalability into an Embedded Stream for Image and/or Video Data
Supervisor 1	A Kassim
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>The Set Partitioning in Hierarchical Trees (SPIHT) and Color-SPHIT (CSPIHT) schemes are embedded image coding schemes for progressive transmission which exploit the properties of the Discrete Wavelet Transform (DWT) to yield efficient coding.</p> <p>In this project, the student will model and evaluate efficient schemes for streaming the embedded data produced by the SPIHT and CSPIHT schemes for color image coding. One of the features to be incorporated is a PSNR scalability feature which enables resolution scalability. With such a feature, a image can be reconstructed to minimum quality levels even if the data stream is terminated.</p> <p>Students will have the opportunity to continue this research to the graduate level.</p>
Nature	Innovative
Pre-requisite	Good in C/C++.
AMP	no
CPE	yes
Supervisor 1 email	eleashra

Group	Communications & Information Engineering
Project No	CIE-CHEOKAD-10
Project Type	normal
Student's userID	
Title	Smart glove and hand mouse
Supervisor 1	AD Cheok
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	Mixed reality is one of the most exciting new areas in virtual reality. Based on sensors on the hand, computer algorithms, and color information from video, this project will develop a method for allowing a wearable interface for functions which are similar to a normal computer mouse.
Nature	software/hardware
Pre-requisite	computer software (low level system algorithms) and hardware
AMP	no
CPE	yes
Supervisor 1 email	eleadc

Group	Communications & Information Engineering
Project No	CIE-CHEOKAD-11
Project Type	normal
Student's userID	
Title	C# - using the new language for internet collaboration
Supervisor 1	AD Cheok
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>C#, pronounced "C sharp," is a new programming language that makes it easier for C and C++ programmers to generate internet ready programs. C# includes built-in support to turn any component into a Web service that can be invoked over the Internet-from any application running on any platform. This project will examine the advantages and disadvantages of this new language and document them. The project will then demonstrate the potential of the new language by developing a cooperative human computer environment over the internet, where the users can work on a multimedia object together over the internet.</p>
Nature	Computational
Pre-requisite	good at software and preferably computer graphics
AMP	no
CPE	yes
Supervisor 1 email	eleadc

Group	Communications & Information Engineering
Project No	CIE-CHEOKAD-8
Project Type	normal
Student's userID	
Title	3D Computer Interaction in Mixed Reality Environment
Supervisor 1	AD Cheok
Supervisor 2	Kuntal Sengupta
Supervisor 3	
No. of student	1
Synopsis	Synopsis: In this project a 3D chess game will be designed together with an avatar of a 3D character or human to play chess with a human in a mixed reality environment.
Nature	Computational
Pre-requisite	good at software and computer graphics
AMP	yes
CPE	yes
Supervisor 1 email	eleadc

Group	Communications & Information Engineering
Project No	CIE-CHEOKAD-9
Project Type	normal
Student's userID	
Title	Virtual Objects Merging with Humans in Video Sequences
Supervisor 1	AD Cheok
Supervisor 2	Kuntal Sengupta
Supervisor 3	
No. of student	1
Synopsis	Merging computer graphics with human video is important for augmented reality, special effects in movies, and fashion. In this project a technique of automatic registration of virtual objects with human body images will be undertaken. The computer graphics objects will be used to obtain a synthesised image.
Nature	Computational
Pre-requisite	very good at software and computer graphics
AMP	yes
CPE	yes
Supervisor 1 email	eleadc

Group	Communications & Information Engineering
Project No	CIE-KOCC-2
Project Type	normal
Student's userID	
Title	Acoustic source separation
Supervisor 1	CC Ko
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	The aim of the project is to design and investigate the use of DSP techniques for separating signals from human speakers inside a car. Currently, signals from a 4-element microphone array have been recorded. The project will require the student to carry out some statistical investigation on the characteristics of the signals and then to design suitable signal processing algorithms to separate the signals. Programming will be done in MathLab.
Nature	Computational
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elekoc

Group	Communications & Information Engineering
Project No	CIE-KOCC-4
Project Type	normal
Student's userID	
Title	Performance Studies of A Electromagnetic Vector Sensor
Supervisor 1	CC Ko
Supervisor 2	
Supervisor 3	
No. of student	2
Synopsis	The aim of this project is to study the performance of a electromagnetic vector sensor, which is able to give simultaneous measurement of the electric and magnetic fields of the radio wave at a particular location. The study will involve some appropriate formulation that compares the performance of such a sensor with conventional receiving antennas. Some simulation carried out using MATLAB may also be needed at various stages of the project.
Nature	Computational
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elekocc

Group	Communications & Information Engineering
Project No	CIE-KOCC-1
Project Type	normal
Student's userID	
Title	Acoustic noise cancellation using a microphone array
Supervisor 1	CC Ko
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	The aim of the project is to design and investigate the use of DSP techniques for enhancing the signals from human speakers inside a car. Currently, signals from a 4-element microphone array have been recorded. The project will require the student to carry out some statistical investigation on the characteristics of the signals and then to design suitable signal processing algorithms to enhance the signals. Programming will be done in MathLab.
Nature	Software
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elekoc

Group	Communications & Information Engineering
Project No	CIE-KOCC-3
Project Type	normal
Student's userID	
Title	Virtual reality based remote experimentation
Supervisor 1	CC Ko
Supervisor 2	
Supervisor 3	
No. of student	2
Synopsis	In this project, a web-based virtual reality based virtual laboratory is to be developed for an experiment for it to be carried out anytime anywhere through the Internet. The project will involve some initial system design on the components and sub-system needed, the setting up of these sub-systems and the development of the appropriate control program and web interface. Also, it will be nice if some management and monitoring software can be developed.
Nature	Software
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elekoc

Group	Communications & Information Engineering
Project No	CIE-THAMCK-1
Project Type	normal
Student's userID	
Title	Inter- and Intra-Domain QoS Management
Supervisor 1	CK Tham
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>The evolution of the current best effort Internet is towards a network with predictable quality of service (QoS) implemented using IETF integrated and differentiated services mechanisms. Building on earlier work which had set up connections with the appropriate QoS for user applications such as Voice over IP and video streaming or conferencing sessions over the SingAREN and the Internet2 QoS Backbone (QBone) networks, the focus of this project is develop and deploy traffic and router status measurement components into a QoS management framework. These measurements will be recorded in a structured and hierarchical fashion. Algorithms and processing logic will be developed in Bandwidth Brokers (BBs) for adaptively provisioning network resources to control QoS for users and maximize revenue for the operator. This work will involve configuring and instrumenting high-end Cisco routers as well as Linux-based PC routers.</p>
Nature	Innovative
Pre-requisite	Good in C/C++/Java and network programming, Unix operating system, and plan to take EE4204
AMP	yes
CPE	yes
Supervisor 1 email	eletck

Group	Communications & Information Engineering
Project No	CIE-THAMCK-2
Project Type	normal
Student's userID	
Title	Quality of Service (QoS) Management in Differentiated Services-MPLS Networks
Supervisor 1	CK Tham
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Multi-Protocol Label Switching (MPLS) is a promising new technology that permits useful functionalities like determining a specific path for data packets to flow and faster packet processing at each node in the internetwork. It is beneficial to combine MPLS with Differentiated Services (DS) methods so that several grades of service can be offered to applications. This project will seek to develop and deploy probes or meters which monitor the Quality of Service (QoS) experienced by flows or aggregates of flows in a DS-MPLS network as well as monitor DS and MPLS-specific status information. The most common QoS parameters are throughput, loss, delay and delay variation or jitter. The probes will provide information at regular intervals to a centralised or hierarchical network manager which can display the information to the network administrator, or act autonomously to dictate changes in the DS-MPLS network such as the modification of an MPLS label-switched path (LSP) or other forms of traffic engineering at the MPLS level, or other mechanisms at the DS level, in order to ensure that flows or aggregates of flows get the QoS that they require. A physical DS-MPLS network will be used for this work comprising Cisco and Linux DS routers an IBM MPLS-capable switch-router.</p>
Nature	Innovative
Pre-requisite	Good in C/C++/Java and network programming, Unix operating system, and plan to take EE4204
AMP	yes
CPE	yes
Supervisor 1 email	elctck

Group	Communications & Information Engineering
Project No	CIE-THAMCK-3
Project Type	normal
Student's userID	
Title	Differentiated Services at Application Servers and Networks
Supervisor 1	CK Tham
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>With the presence of high bandwidth networks, the bottleneck to client-server application performance is not the network but the server. This project will treat network-level and application-level quality of service (QoS) in a wholistic manner and study and develop algorithms and mechanisms that can simultaneously handle QoS requirements in both networks and applications. Several performance requirements such as guaranteed service, fair service, proportional differentiated service etc. will be studied and implemented for the cases of Apache web servers and Java-based application servers. Service management, look-up and discovery mechanisms will also be considered.</p>
Nature	Innovative
Pre-requisite	Good in C/C++/Java and network programming, Unix operating system, and plan to take EE4204
AMP	yes
CPE	yes
Supervisor 1 email	eletck

Group	Communications & Information Engineering
Project No	CIE-MATHEWG-1
Project Type	normal
Student's userID	
Title	Detection for Perpendicular Magnetic Recording Channels in the Presence of Transition Noise
Supervisor 1	G Mathew(DSI)
Supervisor 2	KC Indukumar (DSI)
Supervisor 3	
No. of student	1
Synopsis	<p>To meet the ever-increasing demand for storage, the longitudinal magnetic recording technology has made several break-through achievements in the development of read-write heads, magnetic media, servo systems, and read-write signal processing. While areal density of 100Gb/sq.in will become a reality very soon, it is known that the phenomenon of 'super-paramagnetic effect' will not allow this steady progress to continue much further. As a result, there has been intense research activity in the development of perpendicular magnetic recording systems, which show a clear advantage in being able to postpone the super-paramagnetic limit for another several years.</p> <p>As in longitudinal recording, one of the key issues that needs to be addressed in very high-density perpendicular recording systems is 'detection performance in the presence of media noise'. Media noise can be modeled using transition noise, and this becomes one of the dominant causes of channel distortions at high densities. The goals of the proposed project are 1) to study the effect of media noise on the performance of advanced partial response detectors, and 2) to develop techniques for improving the detection performance in the presence of media noise. This study has immediate applications in disk-drive industries. The student, in addition to learning important signal processing techniques for data storage applications, will develop simulation and analytical skills in the study of recording channels, and will be trained to develop innovative techniques for solving practical problems.</p>
Nature	Computational/analytical: 65%; Discovery/innovative: 35%
Pre-requisite	Introductory knowledge in Digital Signal Processing and Digital Communications; Computer programming skills
AMP	no
CPE	yes
Supervisor 1 email	elemg

Group	Communications & Information Engineering
Project No	CIE-MATHEWG-2
Project Type	normal
Student's userID	
Title	Iterative Detection for Perpendicular Magnetic Recording Channels
Supervisor 1	G Mathew(DSI)
Supervisor 2	KC Indukumar (DSI)
Supervisor 3	
No. of student	1
Synopsis	<p>Over the past two decades, there has been a phenomenal growth in the storage capacity of magnetic recording systems. While technological innovations in the design of heads and media have been mainly responsible for this, coding and signal processing techniques have played a vital role in supporting and augmenting this growth. However, the phenomenon of ‘super-paramagnetic effect’ imposes a physical limit on the areal density achievable by the currently used longitudinal magnetic recording technology, and this limit is predicted to be not significantly higher than 100Gb/sq.in. The perpendicular magnetic recording technology has been proposed as an alternative since it has the advantage of being able to postpone the super-paramagnetic limit for another several years.</p> <p>In the recent past, there has been intense research activity in the area of iterative detection (popularly known as turbo codes) techniques because of their ability to significantly improve the data detection performance of storage/communication systems. In this project, we want to study the application of these techniques for perpendicular systems. In particular, the goals of the proposed project are 1) to study the performance of iterative detection techniques on perpendicular recording channels, and 2) to develop simplified iterative techniques which have less complexity and delay compared to current techniques. The student, in addition to learning important signal processing techniques for data storage applications, will develop simulation and analytical skills that will be useful in the study of recording/communication channels. The knowledge gained from this project will also be useful in digital communication systems, since iterative techniques are also widely used in communications.</p>
Nature	Computational/analytical: 60%; Discovery/innovative: 40%
Pre-requisite	Introductory knowledge in Digital Signal Processing, Digital Communications, and Coding Techniques; Computer programming skills
AMP	yes
CPE	yes
Supervisor 1 email	elemg

Group	Communications & Information Engineering
Project No	CIE-MATHEWG-3
Project Type	normal
Student's userID	
Title	Application of SOVA/BCJR Algorithms for Improved Detection in Magnetic Recording Channels
Supervisor 1	G Mathew(DSI)
Supervisor 2	KC Indukumar (DSI)
Supervisor 3	
No. of student	1
Synopsis	<p>The last two decades witnessed tremendous growth in the storage capacity of magnetic recording systems. Areal density of over 60Gb/sq.in and data transfer-rate of about 1 Gb/s have already been demonstrated. Apart from the major role played by novel heads and media, the development of powerful coding and signal processing techniques have been key in the development of such high performance storage systems.</p> <p>The increase in recording density is usually accompanied by a corresponding reduction in the available signal to noise ratio (SNR) in the read-write channel of the disk drive. Therefore, one of the major challenges in read-write channels is to develop advanced coding and signal processing techniques that are powerful enough to guarantee satisfactory data recovery at low SNRs. Several techniques such as partial response equalization, sequence detection, and distance-enhanced coding have been proposed in the literature for this purpose.</p> <p>In this project, we want to study the use of soft-decision algorithms such as SOVA (soft output Viterbi algorithm) and BCJR (Bahl, Cocke, Jelinek, Raviv) algorithms for achieving good detection performance. In particular, the goals of the proposed project are 1) development of distance enhancing coding and post-processor techniques for achieving improved bit error rate (BER) performance, and 2) to apply the principles of soft-decisions algorithms such as SOVA and/or BCJR for improving the BER performance. The student, in addition to learning important signal processing and coding techniques for data storage applications, will develop simulation and analytical skills that will be useful in the study of recording/communication channels. The knowledge gained from this project will also be useful in digital communication systems.</p>
Nature	Computational/analytical: 60%; Discovery/innovative: 40%
Pre-requisite	Introductory knowledge in Digital Signal Processing, Digital Communications, and Coding Techniques; Computer programming skills
AMP	yes
CPE	yes
Supervisor 1 email	elemg

Group	Communications & Information Engineering
Project No	CIE-MATHEWG-4
Project Type	normal
Student's userID	
Title	Interpolated Timing Recovery for Perpendicular Recording Channels
Supervisor 1	G Mathew(DSI)
Supervisor 2	KC Indukumar (DSI)
Supervisor 3	
No. of student	1
Synopsis	<p>The last two decades witnessed tremendous growth in the storage capacity of magnetic recording systems. Areal density of over 60Gb/sq.in and data transfer-rate of about 1 Gb/s have already been demonstrated. Apart from the major role played by novel heads and media, the development of powerful coding and signal processing techniques have been key in the development of such high performance storage systems. Because the recording density capability of the currently used longitudinal recording based systems is limited by the so-called 'super-paramagnetic effect', perpendicular recording systems will be the technology for next generation products since these have a much higher super-paramagnetic limit compared with the longitudinal systems.</p> <p>At high densities and data-rates, timing recovery is crucial for reliable data-recovery. In conventional systems, the channel output is sampled at the data-rate and the timing loop synchronizes the sampling-clock with the underlying data-clock. This method is not suitable for digital detector implementation because the delay caused by the equalizer is harmful to the timing loop performance. Consequently, the concept of 'interpolated timing recovery' was proposed recently where the channel is sampled using a free-running clock, and an interpolator works on these asynchronous samples to generate the required data-rate samples.</p> <p>In this project, we want to study 'interpolated timing recovery' for perpendicular recording systems. Issues such as under-sampling, over-sampling, choice/design of interpolator and inverse interpolator, and interaction between timing loop and equalizer adaptation loop, will be investigated. In particular, the goals of the proposed project are 1) implementation (software-simulations) and study of interpolated timing recovery for perpendicular recording channels, and 2) analysis of the interaction between timing loop and equalizer adaptation loop, and development of techniques to minimize this interaction. The student, in addition to learning important signal processing techniques for data storage applications, will develop simulation and analytical skills that will be useful in the study of recording/communication channels. The knowledge gained from this project will also be useful in communication systems.</p>
Nature	Computational/analytical: 65%; Discovery/innovative: 35%
Pre-requisite	Introductory knowledge in Digital Signal Processing, Digital Communications, and Digital Circuits; Computer programming skills
AMP	yes
CPE	yes
Supervisor 1 email	elemg

Group	Communications & Information Engineering
Project No	CIE-MATHEWG-5
Project Type	normal
Student's userID	
Title	Efficient design of Hilbert transformer for perpendicular magnetic recording
Supervisor 1	G Mathew(DSI)
Supervisor 2	KC Indukumar (DSI)
Supervisor 3	
No. of student	1
Synopsis	<p>The need for higher storage capacity has pushed the demand for magnetic recording channels beyond 100Gb/sq.in areal density. To achieve such high densities, improvements in recording medium, design of heads and signal processing electronics are mandatory. One of the important changes envisaged is switching from the traditional longitudinal recording principle to perpendicular recording principle. From the industry point-of-view, any major change in the technology needs huge investment and would delay the product realization. Fortunately, the signals from the perpendicular read head can be transformed into signals that are compatible with the electronic chips used in current longitudinal principle based disk drives. The device that converts these signals is Hilbert transformer, and the design of such a device is of much importance.</p> <p>Design of digital and analog Hilbert transformers form the heart of this project. Several issues (e.g. optimality, complexity) pertaining to the perpendicular magnetic recording have to be considered while designing these devices. This study has immediate applications in the disk-drive industry. The student, in addition to learning important signal processing techniques for data storage applications, will develop simulation and analytical skills in the study of recording channels.</p>
Nature	Computational/analytical: 70%; Discovery/innovative: 30%
Pre-requisite	Introductory knowledge in Digital Signal Processing, Digital Communications, and Digital/Analog Circuits; Computer programming skills
AMP	no
CPE	yes
Supervisor 1 email	elemg

Group	Communications & Information Engineering
Project No	CIE-MATHEWG-6
Project Type	normal
Student's userID	
Title	Advanced encoding and decoding for DVD and DVR optical recording systems
Supervisor 1	G Mathew(DSI)
Supervisor 2	KC Indukumar (DSI)
Supervisor 3	
No. of student	1
Synopsis	<p>The widely celebrated CD technology is phasing out slowly with the introduction of the digital versatile disc, popularly known as DVD. The storage capacity has increased from 650MB of a CD to 4.7GB for a regular DVD. With the introduction of multi-layer technology, the capacity has been increased to 8.5GB on a double-layer DVD. Further, with change of recording technology, storage medium and 400nm wavelength lasers, the concept of optical storage medium for read-only purposes is no longer applicable since priority is being given for rewritable devices. The third generation optical recording systems include DVR-technology. Coding plays an important role in these systems in pushing the recording capacity to higher limits. The development of advanced coding schemes such as EFMPlus and its successors is of utmost importance in optical recording systems.</p> <p>Design of encoders and decoders for EFMPlus code gives an adequate exercise to become familiar with the current coding techniques in optical recording industry. Several advances in this direction have been proposed, but are not yet standardized. Investigation of different coding schemes and possible improvements to suit DVR systems form the main goals of this project. This study has immediate applications in the optical recording industry. The student, in addition to learning important signal processing techniques for data storage applications, will develop simulation and analytical skills in the study of recording channels.</p>
Nature	Computational/analytical: 75%; Discovery/innovative: 25%
Pre-requisite	Introductory knowledge in Digital Signal Processing and Digital Communications; Computer programming skills
AMP	no
CPE	yes
Supervisor 1 email	elemg

Group	Communications & Information Engineering
Project No	CIE-MOHANG-1
Project Type	normal
Student's userID	
Title	Algorithms for QoS-based Routing and Resource Allocation in multiservice WDM Networks
Supervisor 1	G Mohan
Supervisor 2	
Supervisor 3	
No. of student	2
Synopsis	WDM optical networks are capable of supporting different kinds of client networks such as SONET, ATM, and IP. Therefore, routing of optical connections in WDM networks based on service-differentiation is an important problem. This project proposal aims at developing efficient algorithms for routing optical connections considering QoS metrics and quality constraints.
Nature	Software
Pre-requisite	Data structures and algorithms, network routing fundamentals
AMP	yes
CPE	yes
Supervisor 1 email	elegm

Group	Communications & Information Engineering
Project No	CIE-MOHANG-2
Project Type	normal
Student's userID	
Title	Efficient Scheduling of Variable-length packets in WDM-based Optical Packet Switching Networks
Supervisor 1	G Mohan
Supervisor 2	Bharadwaj Veeravalli
Supervisor 3	
No. of student	2
Synopsis	<p>Optical packet switching networks based on wavelength division multiplexing (WDM) are a viable solution for carrying IP traffic directly over multi-wavelength optical layer. Since, wavelengths operate at a rate on the order of Gb/s, it is required to efficiently schedule the variable-length packets at a optical packet-switching node reducing the unused voids (gaps) between two successive packets on a wavelength channel. This project proposal aims at developing algorithmic solutions for the above problem.</p>
Nature	Software
Pre-requisite	Fundamentals of data structures, algorithms
AMP	yes
CPE	yes
Supervisor 1 email	elegm

Group	Communications & Information Engineering
Project No	CIE-MOHANG-3
Project Type	normal
Student's userID	
Title	IP/Wavelength Routing in Integrated IP/WDM Networks
Supervisor 1	G Mohan
Supervisor 2	
Supervisor 3	
No. of student	2
Synopsis	Generally, routing in IP layer and wavelength division multiplexed (WDM) optical layer in IP/WDM networks has been dealt separately; IP routing using IP layer information and optical connection (lightpath) routing using WDM layer information. In order to utilize the network resources in an efficient way, integrated routing of IP and WDM becomes necessary. The integrated routing uses the complete resource and topology information in both the IP and WDM layers. This project proposal aims at developing and evaluating integrated routing algorithms.
Nature	Software
Pre-requisite	Fundamentals of data structures, algorithms, and network routing
AMP	yes
CPE	yes
Supervisor 1 email	elegm

Group	Communications & Information Engineering
Project No	CIE-GARGHK-5
Project Type	normal
Student's userID	
Title	Design of Man-Machine Interface for Computing-Communication (Communication) Systems
Supervisor 1	HK Garg
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>One of the main problems that one faces is the appropriate design of interfaces for communication systems. This includes keyboards, mouse, monitor, numeric key-pad, touch-sensitive screens, speech based systems, and several enhanced versions of these. There are several factors involved in such designs, for example, application(s), user-friendliness, uniformity, compatibility, security, ease of use, reliability, price, ergonomics, and so on.</p> <p>In this project, we will take a comprehensive look at the design of man-machine interfaces and study them critically to establish their usefulness in the communication world. We hope this project to give rise to new designs, demonstrate the worthiness of the existing designs, and also lead to a more holistic approach to designing the interfaces (design key-board and mouse together).</p> <p>You take this project only if you are deeply interested in the work being proposed. It is a project that will require innovation and work on rather unconventional topics. We get somewhere if and only if you wish to invent something and are willing to do the distance.</p>
Nature	Innovation, Discovery, Design, Software, Hardware
Pre-requisite	interest in the topic
AMP	no
CPE	yes
Supervisor 1 email	eleghk

Group	Communications & Information Engineering
Project No	CIE-GARGHK-7
Project Type	normal
Student's userID	
Title	Source Coding of Music: Algorithms, Implementation, and Innovation
Supervisor 1	HK Garg
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>In this project, we examine different standards that have been proposed for encoding of music. This will include coding for CD, MP3, MD, and others (for example, memory stick). The objective is one --- to squeeze in as much music in a given memory as possible while keeping the distortion to lowest levels.</p> <p>We will develop extensive software to implement and compare the techniques (the real judge is the ear) and then attempt to look at innovative ways to make encoding more efficient.</p> <p>This project is meant for a serious student who wishes to work on a project where the depth and the breadth of the project know no limits.</p>
Nature	Computational
Pre-requisite	Interest in developing new technologies
AMP	yes
CPE	yes
Supervisor 1 email	eleghk

Group Communications & Information Engineering

Project No CIE-KRACHKOV-1

Project Type normal

Student's userID

Title Design and analysis of soft-output detector/equalizer for channels with ISI

Supervisor 1 Krachkovsky

Supervisor 2 Dr. J.C.Patra (DSI)

Supervisor 3

No. of student 1

Synopsis

In communications and data storage channels, signal dispersion or ISI (intersymbol interference) can be a common cause of performance degradation. To reduce the degradation, the sequence estimation on channel with ISI is typically implemented by a Viterbi Algorithm (VA), which provides maximum-likelihood sequence estimation at the cost of the detector complexity. Such complexity may become prohibitive for long channel impulse responses or when a convolutional code with long memory is used. In these situations, suboptimum DFE-based schemes may be applied, e.g., decision-feedback equalization (DFE) or reduced-state sequence estimation (RSSE). For some channels, however, even for the simplified schemes the complexity still remain a problem. Moreover, DFE-based detectors exhibit other serious limitations. For example, DFE requires a minimum-phase impulse response, which may be difficult to obtain in real time in mobile communications. Also, error propagation in DFE-based detectors can be quite severe.

The main objective of this thesis is to design and test a near-optimal DFE-based detection algorithm of low complexity, which requires no minimum-phase response and which performs even better than the optimized RSSE with high number of states. Testing of the algorithm will be carried out in the Class-IV Partial Response (PR4) channel with Gaussian noise; further studies will also encompass channel decoder into the detector structure. The algorithm is closely related to a theory of neural networks

References

W.H. Gerstaecker, R.R. Muller and J.B. Huber, "Iterative equalization with Adaptive Soft Feedback", IEEE Transactions on Communications, Vol.48, No.9, September 2000, 1999, pp.628-634.

Nature Computational, analytical

Pre-requisite Programming skills

AMP no

CPE yes

Supervisor 1 email elekv

Group	Communications & Information Engineering
Project No	CIE-KRACHKOV-2
Project Type	normal
Student's userID	
Title	Design and analysis of SOVA and Max-Log-MAP detectors
Supervisor 1	Krachkovsky
Supervisor 2	Cai Kui (DSI)
Supervisor 3	
No. of student	1
Synopsis	<p>In communications and data storage channels, signal dispersion or ISI (intersymbol interference) is a common cause of performance degradation. To reduce this degradation, the sequence estimation on channel with ISI is typically implemented as a Viterbi Algorithm (VA), which gives a maximum-likelihood sequence estimation at the cost of detector complexity. However, the VA cannot provide soft output symbol information, which in some applications is also a very important detector characteristic. Precise soft output is needed, for example, when some powerful decoding technique, e.g. turbo-decoding, is used on later stage. The optimal way to calculate the soft output is to apply an APP (a-posteriori probability) estimation, which can be implemented by using the BCJR (Bahl-Cocke-Jelinek-Raviv) algorithm. The BCJR algorithm is not very practical however, since it is quite complicated and also requires real-value multiplications - a great problem in real-time fixed-point implementation. That's why some sub-optimal APP estimation algorithms were recently proposed. The simplest of these algorithms is the SOVA (soft-output Viterbi algorithm), which can provide an enormous reduction in decoding complexity by having a negligible degradation in the bit error rate probability compared to the BCJR algorithm. Recently, another algorithm, the modified SOVA was introduced [1], and was shown to achieve the so-called Max-Log-Map performance, i.e. going even more closer to the BCJR algorithm while possessing still much lower complexity. These algorithms come into scrutiny under the current proposal.</p> <p>The main objective of this thesis is to design and test SOVA and Max-Log-Map algorithms. Testing of the algorithm will be carried out on a Class-IV Partial Response (PR4) channel with Gaussian noise; further studies may also encompass BCJR algorithm to validate the performance.</p> <p>References [1] M.P.C. Fossorier, F. Burkert and J. Hagenauer, "On the equivalence between SOVA and Max-Log-MAP decodings", IEEE Communications Letters, Vol.2, No.5, May 1998, pp.137-139.</p>
Nature	Computational/Analytical
Pre-requisite	Programming skill
AMP	no
CPE	yes
Supervisor 1 email	elekv

Group	Communications & Information Engineering
Project No	CIE-SILVALC-10
Project Type	normal
Student's userID	
Title	User Composition of Query Image for Content-based Image Retrieval (supported by KRDL)
Supervisor 1	LC De Silva
Supervisor 2	Ruihua Ma (KRDL)
Supervisor 3	
No. of student	1
Synopsis	<p>Content-based Image Retrieval (CBIR) relies on image features for searching an image in image databases. In contrast to this technique, conventional image databases depend on textual description of images. The drawbacks are that it requires manual input which is time-consuming and costly and it is limited in describing visual information. CBIR as a complimentary technique overcomes the above drawbacks.</p> <p>Typically, querying in CBIR consists of submitting an image to the system and the latter returns images similar to the query image, i.e., "Get me all the images similar to this one". Obviously, the more similar the query image and the one desired by the user, the more likely the system will return good results. How to get a good query image becomes critical. Generally, a query image is either a sketch draw by the user, or a sample image picked up from an image database. In the first case, drawing skill is required from the user, whereas in the second case, it may happen that no appropriate sample images are available for being directly used as query. However, it is often the case that part of some images meet the requirement of the user in a specific aspect. And the sub-images combined together into a new image may well reflect what the user desires. This is what we call 'User Composition of Query Image for Content-based Image Retrieval'.</p> <p>To allow the user to compose his/her own query image from multiple image, a powerful and user-friendly interface is crucial. The main work of this work will thus be development of user interface (UI). The work is a continuation of a FYP project which set up CBIR platform but has very primitive UI. Intensive Java programming is required.</p>
Nature	Software
Pre-requisite	Java and C++ programming knowledge
AMP	yes
CPE	yes
Supervisor 1 email	elelcds

Group	Communications & Information Engineering
Project No	CIE-CHEONGLF-1
Project Type	normal
Student's userID	
Title	Perception of Depth from Cinematic Images
Supervisor 1	LF Cheong
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	The idea of inferring 3D information from a sequence of 2D images is not new. However, in cinema environment where the viewer can be anywhere in the theatre, the sequence of images is viewed from a point other than the point from which the pictures are taken, or more exactly, projected. The resulting distortion in space perception, though receiving some attention from the psychologists, has not been investigated computationally. In general, it seems that viewers are able to derive quite accurate space percepts from cinema displays. This project attempts to derive the distortion relation between the true space and the perceived space. In particular, distortion of planar parameters such as the tilts and slants are investigated.
Nature	Theoretical
Pre-requisite	None
AMP	no
CPE	yes
Supervisor 1 email	eleclf

Group	Communications & Information Engineering
Project No	CIE-CHEONGLF-2
Project Type	normal
Student's userID	
Title	Using camera motion patterns in Content-based retrieval system
Supervisor 1	LF Cheong
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>One of the key areas of development in computer vision is information superhighways where the bandwidth needed for interactive multimedia would be available at home, and each user would be able to access a remote server containing very large image and video databases. Designing a system which retrieves meaningful documents based on the user-provided categories becomes important. Thus, tools for retrieving the content of multimedia data are naturally required for effectively utilizing the multimedia resources, and therefore, the development of a content-based retrieval system becomes an important consideration.</p> <p>The project involves forming rules based on camera motion to generate high-level descriptors such as "establishing shot", "chase scene" and so forth. Camera motion estimation is classification in terms of following common types of camera movements: track, dolly, pan, roll, tilt and zoom. For example, an interesting scene generally is characterized by quick zoom-in followed by hold for sufficient time. The domain of work could be generic videos like sports, movies, or educational videos.</p> <p>This project is meaningful as it would give sufficient insight into the basics of computer vision and improve theoretical understanding of the concepts. In addition, the exposure to multimedia indexing and video techniques would give students good standing in an incubating and highly demanded technology.</p>
Nature	Software
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	eleclf

Group	Communications & Information Engineering
Project No	CIE-CHEONGLF-3
Project Type	normal
Student's userID	
Title	Contextual information extraction and rule formation in multimedia indexing
Supervisor 1	LF Cheong
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Although multimedia indexing is a very popular research area, the use of contextual information has not been explored systematically. The first two steps in indexing are shot-segmentation and shot-classification. However, it has been shown that both these steps are not very accurate. By integration of contextual (or neighborhood) information, the accuracy of both these steps can be improved. For example, amongst 10 video shot considered, 9 are classified as soccer while the middle one is (wrongly) classified as tennis. But it is known that showing a single shot of a particular sport class is improbable and thus this rule could be used to correctly classify the (misclassified) tennis shot also.</p> <p>The projects involve a) finding what are the types of contextual information exists in videos b) extracting the information of a class and c) automatic forming of rules using some learning technique such as time-delay Neural networks or Hidden-markov model.</p> <p>Since the project involves dealing with interpretative video material, it is interesting and challenging and yet not so complicated. The project opens the opportunity to learning about video processing, computer vision, AI learning tools and pattern classification.</p>
Nature	Software
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	eleclf

Group	Communications & Information Engineering
Project No	CIE-THNGLJ-7
Project Type	normal
Student's userID	
Title	A secondary extension to SNOOPy
Supervisor 1	LJ Thng
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	SNOOPy is a highly optimised calendar queue structure for use as a future event list structure for a discrete event simulator. The latest version of the SNOOPy has deviated from the previous CQ objectives and have adopted a new criteria for optimising its parameters. The new criteria is based on the BY-CY (bucket width - calendar year). The aim of the project is to look at the possibility of adding a secondary extension to the SNOOPy CQ to see if the addition enhances the performance of the
Nature	Computational
Pre-requisite	Require C++ object oriented skills, list structure knowledge
AMP	no
CPE	yes
Supervisor 1 email	eletlj

Group	Communications & Information Engineering
Project No	CIE-MEHULM-5
Project Type	normal
Student's userID	
Title	Large System Analysis in CDMA Systems
Supervisor 1	M Mehul
Supervisor 2	
Supervisor 3	
No. of student	2
Synopsis	<p>Recently, several mathematical results on the convergence of the eigenvalue distribution of random matrices have been applied successfully to the analysis of CDMA systems. Although the results make some asymptotic assumptions, the resulting analysis agrees well with simulation. In this project, we want to study the accuracy of utilizing these random matrix results. We will also investigate the applicability of these random matrix results to the coding-spreading trade-off in CDMA systems. Simulation (by Matlab or C) will certainly be a part of the work involved.</p> <p>This is a mathematically intensive project and requires background reading. This project is ideal for a bright, hardworking student who looks forward to a challenge.</p>
Nature	Theoretical, Analytical, Computational, Innovative
Pre-requisite	Basic knowledge of digital communications and CDMA
AMP	yes
CPE	yes
Supervisor 1 email	elemm

Group	Communications & Information Engineering
Project No	CIE-HALDAR-1
Project Type	normal
Student's userID	
Title	A novel digital phase shifter
Supervisor 1	MK Haldar
Supervisor 2	P.S.Kooi
Supervisor 3	B.L.Ooi
No. of student	1
Synopsis	<p>A phase shifter is an important control device in many communication, radar and measurement systems. A digital phase shifter can produce discrete phase shifts under computer control. For example, a two bit phase shifter can produce phase shifts of 0, 90, 180 and 270 degrees (2 to power 2 phase shifts). Usually, digital phase shifters are made by cascading units each of which can be switched to produce the reference (0) phase shift or a differential phase shift. For example, to make the two bit phase shifter, we cascade two units capable of differential phase shifts of 90 and 180 degrees. Thus an n bit phase shifter will require n units. If one can have an unit which can produce two differential phase shifts, one can reduce the number of units and expect a reduction in the area of the phase shifter IC. Such unit designs using directional couplers and transmission lines however do not give the expected area reduction as the components (directional couplers and transmission lines) are large. A new design using inductors, capacitors and FET switches to produce units with two differential phase shifts has been proposed by us. The object of this project is first to verify the basic design, and then carry out the actual circuit layout to see if area reduction can be achieved. Simulation using vendor supplied equivalent circuits of the components and commercial software will be required to check the performance of the layout (design rules also have to be checked). A successful design may be sent for fabrication later.</p>
Nature	innovative, simulation, IC design
Pre-requisite	none
AMP	no
CPE	yes
Supervisor 1 email	elehalda

Group	Communications & Information Engineering
Project No	CIE-SADASIVANPK-1
Project Type	normal
Student's userID	
Title	Neural Network-based receiver for wireless communications
Supervisor 1	PK Sadasivan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	The purpose of this project is to come up with a novel neural network-based receiver for TDMA wireless communication scheme. The design of the receiver builds on the adaptive signal detection theory. It involves time-frequency analysis, feature extraction and pattern classification.
Nature	Innovative
Pre-requisite	Neural networks, Communication principles
AMP	no
CPE	yes
Supervisor 1 email	elespk

Group	Communications & Information Engineering
Project No	CIE-SADASIVANPK-2
Project Type	normal
Student's userID	
Title	Nonlinear noise reduction for electrocardiogram
Supervisor 1	PK Sadasivan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	The electrical activity of the heart usually shows dynamical behavior which is neither periodic nor deterministic chaotic. These signals are not long-term predictable but good predictions can be made for times smaller than one heart cycle. This fact can be used to suppress measurement errors by a local geometric projection method which was originally developed for chaotic signals.
Nature	Innovative
Pre-requisite	Digital Signal Processing, Chaos theory
AMP	no
CPE	yes
Supervisor 1 email	elespk

Group	Communications & Information Engineering
Project No	CIE-SADASIVANPK-3
Project Type	normal
Student's userID	
Title	Communication with chaos – correlation function for information retrieval.
Supervisor 1	PK Sadasivan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	Chaotic dynamics with noise-like broadband power spectra is shown to be an interesting candidate for encoding and masking information signals in secure communication. In this work, we propose to use correlation method to extract the information with very small error probability, even though the transmitted signals are contaminated with noise.
Nature	Innovative
Pre-requisite	Communication principles, chaos theory
AMP	no
CPE	yes
Supervisor 1 email	elespk

Group	Communications & Information Engineering
Project No	CIE-SADASIVANPK-4
Project Type	normal
Student's userID	
Title	Synchronization with message embedded for generalized Lorenz chaotic communication system.
Supervisor 1	PK Sadasivan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	Synchronization has been the focus of research in the chaos field for the past decade. In this work, by exploiting the skew-symmetric property of the generalized Lorenz systems, a systematic way to synchronize the transmitter-receiver pair is suggested. The Error analysis of the system is to be carried
Nature	Innovative
Pre-requisite	Communication principles, Chaos theory
AMP	no
CPE	yes
Supervisor 1 email	elespk

Group	Communications & Information Engineering
Project No	CIE-SADASIVANPK-5
Project Type	normal
Student's userID	
Title	Noise reduction in chaotic communication systems.
Supervisor 1	PK Sadasivan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	In chaotic communication systems, digital information is carried by inherently wideband chaotic signals. To obtain optimum noise performance, the SNR at the input of the demodulator has to be maximized. The knowledge of the chaotic sequence (used at the transmitter) at the receiver can be exploited to come up with noise reduction techniques in the chaotic communication scheme.
Nature	Innovative
Pre-requisite	Communication principles, chaos theory
AMP	no
CPE	yes
Supervisor 1 email	elespk

Group	Communications & Information Engineering
Project No	CIE-RANGAN-3
Project Type	normal
Student's userID	
Title	Head Orientation Estimation
Supervisor 1	Ranganath
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Estimating the orientation of a person's head is useful for various applications. In a computer-based face recognition system, knowing the orientation of a person's head is useful, as face appearance varies with orientation. In human computer interfaces, knowing the head orientation can also be a useful clue to a person's focus of attention. In this project, we will investigate extraction of various features from a person's face and input these features to several types of neural networks (e.g. parametric self organizing maps, support vector machines) to estimate the head orientation. An effort must be made to make the system work in real time with video sequences.</p> <p>Before proceeding with the computational aspects of the project, a database must be set up which has face images of people with heads oriented in various directions. This will be used to train the neural networks to associate different views with orientation angles.</p>
Nature	Computational
Pre-requisite	good C/C++ programming skills
AMP	no
CPE	yes
Supervisor 1 email	elesr

Group	Communications & Information Engineering
Project No	CIE-RANGAN-4
Project Type	normal
Student's userID	
Title	Representations for Face Recognition
Supervisor 1	Ranganath
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Face detection and recognition from images, and image sequences has become a key aspect of many applications in multimedia, human-computer interactions, surveillance systems, video conferencing, etc.</p> <p>One of the first problems that needs to be addressed for face location/recognition, is how to efficiently represent the face data to solve the problem. A popular technique that has been widely used is called principal component analysis (PCA). However, the drawback is that it is a global technique which analyzes the face image as a whole. In this project, a new type of data representation, called independent component analysis (ICA) will be investigated. This technique appears to form local representations for important features such as the eyes, nose, mouth etc.</p> <p>It is possible that ICA will prove more robust than PCA. The goal of this project is to implement ICA, and compare it to other methods for representing faces and get an idea of robustness with respect to natural image transformations. The work in this project will be carried out using software simulations.</p> <p>and involve no hardware.</p>
Nature	Computational
Pre-requisite	Good C/C++ programming skills
AMP	no
CPE	yes
Supervisor 1 email	elesr

Group	Communications & Information Engineering
Project No	CIE-RANGAN-5
Project Type	normal
Student's userID	
Title	Recognizing facial expressions
Supervisor 1	Ranganath
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Facial expressions play an important role in human interactions, and for human computer interactions, it is of interest to recognize these expressions. Facial expressions are also specifically used by deaf people in sign language communication to convey meaning while signing. For example, similar hand signs made with different facial expressions convey different meanings. The goal of this project is to implement techniques for recognizing facial expressions. Examples are expressions like frowning, smiling, raising one eyebrow or both, etc. Both single images of facial expressions as well as video sequences will be considered. The project will seek to find suitable representations for the expressions, and find appropriate classifiers which can recognize the expressions.</p> <p>The above project description is suitable for a BEng project, where the head of the person is stationary while making the expression.</p> <p>If this assumption is relaxed, i.e. the head is allowed to move naturally, without any constraints, then the problem becomes somewhat more complex, and the scope can be expanded for an AMP project.</p>
Nature	Computational
Pre-requisite	good C/C++ programming skills
AMP	yes
CPE	yes
Supervisor 1 email	elesr

Group	Communications & Information Engineering
Project No	CIE-SENGUPTA-1
Project Type	normal
Student's userID	
Title	Coding of 3D models
Supervisor 1	Sengupta
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	Like image compression, 3D model compression is also becoming an important field of research and development. Especially, with the advent of Web 3D, etc. In this project, we will look into the implementation of some of the existing algorithms and/or propose new algorithms (that depends if the student is capable of doing research or just development).
Nature	Computational
Pre-requisite	C, C++
AMP	no
CPE	yes
Supervisor 1 email	eleks

Group	Communications & Information Engineering
Project No	CIE-SENGUPTA-2
Project Type	normal
Student's userID	
Title	3D motion compression
Supervisor 1	Sengupta
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Compression of 3D motion (especially non rigid motion), like the motion of clouds, and visualisation is an important problem.</p> <p>There hasn't been many studies out there in this area, however, we can draw parallel between MPEG compression and this problem.</p> <p>Alongwith my PhD student, who is performing this research, you will formulate and implement algorithms to compress 3D motion.</p>
Nature	Computational
Pre-requisite	NA
AMP	no
CPE	yes
Supervisor 1 email	eleks

Group	Communications & Information Engineering
Project No	CIE-SENGUPTA-3
Project Type	normal
Student's userID	
Title	Smart Chat environment Realization
Supervisor 1	Sengupta
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	A chat environment based on avatars will be realized.
Nature	Computational
Pre-requisite	None
AMP	no
CPE	yes
Supervisor 1 email	eleks

Group	Communications & Information Engineering
Project No	CIE-SENGUPTA-4
Project Type	normal
Student's userID	
Title	Independent COmponent Analysis for speech separation
Supervisor 1	Sengupta
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	We will study and implement ICA algorithms to separate speech signals. For example, the input can be the speech from two people, and the output is just the speech of one person (its like the Karaoke problem, but much more difficult, because both the signals occupy the same bandwidth, and you can't use just plain old filtering).
Nature	Computational
Pre-requisite	None
AMP	no
CPE	yes
Supervisor 1 email	eleks

Group	Communications & Information Engineering
Project No	CIE-SENGUPTA-5
Project Type	normal
Student's userID	
Title	Realization of smart user interfaces in AR environment
Supervisor 1	Sengupta
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	We will study and implement a few perceptually based user interface for augmented reality
Nature	Computational
Pre-requisite	None
AMP	no
CPE	yes
Supervisor 1 email	eleks

Group	Communications & Information Engineering
Project No	CIE-SENGUPTA-6
Project Type	normal
Student's userID	
Title	Virtual banners in soccer matches
Supervisor 1	Sengupta
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	We will try to put up virtual banners (like ads) in soccer match boradcasts. Requires image analysis and scene understanding problems to be solved.
Nature	Computational
Pre-requisite	None
AMP	no
CPE	yes
Supervisor 1 email	eleks

Group	Communications & Information Engineering
Project No	CIE-ONGSH-1
Project Type	normal
Student's userID	
Title	Segmentation of 3D medical images
Supervisor 1	SH Ong
Supervisor 2	S Sanei (Singapore Poly)
Supervisor 3	
No. of student	1
Synopsis	<p>The short-spanning tree (SST) is an algorithm for segmenting an image into homogeneous regions. The project requires the application of the SST algorithm for 3D applications. The program can be developed in MATLAB.</p> <p>Coarse 3D segmentation of 3D medical images (CT and MRI) can locate the abnormalities in 3D space. In the case of having a region with a number of distinct segments, they can be pseudo coloured and individually represented. In MR images, the different tissues have different intensities.</p> <p>Separation and characterization of such tissues may also be achieved by a proper segmentation method. SST is very effective since it considers both intensity and geometrical information into account. The geometrical information of the abnormalities be used in surgery. Another important advantage is 3D encoding of these images.</p>
Nature	Innovative
Pre-requisite	Interest in biomedical imaging, good programming skills
AMP	yes
CPE	yes
Supervisor 1 email	eleongsh

Group	Communications & Information Engineering
Project No	CIE-ONGSH-2
Project Type	normal
Student's userID	
Title	Computation of eigencells for analysis of blood cell images
Supervisor 1	SH Ong
Supervisor 2	S Sanei (Singapore Poly)
Supervisor 3	
No. of student	1
Synopsis	<p>This project aims to apply image processing methods to the classification of images of blood cells. Initial pre-processing of the colour images is needed to correct for geometrical and illumination defects.</p> <p>Classification is based on the well known "eigenface" method used in face recognition. The objective is to incorporate global information in blood pattern in a completely automatic cell recognition</p>
Nature	Innovative
Pre-requisite	Interest in biomedical image processing, good programming skills
AMP	yes
CPE	yes
Supervisor 1 email	eleongsh

Group	Communications & Information Engineering
Project No	CIE-ONGSH-3
Project Type	normal
Student's userID	
Title	Analysis and visualisation of 3D palatal shape and arch form
Supervisor 1	SH Ong
Supervisor 2	KWC Foong (Dentistry)
Supervisor 3	
No. of student	1
Synopsis	<p>Advances in 3D surface laser imaging technologies have spawned new applications in dentistry. Dental plaster models can be converted into 3D images with laser scanning and viewed in any preferred orientation and subjected to quantitative analysis.</p> <p>The project aims to develop the algorithms to characterise the palatal shape and arch form of palates of neonatal normal non-cleft and cleft models based on two methods of data capture: surface laser scanning and CT scanning. Accuracy of the data will be compared with the two methods.</p>
Nature	Innovative
Pre-requisite	Interest in biomedical image processing, good programming skills
AMP	yes
CPE	yes
Supervisor 1 email	eleongsh

Group	Communications & Information Engineering
Project No	CIE-ONGSH-6
Project Type	normal
Student's userID	
Title	Landmark registration from 3D CT and X-ray skull data
Supervisor 1	SH Ong
Supervisor 2	KWC Foong (Dentistry)
Supervisor 3	
No. of student	1
Synopsis	<p>This project aims to match important feature points (landmarks) from skull X-rays and CT data. The initial emphasis will be on the lower jaw (mandible).</p> <p>Three orthogonal X-rays of a human skull will be digitised and the landmarks manually detected. CT scanning of the same skull will also be carried out and the data reconstructed for 3D viewing. Algorithms will be developed to transform the detected landmarks to the appropriate points on the reconstructed CT image. An important part of the project will be to develop a suitable interface for user interaction and visualisation of the results.</p>
Nature	Innovative
Pre-requisite	Interest in medical image processing, good programming skills
AMP	yes
CPE	yes
Supervisor 1 email	eleongsh

Group	Communications & Information Engineering
Project No	CIE-FOOSW-1
Project Type	normal
Student's userID	
Title	Audio Segmentation for Audio Information using MPEG-7 Technology
Supervisor 1	SW Foo
Supervisor 2	HUANG Dong Yan (IME)
Supervisor 3	
No. of student	1
Synopsis	<p>The project is linked to standardization work in MPEG-4, which is taking place in ISO/SC29 WG11. This project can be extended as a Master thesis.</p> <p>Audio and visual information are the main types of information in multimedia system. As more and more pieces of audio and visual information are put on the Internet, efficient search for the information wanted is desirable. MPEG-7 is designed for this purpose.</p> <p>In order to extract the content-based features of audio signals, the signals should be segmented. The objective of this project is to develop methods for audio segmentation. The student would learn to use MPEG-7 XML to test the methods and Java, Frontpage and whatever tools needed to create demos.</p>
Nature	Signal Processing & Computational
Pre-requisite	Student must have done DSP Fundamental, good in Matlab or C++
AMP	yes
CPE	yes
Supervisor 1 email	elefoosw

Group Communications & Information Engineering
Project No CIE-FOOSW-3
Project Type normal
Student's userID
Title Audio Watermarking System
Supervisor 1 SW Foo
Supervisor 2
Supervisor 3
No. of student 1
Synopsis The purpose of the project is to investigate the performance of an audio watermarking system when the signal is subjected to various forms of signal processing and to improve the system to make it more robust to such signal processing.

Nature Signal Processing and Computational
Pre-requisite Student must have completed DSP Fundamental, Communications. Student must be proficient in Matlab or C++.
AMP yes
CPE yes
Supervisor 1 email elefoosw

Group	Communications & Information Engineering
Project No	CIE-FOOSW-4
Project Type	normal
Student's userID	
Title	Speaker Recognition.
Supervisor 1	SW Foo
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Speaker recognition consists of two parts: speaker identification and speaker verification. The ability to verify a speaker from his speech provides a form of security control.</p> <p>Some of the methods include Neural Network approach and Hidden Markov Model approach. In this project, the student simulate some of the promising methods of speaker recognition and to improve on the methods.</p>
Nature	Signal Processing and Computational.
Pre-requisite	Student must have completed DSP Fundamental and be proficient in C programming.
AMP	yes
CPE	yes
Supervisor 1 email	elefoosw

Group	Communications & Information Engineering
Project No	CIE-FOOSW-7
Project Type	normal
Student's userID	
Title	Classification of Mouth Movement for Lip Reading
Supervisor 1	SW Foo
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>In very noisy environment, it is sometime possible to understand what the speaker is saying through reading his lip movement.</p> <p>The objective of this project is to classify the lip movement of the English phonemes and to investigate the accuracy of recognition of the phonemes based on the lip movement.</p>
Nature	Computational
Pre-requisite	DSP Fundamental; Co-requisite: Image Processing. Proficient in C Programming.
AMP	no
CPE	yes
Supervisor 1 email	elefoosw

Group	Communications & Information Engineering
Project No	CIE-TAYTT-1
Project Type	normal
Student's userID	
Title	Design and Fabrication of a Microcontroller
Supervisor 1	TT Tay
Supervisor 2	YP Xu
Supervisor 3	
No. of student	1
Synopsis	In this project, the student will design and fabricate an Intel 8051 lookalike microcontroller. In the first part of the project, the student will specify the instruction set architecture (ISA) of the microcontroller. He will then go on to design the logic circuit to implement that ISA. This will be followed by a layout design and finally a fabrication on silicon. The fabricated chip will be tested for
Nature	Hardware
Pre-requisite	none
AMP	no
CPE	yes
Supervisor 1 email	eletaytt

Group	Communications & Information Engineering
Project No	CIE-TAYTT-2
Project Type	normal
Student's userID	
Title	Embedded Architecture of a CDRW
Supervisor 1	TT Tay
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>What is an embedded system? Most systems are based on standard building blocks such as a microprocessor, an A/D, a parallel port, etc. The question is if one is given a free hand to reorganize without the constraints of using standard components, what then is the optimal way to group functions? System on a chip methodology is not just a matter of integrating existing components on a single die. It is a platform to re-examine issues relating to objects and functions relationship and then to provide a more optimal architecture to achieve the system objectives. Questions to be answered include: · Should the system be a single chip? There is a constraint on die size. · If it is going to be many chips, how should functions be organized? · How much of the functions should be realised in software and how much in hardware? · Is there a way to optimize the partitioning according to various criteria; cost, size, ease of developmental control, inter-chip data volume, peak inter-chip data rate, redundancy, robustness, etc. In this project, a split/combine approach will be used to derive optimal architectures for a CDRW according to different performance criteria.</p>
Nature	Analytical
Pre-requisite	none
AMP	yes
CPE	yes
Supervisor 1 email	eletaytt

Group	Communications & Information Engineering
Project No	CIE-TAYTT-3
Project Type	normal
Student's userID	
Title	Remote Lecture System
Supervisor 1	TT Tay
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	In this project, software will be developed to allow a lecture to be multicasted to all subscribers. The platform is based on Microsoft Netmeeting. The software should also allow the session to be automatically archived so that users may review the lecture again in the future. All multimedia information, data, audio and video will be captured off the network and stored to disk. The captured data can later be played back if desired.
Nature	Software
Pre-requisite	none
AMP	no
CPE	yes
Supervisor 1 email	eletaytt

Group	Communications & Information Engineering
Project No	CIE-TAYTT-4
Project Type	normal
Student's userID	
Title	Software for Embedded System Design
Supervisor 1	TT Tay
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>What is an embedded system? Most systems are based on standard building blocks such as a microprocessor, an A/D, a parallel port, etc. The question is if one is given a free hand to reorganize without the constraints of using standard components, what then is the optimal way to group functions? System on a chip methodology is not just a matter of integrating existing components on a single die. It is a platform to re-examine issues relating to objects and functions relationship and then to provide a more optimal architecture to achieve the system objectives. Questions to be answered include:</p> <ul style="list-style-type: none"> · Should the system be a single chip? There is a constraint on die size. · If it is going to be many chips, how should functions be organized? · How much of the functions should be realised in software and how much in hardware? · Is there a way to optimize the partitioning according to various criteria; cost, size, ease of developmental control, inter-chip data volume, peak inter-chip data rate, redundancy, robustness, etc. <p>In this project, a software package will be developed to allow optimal partition of the</p>
Nature	Analytical
Pre-requisite	none
AMP	yes
CPE	yes
Supervisor 1 email	eletaytt

Group	Communications & Information Engineering
Project No	CIE-TAYTT-5
Project Type	normal
Student's userID	
Title	Powerline Transmission System
Supervisor 1	TT Tay
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	Power lines are optimized to carry electrical current at low frequency, typical under 100 Hz. At higher frequencies, in the region of 25 Mhz to 30 Mhz, the frequency response is badly characterized. However at these frequencies, it is still possible to pump data through a significant distance on the power cable, without upsetting the emission limit imposed by most major regulatory bodies such as the FCC. In this project a transceiver system will be designed to relay data at rate of 4 Mbps on domestic power lines. A distance of 100 metres can be achieved. Data processing will also be added
Nature	Hardware
Pre-requisite	none
AMP	yes
CPE	yes
Supervisor 1 email	eletaytt

Group	Communications & Information Engineering
Project No	CIE-TAYTT-6
Project Type	normal
Student's userID	
Title	Enlarging Video images
Supervisor 1	TT Tay
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Images especially those available from the web are often small and could not be viewed clearly. Re-sizing using standard software do not produce acceptable results. The enlarged image either has very uneven edges (when a simple resizing algorithm is used) or loses contrast (when interpolation algorithms such as cubic interpolation is used). A novel multi-tier enlargement algorithm had been developed to ensure both of the above are not present. The resultant enlarged image does not have a coarse grain effect and has contrast comparable to the non-enlarged image. The technique will be extended to process video images where speed of processing is now important.</p>
Nature	Software
Pre-requisite	none
AMP	yes
CPE	yes
Supervisor 1 email	eletaytt

Group	Communications & Information Engineering
Project No	CIE-BHARADWAV-1
Project Type	normal
Student's userID	
Title	Design and Analysis of Scheduling Multiple Divisible Loads on Linear Daisy Chain Networks
Supervisor 1	V Bharadwaj
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Designing strategies for scheduling and processing divisible load on distributed networks is a challenging problem. Scheduling a batch of divisible loads on linear networks is to be studied in this project. The objective is to design strategies for load dissemination, scheduling and processing of multiple loads such that the total processing time for all the loads is a minimum.</p> <p>Student #1: (i) Processors equipped with Front-ends</p> <p>Relevant literature will be provided to expose the student to understand some key concepts involved.</p> <p>Using MATLAB or any hi-level language, the strategies have to simulated and performance of the strategies have to be analyzed.</p> <p>NOTE: Case (i) and Case (ii) are independent and each student will be independent on his/her own.</p>
Nature	Analytical
Pre-requisite	Knowledge of Matlab or any high level language
AMP	no
CPE	yes
Supervisor 1 email	elebv

Group	Communications & Information Engineering
Project No	CIE-BHARADWAV-2
Project Type	normal
Student's userID	
Title	Jini Technology Support for Video-On-Demand Services
Supervisor 1	V Bharadwaj
Supervisor 2	
Supervisor 3	
No. of student	2
Synopsis	<p>A Video-On-Demand system with JINI agent driven service currently exists as a prototype. This is for providing long duration movie on demand services on networks. Some issues such as, allowing multiple clients to interact with the system, buffer management at the client site, implementing VCR control operations, improving agent services, incorporating fault-tolerance for agents, etc needs to be addressed. Also, a rigorous testing process for Internet-like networks is to be carried.</p> <p>NOTE: This is an extension of the existing prototype. Hence, the students are expected to be comfortable during the initial "code-reading" phase to catch up the work done so far.</p>
Nature	Software
Pre-requisite	Java, JINI programing skills
AMP	no
CPE	yes
Supervisor 1 email	elebv

Group	Communications & Information Engineering
Project No	CIE-BHARADWAV-3
Project Type	normal
Student's userID	
Title	Design of an Interactive Story-Telling Environment
Supervisor 1	V Bharadwaj
Supervisor 2	
Supervisor 3	
No. of student	2
Synopsis	<p>An interactive story-telling environment has to be designed which aids an author (the story-teller) to "narrate" a story, which when "compiled" allows to enact the desired play. Thus, a programming methodology with a reasonably easy-to-pick-up syntax needs to be developed and a compiler that extracts an equivalent "object" code is to be designed. This compiler must be interfaced with a standard authoring tool such as Macromedia Director, which aids the desired presentation.</p> <p>NOTE: The exact choice of the software tools can be decided depending on the needs.</p> <p>This project needs lots of imagination and commitment to realize a working prototype. There is sufficient work for two persons. The responsibilities right from the design stage to a working prototype will be equally shared among the two. We need to discuss on finer details.</p>
Nature	Software
Pre-requisite	Programming skills, using JAVA/C++ and use of Macromedia Director/equivalent software tool
AMP	no
CPE	yes
Supervisor 1 email	elebv

Group	Communications & Information Engineering
Project No	CIE-YANCH-1
Project Type	normal
Student's userID	
Title	Non-Rigid Registration of contrast-enhanced MR mammography
Supervisor 1	Yan Chye Hwang
Supervisor 2	Ong Sim Heng
Supervisor 3	Wang Shih-Chang
No. of student	1
Synopsis	<p>Carcinoma of the breast is the most common malignant disease in women in the western world. The major goals of breast cancer diagnosis are early detection of malignancy and its differentiation from other breast disease. Currently, the detection and diagnosis of breast cancer primarily relies on X-ray mammography. Although X-ray mammography has advantages it is not universally applicable. This has led to the investigation of alternative imaging modalities such as MRI. Typically, the detection of breast cancer in MRI requires the injection of a contrast agent such as Gadolinium DTPA. It is known that the contrast agent uptake curves of malignant disease differ from benign disease and this property can be used to identify cancerous lesions. To quantify the rate of uptake, a 3D MRI scan is acquired prior to the injection of contrast media, followed by a dynamic sequence of 3D MRI scans.</p> <p>The detection of subtle enhancement is greatly enhanced by image post-processing using subtraction of pre- from post-contrast images. However, any motion of the patient between scans, or even normal respiratory and cardiac motion, can cause the breast tissue to be mis-registered between the datasets, possibly causing artifact suppression or "creation" of pathological lesions. Existing subtraction techniques are based on rigid frame slice-by-slice methods and cannot cope with real-life 3D translation, through-plane motion, rotation and elastic deformities that occur with physiological motion.</p>
Nature	Computational
Pre-requisite	an interest in image and signal processing and knowledge of MATLAB, C++ and good programming
AMP	yes
CPE	yes
Supervisor 1 email	eleyanch

Group	Communications & Information Engineering
Project No	CIE-YANCH-2
Project Type	normal
Student's userID	
Title	Virtual Colonoscopy
Supervisor 1	Yan Chye Hwang
Supervisor 2	Ong Sim Heng
Supervisor 3	Wang Shih-Chang
No. of student	1
Synopsis	<p>It is recommended that patients undergo a test that allows the doctor to see the entire colon at age 50 and then every three to five years. Currently, conventional colonoscopy is used to detect polyps, which are known to be premalignant or early malignant lesions. Conventional colonoscopy is associated with increased risk to the patient and cost. Conventional colonoscopy is unable to see the entire colon in 1 out of ten people, and lesions may easily be hidden on the "back" of folds, leading to as many as 20% of small lesions being missed. In addition, Conventional colonoscopy may cause an injury of the colon (tear or perforation) in one of 1500 patients. Medication given into the vein (intravenous sedation) is usually required to make the exam bearable and therefore patients cannot resume normal activities immediately after the test.</p> <p>Virtual colonoscopy uses a single fast spiral computed tomography (CT or CAT scan) acquisition of the abdomen in a single breath-hold, without sedation or significant risk of bowel injury, which allows radiologists (physicians with advanced training in x-ray imaging) to create 3D models on a workstation that look similar to those seen by Conventional colonoscopy. However, it is now recognized that visualization of the colon with this 3D method is often incomplete and takes a long time using this technique. Much faster automated methods of colonic surface depiction and interpretation are required in order to make mass screening for colonic carcinoma with this technique financially viable or practical in future.</p>
Nature	Computational
Pre-requisite	an interest in image and signal processing and knowledge of MATLAB, C++ and good programming
AMP	yes
CPE	yes
Supervisor 1 email	eleyanch

Group	Data Storage Institute
Project No	DS-XIAOGG-4
Project Type	normal
Student's userID	
Title	Servo system transient response improvement via feed forward control*
Supervisor 1	GG Xiao(DSI)
Supervisor 2	Prof TS Low
Supervisor 3	
No. of student	1
Synopsis	<p>Advanced servo systems position the objects as accurately as possible, and as quickly as possible, in the face of various environmental factors. The initial state of the object, (or the initial value of the plant to be controlled in control term), possibly inherited from the previous stage of operation, affects the transient of the moving process. Although feedback control change the various behavior of the servo system, feed forward control offers some flexibility of changing the closed-loop transient response without affecting the steady state performance. Over the years, initial value compensation (IVC) has been employed as an effective way of improving the transient response.</p> <p>The present study aims at testing some of the well know IVC designs via simulation and implementation. Some new designs will be studied.</p> <p>For those interested in doing AMP, the methods could be extended to dual-stage servo systems. The switching condition, optimal design, and multirate control can also be considered.</p> <p>The student should feel comfortable with writing assembly and C programs. Will need to use Matlab and control theory extensively.</p>
Nature	Innovative
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	dsiguogx

Group	Data Storage Institute
Project No	DS-XIAOGG-1
Project Type	normal
Student's userID	
Title	Temperature control unit design considering saturation*
Supervisor 1	GG Xiao(DSI)
Supervisor 2	A/Prof Ben Chen
Supervisor 3	
No. of student	1
Synopsis	<p>Most control systems require the change of the output as desired, and in most cases, from the initial state to the desired state as quickly as possible and stay at the desired state as accurately as possible.</p> <p>The project is to design a temperature controller for a control unit, for HDD read write test stand being developed at the DSI, considering the saturation of the heater, such that the temperature can change to the desired value as soon as possible. The controller should stabilize the system with respect to a given set of admissible initial states and, in addition, guarantees some dynamical performances when the system operates when the controls are not saturated.</p> <p>The candidate will learn to use LabView or Labwindows/CVI or DSP to program the controller, and use Matlab to design and simulate the controller. Modification of some electronic circuits (including digital and analog) is also expected. The candidate will have to learn some feedback control theory to successfully complete the project.</p>
Nature	hardware and theory
Pre-requisite	None
AMP	no
CPE	yes
Supervisor 1 email	dsiguogx

Group Data Storage Institute

Project No DS-XIAOGG-5

Project Type normal

Student's userID

Title Study of MEMS based dual-stage servo systems*

Supervisor 1 GG Xiao(DSI)

Supervisor 2

Supervisor 3

No. of student 1

Synopsis

Dual stage servo is widely believed to be the key technology to support future high-density hard disk drives. Various milli and micro actuators and related servo systems, including control, electronics, have been studied extensively over the years at the Mechatronics and Micro Systems Group of Data Storage Institute.

The present project is to study the control design and implementation issues for MEMS based dual stage servo systems. The project is to identify the performance limitation of the MEMS actuators based dual stage servo system from control point of view, and try to relax some of the limitations via novel control, electronics, or mechanical design. The student will be trained in applied control theory, precision measurement electronics, DSP programming, and high performance servo system.

Nature Innovative

Pre-requisite none

AMP yes

CPE yes

Supervisor 1 email dsiguogx

Group	Drives, Power & Control Systems
Project No	DPCS-MAMUNAL-1
Project Type	normal
Student's userID	
Title	Cooperative Operation of Multiple Mobile Robots
Supervisor 1	A Al Mamun
Supervisor 2	Dr. Prahlad V
Supervisor 3	
No. of student	1
Synopsis	The main objective of this project is to simulate an environment with multiple robots deployed for some common task. They robots should acquire cooperative behaviours, such as collision avoidance, formation driving, and cooperative motion. The environment and behaviour acquisition is to be simulated using Webots robot simulator. After successful simulation of the behaviour, the codes can be downloaded to the Webots mobile robots.
Nature	Simulation and Hardware Implementation
Pre-requisite	Comfortable with C++ programming
AMP	yes
CPE	yes
Supervisor 1 email	eleaam

Group	Drives, Power & Control Systems
Project No	DPCS-KHAMBADK-1
Project Type	normal
Student's userID	
Title	Deterministic Ethernet in electrical drive control
Supervisor 1	A Khambadkone
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	The project investigates the use of deterministic ethernet for communication and control between different units of electrical drives. A networked architecture is to be designed that can allow flexible configurations and programming of drive control structures. This approach to drives design is new and
Nature	Analytical
Pre-requisite	computer networks, electrical drives
AMP	yes
CPE	yes
Supervisor 1 email	eleamk

Group	Drives, Power & Control Systems
Project No	DPCS-LOHAP-4
Project Type	normal
Student's userID	
Title	Auto-tuning of Phase Compensators
Supervisor 1	AP Loh
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Phase lead or lag compensators are typically tuned or designed manually. They are generally tuned based on gain and phase margins. Recent research has explored ways of auto-tuning them using relays in feedback loops. The objectives of the project are to</p> <p>a) explore when it is better to have PID control than phase compensators</p> <p>b) analyse the tuning approach to determine the final gain and phase margins.</p>
Nature	Computational
Pre-requisite	None
AMP	no
CPE	yes
Supervisor 1 email	elelohap

Group	Drives, Power & Control Systems
Project No	DPCS-LOHAP-5
Project Type	normal
Student's userID	
Title	Forced Oscillation Conditions in Single- and Multi-loops
Supervisor 1	AP Loh
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Forced oscillations are interesting phenomena in relay feedback systems. Forced oscillations refer to a condition when a periodic disturbance completely damps out the original response and begins to take over or dominate the entire system. It is akin to two clocks on a wall which are originally not synchronized but can be automatically synchronized when the conditions are right. However the conditions for forced oscillations are not completely clear. Some research have been carried out but the results are incomplete.</p> <p>The objectives of this project is to investigate more complete conditions for forced oscillations. In particular, all possible frequencies of forced oscillations are considered. The conditions for them need to be analysed and simulated. The analysis are based on frequency domain considerations and are not difficult. The results of this analysis will be used to understand the oscillation patterns in multi-loop</p>
Nature	Computational
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elelohap

Group Drives, Power & Control Systems

Project No DPCS-SRINID-3

Project Type normal

Student's userID

Title Neural network based harmonic analysis

Supervisor 1 D Srinivasan

Supervisor 2 AC Liew

Supervisor 3

No. of student 1

Synopsis The quality of an electric power supply includes the range of voltage swings, frequency deviations, distortion, unbalance and availability. It is becoming of increasing concern because of the tight requirements of modern equipment which are usually digitally controlled. With the growth of power electronics, the management of harmonics is becoming an important issue. The conventional methods of evaluating the frequency components require enormous computations, which are very time consuming. This project aims to develop an artificial neural network (ANN) -based model for real-time estimation of harmonics in the power supply. Artificial Neural Networks have been found to be more efficient in learning non-linear system mappings. The power of neural network lies in the synaptic weights, which are adjusted in the process of 'training' to get an exact input-output matching. Simple feed forward networks will be trained using back propagation algorithm to estimate the fundamental frequency as well as the harmonics. The work on this project will involve:

1. The selection of the various network parameters to get a system with a very good generalization performance on global data.
2. Determining the software and hardware requirements for online implementation.
3. Comparison of the performance of the proposed system with the existing harmonic estimators.

Nature Computational

Pre-requisite None

AMP yes

CPE yes

Supervisor 1 email elesd

Group	Drives, Power & Control Systems
Project No	DPCS-SRINID-4
Project Type	normal
Student's userID	
Title	Artificial Intelligent techniques for non-linear modelling and control of DC-DC converters
Supervisor 1	D Srinivasan
Supervisor 2	A/Prof. R. Oruganti
Supervisor 3	
No. of student	1
Synopsis	<p>DC-DC converters are highly non-linear due to the presence of switches. For modelling a controller for the converters, the most widely used method is to linearise the non-linear converter in the region near to the operating point. This gives rise to a linear model of the converter about the operating point. The converter will have different models corresponding to different operating points.</p> <p>Artificial intelligence techniques (AI) such as Fuzzy logic, neural networks, evolutionary techniques and Space vector machines have been found to be very powerful in modelling and control of non-linear systems. The proposed project aims at applying the conventional non-linear methods of analysis for a DC-DC power converter (e.g. A boost converter) and explore the possibilities and the strengths of the various suitable artificial intelligent techniques for the purpose of the control of the DC-DC converters. Simulations followed by construction of a working AI controlled power converter form a part of the proposed project.</p>
Nature	Software/hardware
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elesd

Group	Drives, Power & Control Systems
Project No	DPCS-SRINID-5
Project Type	normal
Student's userID	
Title	An Evolutionary Algorithm for Solving the Time-Tabling Problem
Supervisor 1	D Srinivasan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	This Artificial Intelligence (AI)-based project aims to develop an evolutionary algorithm for class time-tabling. The project will use actual data for development and testing. The problem will be formulated using if-then type heuristic rules using fuzzy logic.
Nature	Computational
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elisd

Group	Drives, Power & Control Systems
Project No	DPCS-SRINID-6
Project Type	normal
Student's userID	
Title	Application of Fuzzy Multiobjective Decision Making in Spatial Load Forecasting
Supervisor 1	D Srinivasan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	Electric distribution system planning is to provide an economic expansion plan to meet the future demands in its territory. A forecast of the future electric demand and its geographic distribution is a prerequisite for distribution planning. The quality and accuracy of this forecast have large influence on the quality of the electrical distribution system planning. Spatial load forecasting emerges to provide a more accurate prediction of both the magnitudes and locations of future electric loads. Since the load growth pattern is dominated by its land-use (residential, commercial, or industrial), the land usage study of small area is important to capture the future loads accurately. This project will apply fuzzy multiobjective decision making scheme to handle the spatial load forecasting problem.
Nature	Computational
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elesd

Group	Drives, Power & Control Systems
Project No	DPCS-SRINID-7
Project Type	normal
Student's userID	
Title	Development of a hybrid AI technique for input feature selection of incident detection models
Supervisor 1	D Srinivasan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	Artificial intelligence based models have recently been investigated for detecting traffic incidents on freeways. Support vector machines (SVMs) have increased in popularity over the past few years due to their solid theoretical foundations and their state-of-the-art performance in a number of applications. The aim of this project is to develop a hybrid AI model using support vector machine and genetic algorithms for input feature selection of automatic incident detection models.
Nature	Computational
Pre-requisite	Knowledge of MATLAB
AMP	yes
CPE	yes
Supervisor 1 email	elesd

Group	Drives, Power & Control Systems
Project No	DPCS-ELANGO-1
Project Type	normal
Student's userID	
Title	Web-Based Interactive Learning Tools for Power Systems
Supervisor 1	Elangovan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Web-based interactive learning tools will be developed to facilitate self-learning of following topics of Power System Engineering:</p> <ol style="list-style-type: none"> 1. Network modeling: Step-by-step approach of building the bus admittance and bus impedance matrices of power system networks. The network may contain mutually coupled elements. 2. Short circuit studies: Symmetrical components theory for unbalanced systems, carrying out studies on power system networks for balanced and unbalanced faults will be covered. 3. Economic Dispatch: Allocation of load between the generating units so as to minimize the cost of generation. Suitable loss-formula coefficients in terms of plant generation will be developed based on the system network details. 4. Load flow studies: Gauss-Seidel, Newton Raphson, Decoupled, Fast Decoupled methods and DC load flow. Special methods of handling radial systems will also be considered. <p>These concepts will be explained with suitable built-in examples of manageable size that could be easily accommodated on a web page. Finally, the user may be allowed to play with these tools by getting the solutions for their own problems. However, there may be a restriction on the size of the system they could use mainly due to the web-page constraints in accepting the data and displaying</p>
Nature	Computational
Pre-requisite	Good knowledge of Computer Programming and Web-related tools.
AMP	no
CPE	yes
Supervisor 1 email	elegovan

Group	Drives, Power & Control Systems
Project No	DPCS-ELANGO-3
Project Type	normal
Student's userID	
Title	Digital Relay for the Protection of DC Systems.
Supervisor 1	Elangovan
Supervisor 2	Devotta, JBX
Supervisor 3	
No. of student	1
Synopsis	<p>A microprocessor based digital relay for the protection of a DC system has to designed and constructed.</p> <p>The digital relay has to monitor the system voltage and current continuously. If there are sudden changes in these, the relay should be intelligent enough to distinguish the faults on the system from the normal transients that may exist for a short duration. So it has to keep in its memory the information about the characteristics of the load it is protecting. If a new pattern of behaviour on the part of the load is encountered, the relay has to learn this new behaviour for future use provided it is harmless.</p> <p>This is a new area being investigated. The student may have to undertake an extensive literature survey on the protection of DC systems.</p>
Nature	Hardware
Pre-requisite	Good knowledge of microprocessors.
AMP	no
CPE	yes
Supervisor 1 email	elegovan

Group	Drives, Power & Control Systems
Project No	DPCS-XUJX-4
Project Type	normal
Student's userID	
Title	Development of an Interactive Database
Supervisor 1	JX Xu
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>An interactive database sited on web will be developed. The webside will provide a channel to a SQL database.</p> <p>Remote users will be automatically assigned a virtual room with appropriate space (quota) and security (firewall). The project consists of three stages:</p> <ol style="list-style-type: none"> 1) Maximise the database functionality and set up an appropriate server accordingly; 2) Develop a particular web oriented platform with some graphics display. It should be object-oriented for expandability; 3) Function integration under the platform..
Nature	Computational
Pre-requisite	none
AMP	no
CPE	yes
Supervisor 1 email	elxujx

Group Drives, Power & Control Systems

Project No DPCS-TANKC-1

Project Type normal

Student's userID

Title Distributed evolutionary computing over the Internet

Supervisor 1 KC Tan

Supervisor 2 TH Lee

Supervisor 3

No. of student 1

Synopsis Evolutionary algorithm is a powerful tool for solving difficult optimization problems, which can 'intelligently' explore a poorly understood or complex search space in parallel. The drawback of evolutionary algorithm is that it requires a large number of function iterations with considerable amount of computation power for finding the global solution. For this reason, a Distributed Evolutionary Computing (DEC) software which is capable of utilizing the idling computing resources of computers connected over the Internet for solving complex optimization problems has been developed at NUS. The DEC incorporates the modern peer-to-peer computing techniques and the island model of parallel evolutionary algorithms, where each population is segregated into multiple sub-populations and promising individuals are migrated among these sub-populations occasionally.

This project aims to enhance the DEC software by:

1. Fault tolerance: Since the DEC is meant for execution over the Internet, it should exhibit a large degree of robustness due to any uncertainties posed by the Internet, such as migration strategy, synchronization and scheduling of computers, and firewall problems.
2. Benchmarking: To evaluate the performance of DEC over the Internet for a set of difficult-to-solve or unsolvable benchmark problems. The evaluation criteria should at least include the issue of reliability, accuracy and speed of execution.

Nature Software

Pre-requisite Knowledge of Java and C++ programming

AMP yes

CPE yes

Supervisor 1 email eletankc

Group	Drives, Power & Control Systems
Project No	DPCS-TANKC-2
Project Type	normal
Student's userID	
Title	Automated rules extraction in data mining via evolutionary computing
Supervisor 1	KC Tan
Supervisor 2	TH Lee
Supervisor 3	
No. of student	1
Synopsis	<p>Data mining is an automated process of discovering knowledge from databases. Recent advances in data collection and storage technologies have made data accumulates in a speed unmatched by human's capacity of data processing. In order to make these raw data useful, we need to represent it, process it and extract knowledge from it for various applications. As such, comprehensive data mining technology becomes indispensable. One of the main challenges in data mining is to discover comprehensive rules and interesting patterns from a given dataset. Along with various kinds of data mining methods, evolutionary computing has emerged as a possible solution to this problem.</p> <p>In this project, the student is expected to perform the following tasks:</p> <ol style="list-style-type: none"> 1. Develop a methodology for automated rules extraction in data mining using an existing evolutionary algorithm. 2. Apply the technique to a set of benchmark datasets and evaluate the performance using standard performance metrics. 3. Compare the results with existing data mining algorithms such as decision tree, rule induction and etc.
Nature	Software
Pre-requisite	Knowledge of Java and C++ programming
AMP	yes
CPE	yes
Supervisor 1 email	eletankc

Group	Drives, Power & Control Systems
Project No	DPCS-TANKC-3
Project Type	normal
Student's userID	
Title	Behavior-based object classification for autonomous robots
Supervisor 1	KC Tan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Object identification in autonomous robots is often performed through the mapping of sensory information and predefined features of the object, which is very inflexible and non-adaptive for the robots to operate in varying or unknown environments. This project aims to develop a behavior-based object classification technique for autonomous robots. The technique should be capable of setting up its own knowledge database about the objects to be interacted in a developmental and self-organizing approach. The behavior-based classification process will be based on reward signals obtained through active interaction with objects in the environments. The behavior of the robot will be preprogrammed as innate or learned through the robot's experiences. The rewarding system will be based on the principle of reinforcement learning such that any helpful behaviors in achieving the goal will be rewarded. Implementation of the developed behavior-based object classification methodology on an existing mobile robot is also included in this project.</p>
Nature	Computational
Pre-requisite	Knowledge of C/C++ programming
AMP	yes
CPE	yes
Supervisor 1 email	eletankc

Group	Drives, Power & Control Systems
Project No	DPCS-TANKC-4
Project Type	normal
Student's userID	
Title	Solving vehicle routing problem with time window constraints via genetic programming
Supervisor 1	KC Tan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	In Vehicle Routing Problems with Time Window Constraints (VRPTW), a set of vehicles with limited capacity, are to be routed from a central depot to a set of geographically dispersed customers with known demands and predefined time windows. To solve the problem, the optimized assignment of vehicles to each customer is needed as to achieve the minimal total cost without violating the capacity and time window constraints. Combinatorial optimization problems of this kind are NP-hard and difficult to be solved using simple heuristic methods. This project aims to apply the technique of Genetic Programming (GP) to solve the VRPTW problem for the benchmark problem of Solomon's 56 VRPTW with 100-customer instances. GP is an evolutionary optimisation method in which a population of candidate structures evolves towards near-optimal structural expression by going through a series of genetic operations. The GP has the merit of directly realizing the relational search needed in VRPTW representation, which cannot be easily realized using simple heuristic methods. Results obtained from the GP based methodology will be compared to other heuristic techniques in literature.
Nature	Computational
Pre-requisite	Knowledge of C++ programming
AMP	yes
CPE	yes
Supervisor 1 email	eletankc

Group	Drives, Power & Control Systems
Project No	DPCS-TANKC-5
Project Type	normal
Student's userID	
Title	A standalone multi-objective evolutionary algorithm software
Supervisor 1	KC Tan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	A GUI Matlab MOEA optimization toolbox has been developed at the Department of Electrical & Computer Engineering in NUS, which is based on a multi-objective evolutionary algorithm inspired by the principles of natural selection and natural genetics. The toolbox is capable of evolving various trade-offs for multiple objectives scenarios to be examined, aiding at decision-making for a global solution that best meets the design specifications. This project aims to convert the MOEA toolbox into a standalone self-executable software in Windows or Unix, using a commercial Matlab to C++ conversion software, such as Matcom or Matlab C compiler. The standalone software should be able to provide graphical displays and GUIs supported in Matlab. The converted C++ codes should also be optimized to maximize the speed of program execution.
Nature	Computational
Pre-requisite	Knowledge of Matlab and C++ programming
AMP	yes
CPE	yes
Supervisor 1 email	eletankc

Group	Drives, Power & Control Systems
Project No	DPCS-TANKC-6
Project Type	normal
Student's userID	
Title	Artificial immune system
Supervisor 1	KC Tan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>This project aims to explore different immunological mechanisms and their relation to information processing and problem solving. The natural immune system is an adaptive learning system which employs several alternative and complementary mechanisms for defense against foreign pathogens. The main purpose of the immune system is to recognize all cells (or molecules) within the body and categorize those cells as self or non-self. The non-self cells are further categorized in order to induce an appropriate type of defensive mechanism. The immune system learns through evolution to distinguish between foreign antigens (e.g., bacteria, viruses) and the body's own cells or molecules. From an information-processing perspective, the immune system is a remarkable parallel and distributed adaptive system which provides several important aspects in the field of computation. The developed artificial immune system should incorporate different computational algorithms based on immunological principles, and should be applied to the control optimization of a 2DOF helicopter plant. The student should also compare performance of the artificial immune system based controller with existing fuzzy logic and neural network controllers.</p>
Nature	Computational
Pre-requisite	Knowledge of C++ and Matlab programming
AMP	yes
CPE	yes
Supervisor 1 email	eletankc

Group	Drives, Power & Control Systems
Project No	DPCS-TANKC-7
Project Type	normal
Student's userID	
Title	An interactive evolutionary algorithm demonstrator for teaching
Supervisor 1	KC Tan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Evolutionary algorithm (EA) is a global optimization technique based on the mechanism of natural selection and genetics. The algorithm can “intelligently” explore a poorly understood or irregular solution space in parallel and has been proven to be very efficient and powerful in solving complex search problems.</p> <p>This simulated evolution search beings with an initial population of multiple coded strings representing random candidate solutions. At each generation of search, performances for multiple candidates are evaluated and the search will be directed intelligently according to a “survival-of-the-fittest” principle. Then useful search information and co-ordinates are exchanged and altered for the next generation. This evolution cycle will be repeated until the final generation is reached or the solution has been found.</p> <p>This project aims at developing a user-friendly EA demonstrator to illustrate the working mechanism of the genetic evolution for teaching purpose. The EA demonstrator should allow users to input its</p>
Nature	Software
Pre-requisite	Knowledge of Java, C++ and Matlab programming
AMP	yes
CPE	yes
Supervisor 1 email	eletankc

Group	Drives, Power & Control Systems
Project No	DPCS-LIMKW-1
Project Type	normal
Student's userID	
Title	Evaluating alarm management strategies on a model
Supervisor 1	KW Lim
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Modern chemical plants are complex. To operate at maximum efficiency, the state of the plant is carefully monitored using computer systems. In a typical plant, there may be hundreds of plant measurements which are continuously monitored. Alarms are generated when a measurement deviates from an acceptable range. Plant personnel must then respond to an alarm.</p> <p>The student will join a team of research engineers and academic staff working at CPEC. He/she will build upon a software framework developed for an industrial project. The existing framework supports dynamic plant simulation (based upon a refinery plant operating in Singapore), an expert system shell, an industry standard OPC server and an alarm management package developed for industry. It allows the evaluation of alternative strategies.</p> <p>The focus of the student project will be on the evaluation of alternative strategies and a comparison with the one developed for and currently operating on the refinery plant.</p>
Nature	Software
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elelimkw

Group Drives, Power & Control Systems

Project No DPCS-LIMKW-2

Project Type normal

Student's userID

Title Control of a Batch Process

Supervisor 1 KW Lim

Supervisor 2

Supervisor 3

No. of student 1

Synopsis Batch process systems are commonly used in producing small volumes of products such as semiconductor wafers and pharmaceuticals. An experimental batch process pilot plant has been commissioned at the CPEC laboratory and will form the focus of this project.

Firstly, an appropriate dynamic (hybrid) model that marries a conventional differential equation description with discrete state transitions is needed. With an appropriate model, systematic design procedures can be developed for the synthesis of appropriate supervisory controllers which will facilitate the safe and efficient operation of process plants.

The model and resulting controller design will be against experimental data from the plant.

Nature Discovery

Pre-requisite None

AMP yes

CPE yes

Supervisor 1 email elelimkw

Group	Drives, Power & Control Systems
Project No	DPCS-JABBAR-1
Project Type	normal
Student's userID	
Title	Development of a design software for special electric motors
Supervisor 1	MA Jabbar
Supervisor 2	Yeo See Wei
Supervisor 3	
No. of student	1
Synopsis	This is a software development project. The student will write and test a design software for the design of special electric motors. The program has to be fully tested on sample designs. This will require understanding of the design details of special types of electric motors.
Nature	Computational
Pre-requisite	Visual Basic, Excel.
AMP	yes
CPE	yes
Supervisor 1 email	elemaj

Group	Drives, Power & Control Systems
Project No	DPCS-JABBAR-2
Project Type	normal
Student's userID	
Title	Computation of forces and torque in electric machines
Supervisor 1	MA Jabbar
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	This project is to investigate the production of forces and torques in electric machines. A comparative analysis of Maxwell Stress Tensors, Virtual work methods and B-square method will be carried out. Their advantages and disadvantages will be discussed and analysed.
Nature	Computational
Pre-requisite	FORTRAN Programming, Numerical Analysis.
AMP	yes
CPE	yes
Supervisor 1 email	elemaj

Group	Drives, Power & Control Systems
Project No	DPCS-WANGQG-1
Project Type	normal
Student's userID	
Title	Development and experiment of Lab-view real time system for multivariable control
Supervisor 1	QG Wang
Supervisor 2	TH Lee
Supervisor 3	
No. of student	1
Synopsis	<p>Over last several years, we have developed a comprehensive technology for adaptive control of industrial applications. It consists of a general process identification with options of relay or step tests and a general control module with options of PID, high-order or IMC controllers. It can achieve excellent performance and robustness. Extensive lab and field tests show that our technology is very practical. So far we have applied the technology to cleanrooms, molding machines and papermachines successfully. This has attracted Yokogawa, a leading international control and automation company, to embed our technology into their commercial distributed control system.</p> <p>We have been implementing our adaptive control technology in Lab-view for purpose of its experiment and demonstration. The Lab-view is the latest product from National Instrument. It provides nice-general-purpose platform for real time control implementation. New control algorithms can be easily implemented and tested with it. With such a system, people without any knowledge of our technology can still use the system to see its performance, and they may find it useful and transfer it to their practical applications after seeing such Demo. The system may also be used to train control students and engineers. They learn how to operate the system and what will happen to such a system. They may use the system for control laboratory and comparison with other systems.</p> <p>We already have a single variable version of such Labview real time system with both conventional feedback and internal model control schemes. This project is to expand it into a multivariable version, make full use of the lab-view's powerful functions, and develop it into user-friendly, easily-restructurable and configurable one for convenience of research and development. The system will be tested thoroughly. The work is mainly on programming. Only basic control is required from the student. However, the student has to be familiar with Labview or very good at computer programming.</p>
Nature	Software
Pre-requisite	familiar with Labview or very good at programming
AMP	no
CPE	yes
Supervisor 1 email	elewqq

Group Drives, Power & Control Systems

Project No DPCS-WANGQG-2

Project Type normal

Student's userID

Title Development of Internet based Matlab toolbox for multivariable control

Supervisor 1 QG Wang

Supervisor 2

Supervisor 3

No. of student 1

Synopsis

Over last several years, we have developed a comprehensive technology for adaptive control of industrial applications. It consists of a general process identification module with options of relay or step tests and a general control module with options of PID, high-order or IMC controllers. It can achieve excellent performance and robustness. Extensive lab and field tests show that our technology is very practical. So far we have applied the technology to cleanrooms, molding machines and papermachines successfully. This has attracted Yokogawa, a leading international control and automation company, to embed our technology into their commercial distributed control system.

We have implemented our adaptive control technology in a Matlab toolbox for purpose of its simulation and demonstration. The Matlab is the most popular control system simulation software package on the world. It provides user-friendly general-purpose platform for dynamic systems and control simulation. Our technology is being implemented and tested with it. With such a system, people without any knowledge of our technology can still use the system to see its performance, and they may find it useful and transfer it to their practical applications after seeing such Demo. The system may also be used to train control students and engineers. They learn how to operate the system and what will happen to such a system. They may use the system for control laboratory and comparison with other systems.

Internet and e-service grows explosively. An Internet version of the toolbox will enable wider and easier access by users worldwide. We have developed such a version for single variable case. This project is to extend it to the multivariable version using the existing multivariable functions in our Matlab toolbox. The work is mainly on programming. Only basic control is required from the student. But the student must be good at Internet development, programming, and front-page design.

Nature Software

Pre-requisite none

AMP no

CPE yes

Supervisor 1 email elewqg

Group	Drives, Power & Control Systems
Project No	DPCS-WANGQG-3
Project Type	normal
Student's userID	
Title	Development of wireless, man-free, and hardware-free car park management system
Supervisor 1	QG Wang
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Currently, all car parks exploit some hardware such as gates and auto-pay machines or high tech video based system and/or involve some manpower to guard or monitor. This makes their operations costly. Moreover, these parks are not networked and drivers must have had some unpleasant experience when they drive into a car park but find no parking slot available. The proposed system can effectively solve all these problems and is briefly described as follows.</p> <ol style="list-style-type: none"> 1. Infrastructure <ul style="list-style-type: none"> 1.1 Each and every (no-free) car part slot in any part of Singapore is assigned with a unique code. 1.2 A car par management software is to be set up and is basically a simple data base system which may essentially needs only two fields for each car park slot: the slot code and car code. It can be accessed by phone or internet. It will be used mainly for two functions: parking and booking 2. Parking <p>When a car is parked in a slot, the driver logs in the system with phone or internet, and simply enter the slot code and car code. The phone accessing should be easy: dial a specific no and then key in codes.</p> 3. Booking <p>The driver logons in the system and find a free slot, then enter the slot code and his/her car code</p> 4. Payment <p>Giro or statement-cheque based monthly settlement</p> 5. benefits <ul style="list-style-type: none"> 5.1 manpower saving: no need to man car parks 5.2 no site sensors, or auto-pay machines or car park gates required, cost cut, 5.3 the present non-convenient coupon system can be removed 5.4 more accurate measurement of car park usage 5.5 no cash needed 5.6. convenient for drivers 6. Management <p>A team of inspectors, like the present HDB car park system, have to be employed for inspection and give fines. But with the proposed on-line management system, their inspection task is greatly simplified since they only need to check if the supposed free slots are occupied by some cars, but needn't to check coupon's time.</p>
Nature	Software
Pre-requisite	none
AMP	no
CPE	yes
Monday, May 21, 2001	
Supervisor 1 email	elwqg

Group	Drives, Power & Control Systems
Project No	DPCS-WANGQG-5
Project Type	normal
Student's userID	
Title	Sound Beautifier: A compensation approach to sound distortion
Supervisor 1	QG Wang
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>Ultimately, any Hi-Fi system wants to precisely re-produce the original sound of singers or music instruments. A system usually consists of 3 stages, namely, CA player, amplifier and speaker. The approach which everyone takes is that they try to make each stage precise with no signal distortion. This is certainly very costly if it is not impossible. Technically, the precise re-production of the original signal from CD to the speaker requires that each stage has uniform dynamic performance over a very large range of signal size and a wide range of frequency. Since all physical components more or less have nonlinearity and nonlinearity would usually be severe for large signal range and wide frequency range, precise re-production is almost impossible from technical point of view. Therefore, the cost for improving performance in high-end increases exponentially, and it is no surprising that good speakers can cost \$100k yet some super-fan buys them to just get that effect and feeling.</p> <p>I take a totally different approach to this problem and propose to compensate for signal distortion, instead of making a perfect stage. I have got a novel compensation scheme based on system theory and is in process of patenting it. Thus, technical details will not be released here or to the student until the student has been assigned to this project and signed confidentiality agreement. Obviously, there is a huge market for such technology's application due to huge population with music as their hobby.</p>
Nature	Innovative
Pre-requisite	love music
AMP	yes
CPE	yes
Supervisor 1 email	elewqg

Group	Drives, Power & Control Systems
Project No	DPCS-WANGQG-7
Project Type	normal
Student's userID	
Title	e-control: Development of an e-service control system
Supervisor 1	QG Wang
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>What is e-service? "In its simplest definition: it is when a customer problem is solved through an electronic interaction. The interaction may be in the form of self-serve, just-in-time information. Companies post frequently asked questions, knowledge bases and other content, so customers can quickly find information when they need it. E-service is also characterized by accurate, personalized, timely responses. Moreover, it will ultimately differentiate a company from its competition."</p> <p>A Prototype system is developed. We have made use of the latest Internet technology and developed a prototype e-service system. The system can control a few real time pilot plants by multiple remote users via internet.</p> <p>An Application Example. We have collaborated with Carrier and made E-service for HVAC systems. Currently, many factories, and hotels and commercial buildings have big HVAC systems. Each owner has to employ a team of technicians running shift to look after their systems. Most of time the technicians have nothing to do. The manpower for maintenance work is thus costly but unavoidable now. But such a manpower cost can be cut and at the same time the HVAC system can be maintained better using the proposed E-service to be developed. Incorporated in the e-service is the leading technology package on the HVAC, which, via Internet, provides on line data acquisition and system monitoring, prediction, control, optimization, fault diagnosis, and management on 24-hour basis. A single e-service company can look after a large number of HVAC systems in different places simultaneously and effectively. Such e-service can reduce customer's cost significantly. The ratio of return to investment is very high and the market is huge</p> <p>Call for new applications. We would like the student to find a potential e-service user. Then he or she can bring it as the project, use our prototype and refer to our application example to develop a new e-service application.</p>
Nature	Innovative
Pre-requisite	The student must find a company which agrees to take part in this development. The work is mainly on programming. Only basic control is required from the student.
AMP	no
CPE	yes
Supervisor 1 email	elwqg

Group	Drives, Power & Control Systems
Project No	DPCS-GESZ-1
Project Type	normal
Student's userID	
Title	Development of On-line Learning Technology
Supervisor 1	SZ Ge
Supervisor 2	T.H. Lee
Supervisor 3	
No. of student	1
Synopsis	<p>With the advances of informatiopn technology, on-line learning is possible and becoming is fashion for future education because of its flexible, economical and iterative nature. In the project, the student is to investigate the following tasks:</p> <ol style="list-style-type: none"> 1. Literature search on internet technology and on-line learning techniques 2. Development of on-line learning materials for a suitable subject, such Dynamic Simulation 3. Integration of new and desirable features for efficient learning. <p>The student is encouraged to proposed his/her own algorithm and ideas.</p>
Nature	Software
Pre-requisite	None
AMP	no
CPE	yes
Supervisor 1 email	elegesz

Group	Drives, Power & Control Systems
Project No	DPCS-GESZ-2
Project Type	normal
Student's userID	
Title	Web based Animation and Mobile Robots
Supervisor 1	SZ Ge
Supervisor 2	T.H. Lee
Supervisor 3	
No. of student	1
Synopsis	<p>Active research has been carried out in the last two decades mobile robots. Advanced technologies have made robotics much mature, and readily available in many industries. The student is expected to develop an animation and simulation package using internet technology:</p> <p>The project can be divided into three stages:</p> <ol style="list-style-type: none"> 1. Familiar with the history, class, and design of several class of mobile robots. 2. Familiar with internet technology and programming, do some basic show cases. 3. Propose his/her own concepts/ideas for the web based animation and robotics.
Nature	Computational
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elegesz

Group	Drives, Power & Control Systems
Project No	DPCS-GESZ-3
Project Type	normal
Student's userID	
Title	Real-time data Acquisition and Control using Linux
Supervisor 1	SZ Ge
Supervisor 2	T.H. Lee
Supervisor 3	
No. of student	1
Synopsis	<p>RT-Linux is an emerging technology. Its open architecture makes it very attractive to industry applications and research. In this project, the students are expected to investigate the following tasks:</p> <p>(1) Familiar with Linux Operation System and its resources; (2) Familiar with RT-Linux kernel resources, including RT-Linux Scheduler API, Real-time interrupts handling, and Interprocess Communication mechanism, such as FIFO, and shared memory.</p>
Nature	Computational
Pre-requisite	None
AMP	yes
CPE	yes
Supervisor 1 email	elegesz

Group	Drives, Power & Control Systems
Project No	DPCS-ARTHURTAY-4
Project Type	normal
Student's userID	
Title	Application of Computational Intelligence techniques for DNA Sequencing
Supervisor 1	Tay Ee Beng,Arthur
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	Computational tools such as artificial neural networks, expert systems and evolutionary computation are instrumental for studying the expanding body of gene-expression and functional data, for modeling complex biological networks and interactions, and for collecting and analyzing sequence-variation data. The current proposal aims to utilize these computational tools to find the unique identity for each gene and other non-coding regions of the human genome. Generation of these unique identities is a prelude to a more ambitious project of making a gene chip that represent and cover the entire human genome. We intend to use computational approaches to find strings that are sufficient to represent a genome (3 billion characters for human). As a first step, we will analyze the smaller Yeast genome for applications using DNA MicroArray Technology. The objective is to find a minimum length unique sequence that can represent their longer gene counterparts. This will lead to more cost effective usage of DNA MicroArrays.
Nature	Computational
Pre-requisite	none
AMP	yes
CPE	yes
Supervisor 1 email	eletaya

Group	Drives, Power & Control Systems
Project No	DPCS-PRAHLADV-2
Project Type	normal
Student's userID	
Title	Genetic fuzzy controller for mobile robots
Supervisor 1	V Prahlad
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	The fuzzy control system for mobile robot navigation can be optimized using genetic algorithm. Adaptive behaviors result from the interaction of several primitive low-level strategies acquired through the evolutionary process. The robots are expected to adapt automatically in a changing environment.
Nature	Software
Pre-requisite	C++
AMP	yes
CPE	yes
Supervisor 1 email	elepvt

Group	Drives, Power & Control Systems
Project No	DPCS-PRAHLADV-5
Project Type	normal
Student's userID	
Title	Evolving neural networks for the predator-evader problem
Supervisor 1	V Prahlad
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>It is required to develop an architecture for the predator-evader problem on the available animation package. The predator's primary objective is to capture the evader and evader's objective is to avoid becoming the prey. As a result both the predator and the evader have to develop strategies to defeat each other and thus stay alive.</p> <p>Evolutionary programming is to be employed to evolve the predator for developing adaptive behaviors to meet its goal. Neural network based competitive co-evolution between predator and evader to be studied on the animation package and then tested on the real robots.</p>
Nature	Software
Pre-requisite	Java
AMP	no
CPE	yes
Supervisor 1 email	elepvt

Group	Microelectronics
Project No	ME-ADEYEEA-3
Project Type	normal
Student's userID	
Title	Development of a Real Time Data Acquisition Package for Magnetolectronics Devices
Supervisor 1	A Adeyeye
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	In this project, a multipurpose real time data acquisition package will be designed and developed using C++ and Labview. This package will be used to characterize spin-electronics and other magnetolectronics devices at low temperature down to room temperature. This package will be used to automate all the measurements and communicate with various instruments via GPIB. This project will also involve some testing/chacterisation in order to evaluate the package.
Nature	Software
Pre-requisite	Interest in computer programming and communication with instruments.
AMP	no
CPE	yes
Supervisor 1 email	eleaao

Group	Microelectronics
Project No	ME-CHANDSH-1
Project Type	normal
Student's userID	
Title	Development & Characterisation of A Novel Approach to Image Acquisition in Scanning Microscopy.
Supervisor 1	DSH Chan
Supervisor 2	JCH Phang
Supervisor 3	YY Liu
No. of student	1
Synopsis	<p>A radically new method for image formation in scanning microscopy has been proposed in our laboratory. This method offers significant performance advantages over conventional scanning systems. Its feasibility has been demonstrated by the present year's Final year Project student. The required hardware construction of the mechanical system has been completed and tested. The software programming for system control and image acquisition using standard C in LabWindows CVI environment under Windows has also been partially completed. This new project aims to continue the efforts towards full performance image acquisition. Various system software and hardware issues will be assessed such as timing during image acquisition, image resolution and mechanical vibration.</p> <p>This project description is necessarily brief because it is the subject of a patent application; interested students can obtain more details of this project by approaching the supervisors.</p>
Nature	Innovative
Pre-requisite	Basic electronics. Some knowledge on image formation and prior experience in Standard C Programming (eg. under LabWindows CVI environment) would be advantageous.
AMP	yes
CPE	yes
Supervisor 1 email	elecshd

Group	Microelectronics
Project No	ME-TANLS-2
Project Type	normal
Student's userID	
Title	Development of an interactive on-line tutorial system
Supervisor 1	LS Tan
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>The rapid development of information technology has opened up new avenues for teaching and learning. An example is the development of an on-line tutorial system to supplement the teaching and learning of semiconductor devices.</p> <p>Such an on-line system has been initiated in the past year. In this system, a set of tutorial problems are written in the JAVA language. While the style of the questions will be similar, the values of certain parameters will be different each time a student logs on. The student will have to key in the answer. The system will check the answer against the correct answer as well as a set of anticipated common mistakes, and feed back to the student immediately. A preliminary trial run has been carried out in academic year 2000 for the module EE3405.</p> <p>In this year, the student will continue to work on a similar concept to develop a more extensive set of questions. A full set of tutorials will be mounted for EE3405 this year. The student will investigate the development of different styles of question, such as those that accepts graphical inputs, etc. The student may also develop other JAVA applets on animations and simulations to help the students to understand the concepts in the subject better.</p>
Nature	Software
Pre-requisite	Knowledge of Java programming is essential
AMP	no
CPE	yes
Supervisor 1 email	eletanls

Group	Microelectronics
Project No	ME-WONGWK-1
Project Type	normal
Student's userID	
Title	Controlled-Charge Development for Scanning Microscopy
Supervisor 1	WK Wong
Supervisor 2	JCH Phang
Supervisor 3	JTL Thong
No. of student	1
Synopsis	<p>This project focuses on the implementation of front-end algorithms for closed-loop instrument control on charged-particle microscopes such as the Scanning Electron Microscope. These algorithms represent a significant departure from the present static operating modes to one where instrument parameters can be dynamically changed to optimise the performance of the microscope depending on the imaging conditions. Once successfully prototyped, the development of the Controlled-Charge operating mode represents a major development which would significantly transform the role and operating scope of today's electron and ion beam instrumentation.</p>
Nature	Innovative
Pre-requisite	Programming know-how in C/C++/MFC, Passion for Systems Development Work
AMP	no
CPE	yes
Supervisor 1 email	elewwk

Group	Microelectronics
Project No	ME-WONGWK-2
Project Type	normal
Student's userID	
Title	Novel Scanning Algorithm for Scanned Image Systems
Supervisor 1	WK Wong
Supervisor 2	YY Liu
Supervisor 3	
No. of student	1
Synopsis	<p>Scanned imaging systems have been in use since the last century in applications as diverse as the television in consumer-oriented electronics to specialised instruments such as electron and laser microscopes. However, most, if not all of these devices still rely on the tried-and-trusted raster scanning scheme as their core operating principle. It has been discussed in previous literature of the potential utility of non-raster scanning schemes. This project focuses on the development of a algorithm-based scanning sub-system in which the scanning can be varied dynamically depending on the operating condition and functionality objectives. The eventual successful prototyping of this technique could lead to significant enhancements in existing scanned imaging system architectures.</p>
Nature	Software
Pre-requisite	Programming in C/C++ and LabWindows
AMP	no
CPE	yes
Supervisor 1 email	elewwk

Group	Microwave & RF
Project No	MW-OOIBL-2
Project Type	normal
Student's userID	
Title	Wideband and compact antenna design
Supervisor 1	BL Ooi
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>The design of ultra-broadband antenna will be explored. The student is expected to research into novel feeding techniques that allows broadband reception. Design criterions such as small estate size, low profile, ease of feeding, good radiation patterns and array design should be investigated.</p> <p>Reading Materials: (1) K. L. Lau, K. M. Luk, and K. F. Lee, "Wideband U-slot microstrip patch antenna array", IEE Proceedings, vol. 148, no. 1, pp. 41-44, Feb. 2001</p>
Nature	Computational
Pre-requisite	Fields and waves
AMP	yes
CPE	yes
Supervisor 1 email	eleooibl

Group	Microwave & RF
Project No	MW-OOIBL-3
Project Type	normal
Student's userID	
Title	Computation of large array problems with forward-backward method spectral acceleration
Supervisor 1	BL Ooi
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>The analysis of large array problems has been a very difficult task because of the limitations of currently available numerical methods such as method of moments (MoM), especially in the situation where non-periodic structures are present. Problems such as efficient memory usage and reasonable solution time are important criterion for adopting any electromagnetic solver. In this project, the student is expected to extend the forward and backward method with spectral acceleration in the fast computation of a design large array.</p> <p>Reading Materials: (1) H. T. Chou, "Extension of the forward-backward method using spectral acceleration for the fast analysis of large array problems", IEE Proceedings, vol. 147, no. 3, pp. 167-172, june 2000.</p>
Nature	Computational
Pre-requisite	Good in Maths, fields and waves, and circuits
AMP	yes
CPE	yes
Supervisor 1 email	eleoibl

Group Microwave & RF

Project No MW-OOIBL-4

Project Type normal

Student's userID

Title Package Characterisation

Supervisor 1 BL Ooi

Supervisor 2

Supervisor 3

No. of student 1

Synopsis This project is aimed at analyzing and developing a novel technique for characterising and modelling of a microwave TSSOP packages. The uniqueness of this project is the research of novel characterisation techniques for this unique microwave packages. The student is expected to come up with a suitable measuring technique and provide empirical models for this package.

References:

1. Y. Chen, P. Harms, R. Mittra, and W. T. Beyene, "An FDTD – Touchstone hybrid technique for equivalent circuit modeling of SOP electronic packages", IEEE MTT-45, no. 10, pp.1911-1917, Oct 1997 (special issue on interconnects and packaging).

Nature Computational

Pre-requisite Fields and wave

AMP yes

CPE yes

Supervisor 1 email eleoibl

Group	Microwave & RF
Project No	MW-OOIBL-5
Project Type	normal
Student's userID	
Title	Broadband Balun networks
Supervisor 1	BL Ooi
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	Balun networks are key components in the design of microwave circuits. Although there are numerous literatures on the design on balun networks, they are not comprehensive enough to cover a wide range of frequencies. Further work could be carried out to improve the performance of these baluns. In this project, a number of balun networks will be reviewed and the student is expected to design a balun that operates in the X-band. The simulated response will then be verified by measurements performed on an actual prototype fabricated on microstrip or coplanar technology.
Nature	Hardware
Pre-requisite	Fields and waves
AMP	yes
CPE	yes
Supervisor 1 email	eleoibl

Group	Microwave & RF
Project No	MW-OOIBL-6
Project Type	normal
Student's userID	
Title	Efficient evaluation of half-space green's function for fast multipole scattering models
Supervisor 1	BL Ooi
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	There has recently been significant interest in the method-of-moments (MOM) and fast multipole method (FMM for the analysis of scattering from large targets in the presence of a lossy dielectric half space. It is desirable to make the analysis of scattering from such a target consistent with the use of free space Green's function, to exploit previously developed free-space scattering models and for compatibility with the Fast Multipole Method. The student is expected to investigate and program the FMM. The derived program will be used to solve some large structures of
Nature	Computational
Pre-requisite	Fields and Waves, Maths
AMP	yes
CPE	yes
Supervisor 1 email	eleooibl

Group	Microwave & RF
Project No	MW-OOIBL-7
Project Type	normal
Student's userID	
Title	Optical Quasi Power Combiner
Supervisor 1	BL Ooi
Supervisor 2	P S Kooi
Supervisor 3	
No. of student	1
Synopsis	<p>This project is aimed at analyzing and developing a high power ridge waveguide power combiner/divider. The uniqueness of this project is the research for a design rule for building a high power ridge-waveguide combiner/divider operating at X-band.</p> <p>The student is expected to study the construction of the divider/combiner and provide a suitable design technique for the divider/combiner.</p>
Nature	Hardware
Pre-requisite	Fields and Waves
AMP	yes
CPE	yes
Supervisor 1 email	eleooibl

Group	Microwave & RF
Project No	MW-OOIBL-8
Project Type	normal
Student's userID	
Title	Broadband Vivaldi Antenna Design
Supervisor 1	BL Ooi
Supervisor 2	P S Kooi
Supervisor 3	
No. of student	1
Synopsis	The project aims at designing several broadband vivaldi antennas for mobile communication applications. Conventional vivaldi antenna usually has very long antenna length and this makes it unsuitable for mobile communication applications. In this project, the student is expected to investigate into miniaturized vivaldi antenna and explored concepts like inductive coupling, capacitive coupling and short-circuit plane for antenna design.
Nature	Hardware
Pre-requisite	Fields and Waves
AMP	yes
CPE	yes
Supervisor 1 email	eleooibl

Group	Microwave & RF
Project No	MW-OOIBL-9
Project Type	normal
Student's userID	
Title	Precorrected FFT algorithm for large scale computation
Supervisor 1	BL Ooi
Supervisor 2	M S Leong
Supervisor 3	
No. of student	1
Synopsis	<p>The aim of this project is to initially implement the precorrected FFT method for large scale structures computation. Having completed the first stage, the student is expected to investigate new interpolation and extrapolation schemes for the precorrected FFT algorithm. A hybrid FMM, precorrected FFT and Adaptive Integral Method can be explored.</p> <p>The derived algorithm will be used to compute the radar cross section of the fighter aircrafts, navy ships or helicopters.</p>
Nature	Computational
Pre-requisite	Maths, Fields and Waves
AMP	yes
CPE	yes
Supervisor 1 email	eleoibl

Group	Microwave & RF
Project No	MW-OOIBL-10
Project Type	normal
Student's userID	
Title	Design and development of Waveguide-based power combining *
Supervisor 1	BL Ooi
Supervisor 2	Prof. P. S. Kooi
Supervisor 3	
No. of student	1
Synopsis	Spatial or quasi-optical power combining is a promising approach that integrates a large number of devices to get watt-level powers. In this project, the student is expected to design a waveguide-based power combiner for application in satellite communications. He is expected to investigate several broadband transition, antenna design and waveguide to microstrip transition.
Nature	Hardware
Pre-requisite	Fields and waves
AMP	yes
CPE	yes
Supervisor 1 email	eleooibl

Group	Microwave & RF
Project No	MW-OOIBL-11
Project Type	normal
Student's userID	
Title	Design and Characterisation of a microwave feed-forward amplifier *
Supervisor 1	BL Ooi
Supervisor 2	Prof. P. S. Kooi
Supervisor 3	
No. of student	1
Synopsis	Feed-forward linearization has been a popular technique for reducing distortion at the output of the multicarrier cellular base-station transmitter. Such technique has superior distortion improvement over other linearization schemes. In this project, the student is expected to investigate and design a broadband feed-forward amplifier using an improved wide-band distortion cancellation technique.
Nature	Hardware
Pre-requisite	Fields and waves
AMP	yes
CPE	yes
Supervisor 1 email	eleooibl

Group Microwave & RF

Project No MW-LILW-5

Project Type normal

Student's userID

Title Application of P-FFT to Radome Design

Supervisor 1 LW Li

Supervisor 2 TS Yeo

Supervisor 3

No. of student 1

Synopsis Electromagnetic (EM) scattering by an arbitrarily shaped conductor can be converted to finding the solution of an integral equation where the unknown function is the induced current distribution, provided that the Green's function for that scattering system is known. The integral equation can be then discretized to form a matrix equation by the method of moments (MoM). The resultant matrix equation is then solved by iterative methods, requiring usually $O(N*N)$ operations for the matrix-vector multiplies in each iteration, where N is the number of unknowns.

The precorrected-FFT method is an alternative technique to accelerate the matrix-vector product. It was originally proposed by Philips and White to solve electrostatic integral equation associated with capacitance extraction problems. It has been demonstrated that for roughly equivalent accuracy, the precorrected-FFT can be superior to the fast multipole based schemes such as the multi-level fast multipole algorithm (MLFMA) in terms of a speed-memory product.

This project will apply this method to design airborne radome of arbitrary shape.

Nature Computational

Pre-requisite Fortran

AMP yes

CPE yes

Supervisor 1 email elelilw

Group	Microwave & RF
Project No	MW-LEONGMS-4
Project Type	normal
Student's userID	
Title	Development of User-friendly Windows-based software programme to calculate and output the equipotential contours and electric flux lines of arbitrarily shaped electrodes*
Supervisor 1	MS Leong
Supervisor 2	
Supervisor 3	
No. of student	1
Synopsis	<p>In an earlier project, the equipotential distributions in a region were computed using the Laplace 4-point finite-difference formula, with the boundary conditions specified on all parts of the boundaries. This method suffered from one serious drawback: the boundary conditions have to be specified on all parts of the region boundary and the electrodes have to be of regular shapes(planar). This means even the regions where field quantities are not required have to have their boundary conditions specified. For most general cases, these are neither explicit nor known with certainty.</p> <p>In the proposed project, such cumbersome restrictions will be dispensed with, and the method of moments (MOM) will be used instead to compute the potential distribution at all points arising from electrodes of ARBITRARY shapes. The results derived from the software package thus developed will be verified experimentally where necessary, using an analogue method.</p> <p>The versatility and computational efficiency of the Windows-based software in outputting equipotential contours and flux lines will be a major consideration of the project.</p>
Nature	Software
Pre-requisite	Basic EE2113 Fields & Waves, and an interest in CAD software development
AMP	no
CPE	yes
Supervisor 1 email	elelms