Thesis Number	Title	No. of Students
JGR01P	Decoder Implementation (FPGA)	2-3

General Area: Firmware / Hardware
Supervisor: Jim G. Rathmell (Phone:+61 2 93512981, e-mail: jimr@ee.usyd.edu.au)

Given the high demand for wireless communications services, the need for reliable data transfer through error control coding is crucial. Many of the latest coding techniques are based on the soft-output Viterbi algorithm (SOVA).

This project aims to implement a SOVA in FPGA for 2 Mbps communication over a wireless modem. The ultimate application is wireless multimedia services.

This project involves VHDL implementation and testing in an appropriate hardware simulation environment. The project requires a good understanding software development techniques, learning VHDL, understanding multi-process operation and the ability to work as part of a team. Intimate knowledge of the Viterbi algorithm and FEC coding techniques is not essential, but the candidate(s) would be expected to gain familiarity with the different approaches considered. Example source code in C++ / Matlab will be provided.

This project would be performed in conjunction with a company working in the area of wireless mobile communications. Supervision is available from staff working on different aspects of the wireless modem project. Depending on interest and student quality, the implementation may be taken to FPGA for actual hardware implementation and testing.

Thesis Number	Title	No. of Students
JGR02P	Radio Propagation Prediction Tool	1-2

General Area: Software
Supervisor: Jim G. Rathmell (Phone:+61 2 93512981, e-mail: jimr@ee.usyd.edu.au)

As mobile communications systems become more and more popular, system users expect greater coverage and greater quality of service. Part of this increase in service coverage and quality comes in the form of expectation of connection to the mobile network in any location including indoor situations.

In order to provide indoor coverage, network designers may plan network nodes in the ceilings of commercial buildings. In order to limit the number of nodes required in any building, and to limit the interference with the outdoor network, radio propagation prediction tools are often employed. These prediction tools make use of sophisticated modeling techniques to predict signal structure (RMS delay spread, number of multi-path components) and strength at various locations in the indoor environment. Ultimately however, the predictions should be calibrated against actual signal measurements.

This project involves development of a software tool to take 900 MHz and 1.89 GHz

radio measurement results (as used in GSM systems) and match these against predicted signals at the measurement locations. The developed software will allow certain features of the simulation tool to be varied. These features include the electrical characteristics of walls, spatial measurement tolerance and path loss.

The project requires an understanding of Matlab, C/C++, software development techniques and the ability to work as part of a team.

This project would be performed in conjunction with a company working in the area of wireless mobile communications. Supervision is available from staff working on different aspects of the same project.

Thesis Number	**Title**	**No. of Students**
JGR03P	3D Propagation Prediction Tool Environments	1

General Area: Software
Supervisor: Jim G. Rathmell (Phone:+61 2 93512981, e-mail: jimr@ee.usyd.edu.au)

As mobile communications systems become more and more popular, system users expect greater coverage and greater quality of service. Part of this increase in service coverage and quality comes in the form of expectation of connection to the mobile network in any location, including indoor situations.

In order to provide indoor coverage, network designers may plan network nodes in the ceilings of commercial buildings. In order to limit the number of nodes required in any building, and to limit the interference with the outdoor network, radio propagation prediction tools are often employed. These prediction tools make use of sophisticated modelling techniques to predict signal structure (RMS delay spread, number of multi-path components) and strength at various locations in environment, given that detailed spatial information is available to describe the geometry and physical aspects of the environment.

This project involves development of software that can produce flexible three dimensional environments/components for use in a ray tracing engine for propagation prediction in both micro and pico cellular environments.

The project will require an understanding of C/C++ and various computer graphics formats, as well as software development techniques and the ability to work as part of a team. A general interest in mobile communications and computer graphics would be beneficial to the student.

This project would be performed in conjunction with a company working in the area of wireless mobile communications. Supervision and an initial theory/literature search is available from staff working on different aspects of the same project.

Thesis Number	Title	No. of Students
JGR04P	**Stochastic Design of Frequency Hopping Sequences for GSM Systems**	2

General Area: software / analysis
Supervisor: Jim G. Rathmell (Phone:+61 2 93512981, e-mail: jimr@ee.usyd.edu.au)

The ever increasing demand for mobile communications services have placed an enormous burden on existing mobile systems in terms of providing access and limiting interference from other system users. In the most recent modifications to the GSM mobile communications standard, features such as "hopping" of the carrier frequency of each user have been proposed to limit the interference between users in a heavily loaded system. This approach has been seen to offer considerable advantages however the design of these hopping sequences is difficult and cumbersome.

This project involves development and evaluation of a planning tool to automate the design these hopping sequences. The tool will use actual network information about the base stations, their capabilities and traffic loads in order to design the sequences. The predicted sequences will then be passed to a network simulator which has already been developed.

The project requires an understanding of Matlab, C/C++, software development techniques and the ability to work as part of a team. Knowledge of GSM features is not required, however the student(s) will be expected to develop familiarity with the relevant aspects of the system as the project progresses.

This project would be performed in conjunction with a company working in the area of wireless mobile communications. Supervision is available from staff working on different aspects of the same project.