MSc Theses Abstract

Master of Science in

Information and Communication Engineering

Published by

Center for Applied Research and Development (CARD)
2013

Disclaimer:
The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the publisher. The opinions expressed in this publication are those of the author alone and do not imply opinion on the part of the publisher.

Published by
Center for Applied Research and Development (CARD)
Ananda Niketan, Institute of Engineering, Pulchowk Campus,
Tribhuvan University, Nepal
G.P.O. Box: 1915
Phone: 977-1-5521310

Design
Aadhaar Group Pvt. Ltd., Kupondole, Nepal
E-mail: info@aadhaargroup.com.np

Print

Padma Press, Kirtipur, Kathmandu, Nepal

TABLE OF CONTENTS

Graduation Year 2003

Graduation Year 2004

Graduation Year 2005

Graduation Year 2006

Graduation Year 2007

Graduation Year 2008

48.	IMPLEMENTATION OF TURBO CODE IN CDMA 2000	DAMODAR KANDEL	91
49.	ITERATIVE DECODING OF TURBO CODES	DHANESWAR SAH	92
50.	ANALYSIS OF SLOTTED ALOHA BASED SCHEMES AT MAC LAYER FOR MOBILE ADHOC NETWORKS AND UNDERWATER ACOUSTIC SENSER NETWORK	NIRAJ SHAKHAKARMI	94
51.	PAPR REDUCTION IN OFDM SYSTEM USING PULSE SHAPING TECHNIQUE	PRAKASH BAHADUR SHAHI	96
52.	PERFORMANCE EVALUATION OF HANDOVER IN 3G ENVIRONMENTS	PRAKSHET THAPA CHHETRI	98
53.	ANALYSIS OF DIFFERENT TYPES OF CLUSTERING ALGORITHM OF BRAIN MRI SEGMENTATION	SUMAN SHRESTHA	100
54.	DIGITAL WATERMARKING OF AUDIO SIGNALS	MEEN BAHADUR KAKRI	102
55.	DESIGN AND SIMULATION OF SEPARATE L AND S MICROSTRIP ANTENNA	RAJEEV KUMAR KANTH	103

Graduation Year 2009

56.	STUDY AND SIMULATION IF MIMO	AMIT KHANAL	105
57.	IMAGE SEGMENTATION USING HIDDEN MARKOV RANDOM FIELD MODELS – FUZZY CLUSTERING ALGORITHM	BANTI SHRESTHA	107
58.	IMPROVING THE PERFOMANCE OF AODV POUTING PROTOCOL IN AD HOC NETWORK	JAGADISH SHRESTHA	108
59.	CAPACITY AND COVERAGE ENHANCEMENT OF TDD-CDMA ISING RELAYING STRATEGIES	KAMAL BHATTARAI	110
60.	COOPERATIVE POWER MANAGEMENT IN IEEE 802.11 BASED AD HOC NETWORK	MANOJ GYAWALI	113

Graduation Year 2010

Graduation Year 2011

Graduation Year 2012

100.	RECOGNITION OF CANCER CELLS USING IMAGE PROCESSING	ARCHANA GURUNG SHRESTHA	191
101.	CONNECTED DIGIT RECOGNITION IN LOW BIT RATE CODING	DEVENDRA KATHAYAT	193
102.	EMOTION CATEGORIZATION FOR NEPALESE LANGUAGE	GANGA SUBBA	195
103.	SYSTEMATIC APPROACH FOR ANALYSIS OF MIMO AND MIMI-OFDM SYSTEM	KIRAN CHANDRA DAHAL	197
104.	CALL BLOCKING ANALYSIS IN WCDMA CELL	KIRTI GIRI	199
105.	DIRTY PAPER CODE DESIGN FOR MULTIUSER MIMO BROADCAST CHANNEL	KRISHNA PRASAD PHELU	201
106.	FUZZY CLUSTERING BASED BLIND ADAPTIVE OFDM SYSTEM	KRISHNA SUNDAR TWAYANA	203
107.	DECENTRALIZED TDMA SCHEDULING FOR WIRELESS SENSOR NETWORK	LAXMAN PALIKHEL	205
108.	RF AND MICROWAVE RADIATION SAFETY AND ASSESSMENTS	NARESH KUMAR CHAUDHARY	207
109.	WIMAX SECURITY ENHANCEMENT AND PERFORMANCE ANALYSIS	PINTU KUMAR KARN	209
110.	ADAPTIVE MODULATION IN MIMO SYSTEM	RAJEEV PRAJAPATI	211
111.	PERFORMANCE ANALYSIS OF COMP (COORDINATED MULTIPOINT TRANSMISSION AND RECEPTION) IN LTE ADVANCED	RAJENDRA DULAL	213
112.	SOFT FREQUENCY REUSE FOR INTER-CELL INTERFERENCE CO-ORDINATION IN LTE BASED CELLULAR NETWORK	RAJESH KUMAR PAUDYAL	214
113.	PERFORMANCE ANALYSIS AND ENHANCEMENT OF ADAPTIVE MODULATIONS TECHNIQUE IN WIMAX SYSTEM IEEE 802.16 PHYSICAL LAYER	RAJIB BIKRAM ADHIKARI	216

Graduation Year 2013

Graduation Year 2003

Thesis Title: **A MULTI - BAND SPECTRAL SUBTRACTION METHOD FOR SPEECH ENHANCEMENT ADAPTIVE TO SPECTRAL VARIATION OF NOISE**

Submitted by: **Jeevan Kumar Pant**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT:

Speech enhancement is necessary when the production, storage, restoration, recognition, and transmission of speech signal is accomplished. This is because every system that is in close contact with speech has its own type of noise. Therefore various types of noises should be handled during the speech enhancement. Researchers have been giving persistent interest on the problem of speech enhancement by addressing this area from different aspects. Spectral subtraction is the method frequently used because of its simplicity and ease of implementation. Wiener filter is also used as the model based speech enhancement for stationary noise. Kalman filter is also popularly used for non stationary noise as time varying form of Wiener filter. Neural networks are also being used for enhancement of speech in time or frequency domain. Due to simplicity, spectral subtraction is still of interest and its different modifications are

proposed by different researchers to reduce artifacts introduced by this method. In this thesis an adaptive multiband spectral subtraction method for speech enhancement is proposed. In this method the noise model used for enhancement is adapted to the variation of noise spectrum with time. Objective tests have shown that this method is better in reducing the spectral difference between enhanced and clean speech compared to other multi-band spectral subtraction methods. This approach is suitable for noise of which spectral distribution varies with time.

Index Items: Speech Enhancement, Spectral Subtraction, Multiband Spectral Subtraction, Adaptive Multiband Spectral Subtraction

Graduation Year 2004

Thesis Title: **AN INTELLIGENT COMPRESSION TECHNIQUE APPLIED TO THE NEPALI TEXT**

Submitted by: **Arun Ranjitkar**

Supervisor: **Arun Timalsina**

ABSTRACT:

The text compression has gained its value since long time. Then it was the playing of the binary numbers to carry out the messages gave birth to the many of the coding systems such as minimum redundancy code. Later new theory proposed the dictionary-based model in the compression gave new codes such as Limpel-Ziv code etc. Now new methods needed to be focused on so as to have the maximum text compression depending upon the contents of the text, gave new dimension by introducing Artificial Intelligence techniques to the world. Neural networks have the potential to extend data compression algorithms beyond the character level n-gram models now in use, but have usually been avoided because they are too slow to be practical. Here the new concept is introduced a model that produces better compression than popular Limpel-Ziv compressors (zip, gzip, compress), and is competitive in time, space, and compression ratio. The compression is tested with the Nepali text.

Keywords: Neural Network, n-gram model, Prediction by Partial Matching, Predictive Arithmetic Coding

Thesis Title: **ANALYSIS AND PERFORMANCE EVALUATION OF SEGMENTATION OF MAGNETIC RESONANCE IMAGES OF BRAIN**

Submitted by: **Kabita Pathak**

Supervisor: **Prof. Shashidhar Ram Joshi**

ABSTRACT:

Segmentation of medical images is a challenging problem due to the complexity of the images as well as the absence of imaging modalities that fully capture the deformities in each structure of the human body. Segmentation of images obtained from the magnetic resonance imaging (MRI) techniques is an important step in the analysis of MR images of the human body. Tissue classification of normal and pathological tissue types using multi-spectral images of MR images has great importance in clinical practices.

Brain tissue is particularly complex structure and its segmentation is an important task for many purposes i.e., for delineation of areas to be treated prior to radio surgery, the delineation of tumors before and after surgical or radio-surgical intervention for response assessment, and for the calculation of area and volume occupied by different tissue structures of brain. MRI can also provide additional information about structural brain lesions which may compliment that available from CT. In

this study the volumes of white matter, gray matter, cerebrospinal fluid, abnormal tissues of the magnetic resonance images of the brain are the matters of interest.

Selection of proper segmentation methods is the prime purpose of this work. This thesis is totally concerned to the segmentation of MRI of brain and the analysis and performance of different segmentation techniques that can be employed in the segmentation process. The different segmentation techniques including edge based segmentation, multilevel thresholding, region-based approaches, clustering and Artificial Neural Network classifiers incorporating supervised and unsupervised learning processes are used to generate useful outcome.

Thesis Title: **IMPROVING QUALITY OF SERVICE IN WIRELESS LOCAL AREA NETWORK**

Submitted by: **Om Bikram Thapa**

Supervisor: **Prof. Kin-ichiroh Tokiwa and Arun Timalsina**

ABSTRACT:

Quality of service (QoS) is a key issue of today's IP network, which increasingly carries multimedia applications like streaming audio/video, voice telephony etc. At the same time, the Internet is becoming more and more heterogenous due to huge popularity of wireless LAN and wireless LAN has become the edge network of choice. Concurrent with these developments is a high demand of QoS sensitive applications in wireless LAN environments as well. But the issues inherent in wireless environments like scarce bandwidth, time-varying channel characteristics and unpredictable interferences pose difficulties in meeting quality of service required by real-time traffic such as multimedia applications. Moreover, IEEE 802.11-the most widely used WLAN standard-doesn't provide differentiated services to the QoS sensitive traffic. Thus, a large number of schemes have been proposed to enhance QoS of IEEE 802.11.

This thesis, using a network simulator, analyzes and compares various differentiation mechanisms for distributed MAC protocol of IEEE 802.11 including EDCF of the emerging IEEE 802. The

in terms of QoS metrics-throughput, latency, jitter and collision rate. Additionally, the thesis proposes incorporation of two schemes: Slow CW Decrease and Distributed Delay Control in EDCF, which can improve delay and jitter performance of QoS sensitive traffic as well as the overall throughput of the system and the results of the simulation, confirm these improvements over EDCF.

Key words: Wireless LAN, CSMA/CA, QoS, differentiation, EDCF, slow CW decrease, distributed delay control.

Thesis Title: **TIME HOPPING SPREAD SPECTRUM MULTIPLE ACCESS INTERFERENCE OF ULTRA WIDE BAND IMPULSE RADIO**

Submitted by: **Barun Koirala**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT:

Ultra wide band impulse radio modulation is an ongoing open research field for the point to point and short distance high speed data communication. For the wireless system the analysis of interference always play a vital role for the design of the receiver and transmitter. At the same time it will have a great importance on link budget analysis,

Impulse radio (IR) is an ultra-wideband (UWB) modulation that uses waveforms which consist of trains of time-shifted sub nanosecond pulses. Data is transmitted using pulse position modulation at a rate of many pulses per symbol.

Multiple access capability is achieved using spread spectrum time hopping. Impulse radio promises to be a viable technique to build relatively simple and low-cost, low-power transceivers that can be used for short range, high speed multiple-access communications over the multi-path indoor wireless channel.

In this thesis, we have tried to find out the multiple access interference of time hopping pulse position modulation of ultra wide band impulse radio on certain assumed condition for the AWGN channel and single correlation receiver. The performance is calculated in terms of bit error rate against various numbers of users. As this is an open research field lots of things yet to be done. While analyzing the performance the ratio of attenuation of undesired to desired transmitter is assumed to be unity. But on real condition it is not to be unity. Thus this part would a good area for further research. This thesis can be a resource for further research on signal to interference optimization and link budget analysis of UWM impulse radio.

Thesis Title: **PREDICTION ACCORDING TO BIRTH - CHART BASED ON HINDU ASTROLOGY**

Submitted by: **Rajendra Lal Rajbhandari**

Supervisor: **Associate Prof. Shashidhar Ram Joshi**

ABSTRACT:

The software for birth-chart predication, which is the outcome of the thesis, will be beneficial to those persons who are interested in Hindu astrology and want to know something about the past, present and future in their lives; computed from their birth-charts.

Birth chart is the real presentation of the position of stars and planets in the universe with respect to the person's (Jatak) birthplace and time of birth. This acts as a reference point in predicting the jatak's past, present and future life. The stars and planets in the universe are changing their own position as well as the position with respect to the earth or jatak's birthplace with time periodically. This periodical change in position of planets and stars affect jatak's life similarly. This can be analyzed as according to the position of planets and stars of the universe at that time with respect to the position of the same planets and stars in the birth chart. More details are given in introduction part.

Lots of software related to Hindu astrology has been developed, but not much software has been developed related to prediction based on birth-chart because of a lot of hindrances in computation. Some computational efforts with the help of database have been carried out but it is beyond the reach of the majority and prediction is correct only up to some extent. There are computational difficulties arising in the matter of planet's dristi and number of planets in one house and their strengths.

The software developed in this thesis is by Majority Weighting Selection technique**.** The followings are the steps of analysis in developing software:

Analysis of nine planets and twenty-seven Nakshatra, their periodical revolution and movement in their own position and with respect to the earth and sun respectively.

Analysis of Lagna Kundali (Birth chart). Regarding lagna (Rashi in first house of the birth chart) analysis of birth charts of twelve different lagna.

Analysis of the effect of each of the nine planets in each house of lagna kundali either alone **or** in association with other planets.

Analysis of interrelationship among the nine planets and their Dristi in the corresponding houses of the lagna kundali.

Each Lagna Kundali is analyzed with the position of each planet in each of the 12 houses one by one. According to the output of the analysis the weightings are assigned for the planets after

analyzing the interrelationship of the swami of the house. The 4 weightings are considered.

Weightings - indication 4 Excellent, 3 Good, 2 General and 1 Poor or Lacking results.

This Software has been developed by implementing object oriented language *Visual Basic 6.* This technique has been able to solve most of the above hindrances up to optimum level and the prediction is also optimum.

Thesis Title: **"LA PAU" SCRIPT READING BY MEANS OF DIGITAL IMAGE PROCESSING**

Submitted by: **Prtima Pradhan**

Supervisor: **Associate Prof. Shashidhar Ram Joshi**

ABSTRACT:

In this thesis, technique for the preservation of "Lu Pan Script" is presented. This Buddhist Sanskrit document is being used for prayer recitation, hence needing to be preserved in digital form.

The preservation system evolves by dealing with three subsystem; preprocessing, segmenting of text from background and binary cleaning. In the preprocessing, a rotating smoothing mask is taken up, after a comparison with other local averaging mask whose intensions are not only noise cleaning but also avoiding the edge blurring at the same time. This subsystem not only performs its intended tasks but also decreases the computation time for the neural network applied during the text segmentation.

In the text segmentation, the segmentation of text from the background is performed. Many modules of segmentation are compared, in order to gain the best result. The proposed segmentation method takes up the application of artificial neural network. This work proposes a MLP model, with BP training, for the classification of text from background for the document

images under study. This module takes advantage of the gray level of the image together with the spatial feature. The parameter values are selected by experimental verification. The preprocessing algorithm assists in the quick convergence and brings out the best visual effect of the text.

The last of the system consist the binary cleaning. The binary cleaning is an enhancement work to the text preservation. A set of morphological masks are compared. The proposed system being a rotating mask to clean undesired background segments and fills small remaining holes inside the text part.

Thesis Title: **A STUDY ON SEGMENTATION AND ANALYSIS OF NEPALI CHARACTER FOR CHARACTER RECOGNITION SYSTEM**

Submitted by: **Daya Sagar Baral**

Supervisor: **Associate Prof. Shashidhar Ram Joshi**

ABSTRACT:

The character recognition is the one of the interesting branch of the pattern recognition. The Nepali script uses the alphabetic characters with complex combination of the character symbols. For the character recognition system the segmentation of the character is necessary. The Nepali script is written from left to right and most of the symbols written in Nepali stand for a consonant plus an inherent vowel. Vowels written at the beginning of a word have distinct symbols and the vowels which follow a consonant takes a modified shape, which is placed to the left, right, top or bottom of the consonant. When consonant without a vowel is written before a consonant then it is written as a half character which joins with the next consonant character. Because of these complex behaviors of the Nepali script than that of the Roman the segmentation and finally the recognition different. For the recognition process the text zone is separated form the whole document. Since segmentation is one of the essential portions of the character recognition system and the

segmentation requires detail knowledge of the characters the analysis of the characters is done. For segmentation initially lines are separated. This is done by using the idea that there is a horizontal gap between the lines but for the touching lines improved algorithms are used. After the segmentation of the lines the words are separated. Words are separated by taking the idea that there is a vertical gap between the words and words are connected by the horizontal header line. After word segmentation the characters are segmented from the word. Since the characters are connected to each other by the header line, it is removed first and characters are separated. But for modifiers and touching characters improved algorithms are used for separation.

Thesis Title: **A STUDY ON LOSSLESS CODING OF DIGITAL AUDIO**

Submitted by: **Sharad Kumar Ghimire**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT:

This thesis mainly focuses on lossless audio compression. Many lossy compression schemes have been widely used (such as MPEG compression), and such schemes are not capable of maintaining high quality as in original format. Applying entropy coding methods as Lempel-Ziv, Huffman or arithmetic coding directly to the audio signal is not very efficient due to the long-time correlations in a 16-bit sampled at 44.1 kHz signal. Therefore, direct use of conventional data compression tools fail in the case of digital audio data. A preprocessing stage, which eliminates the statistical dependencies within the signal, leads to an almost uncorrelated source signal which is easier to code.

In the field of lossless compression there are two broad development sections, modeling of signal and coding algorithm. The modeling mean to know the nature of source signal and coding concerned with the efficient representation of symbols. The purpose of modeling is to de-correlate a signal. There are two different method of modeling a signal, predictive modeling

and transform based modeling. In this thesis predictive modeling based on FIR filter is discussed in depth.

Graduation Year 2005

Thesis Title: **PERFORMANCE IMPROVEMENT IN CDMA CELLULAR COMMUNICATION SYSTEMS EMPLOYING ADAPTIVE ANTENNAS**

Submitted by: **Sagar Ghimire**

Supervisor: **Rjendra Lal Rajbhandari**

ABSTRACT:

Tremendous growth in the wireless communication demands for the higher system I capacity. Due to the limited spectrum, it is critical to have the efficient use of frequency resources. Multiple Access is implemented by having the users share the base station. There are three domains in which this sharing can take place i.e. (i) frequency (ii) time and (iii) code. CDMA employs the spread spectrum modulation in which each user's digital waveform is spread over the entire frequency spectrum that is allocated to all users of network. In this technique, each user signal is modulated with a unique code that identifies the sender. In CDMA system, the capacity is interference limited, the blocking in CDMA system is defined to occur when the interference level exceeds the predetermined level. As the number of user increases, the signal quality of each user degrades gracefully, placing the soft limit on capacity. The use of adaptive antenna array combines,

multiple antenna elements with a signal processing capability to optimize its radiation and /or reception pattern automatically in response to the signal environment. These systems can provide greater coverage area for each cell site, higher rejection of interference, and substantial capacity improvement.

The improvement in performance is quantified by comparison with the omni directional antenna system using realistic simulations. The comparisons of different adaptive arrays are discussed. A high level of capacity can be achieved via frequency reuse within a cell by using independently steered high gain beams at the same carrier frequency to provide service to the individual users within a cell. To carry out the frequency reuse within a cell, a certain spatial isolation between co-channel signals is required to maintain an acceptable signal to interference power ratio. Adaptive array can provide such a spatial isolation by providing a beam at the mobile user and at the same time nulling out the interference from co-channel user.

Thesis Title: **CLASSIFICATION OF HANDWRITTEN NUMERALS USING SUPPORT VECTOR MACHINE**

Submitted by: **Subash K. C.**

Supervisor: **Shashidhar Ram Joshi**

ABSTRACT:

For a human brain, it is very easy to recognize a face, understand spoken words, read handwritten characters; however these processes are actually very complex which involves the act of taking raw data and making an action based on the "category" of the pattern - A field of study known as pattern classification, or in a more broader sense it may be called as pattern recognition. The solution of above mentioned problems such as face recognition, speech recognition and classification of hand written characters, using computers has proved to be immensely difficult. Throughout the years many classification algorithms have been developed tested and applied in many fields.

The objective of this thesis work is to study an important classification algorithm, known as the Support Vector Machine (SVM) and as an application develop a system that would recognize handwritten numerals from 0 to 9.

The work is divided into three major parts:

1. Collection of training examples of digits.

2. Training the SVM, and

3. Classification.

The training examples are needed to train the SVM for which we need to collect as many data as possible. These training examples with their corresponding output labels are used to train the SVM, which will then be able to correctly classify the unseen test numerals.

Thesis Title: **INTER-CARRIER INTERFERENCE CANCELLATION IN ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING SYSTEMS**

Submitted by: **Dipesh Shrestha**

Supervisor: **Ram Krishna Maharjan**

ABSTRACT:

With the rapid growth of digital wireless communication in recent years, the need for high-speed data transmission has increased. New modulation techniques are being implemented to keep up with the desire communication capacity with Shannon's limitation in mind. Digital Signal Processing power has increased to a point where Orthogonal Frequency Division Multiplexing (OFDM) has become feasible and economical. OFDM, which has strong resistance to inter-symbol interference (ISI), is an multi-carrier modulation scheme and has been adopted for several wireless standards such as IEEE 802.1 la, 802.1 Ig, EU-DAB, DVB-T, OFDM-UWB and HiperLAN2. However since the multiple carrier separation of OFDM system is very less, it is sensitivity to frequency offset between the transmitted and received carrier frequencies which is well-known problem of OFDM. This frequency offset introduces inter-carrier interference (ICI) in the OFDM.

This thesis investigates various methods for combating the effects of ICI. These methods are compared in terms of bit error rate performance, bandwidth efficiency, and computational complexity. Through simulations, it is shown that the used techniques are effective in mitigating the effects of ICI. The techniques used to decrease ICI are: Self Cancellation, Maximum Likelihood Estimation and Extended Kalman Filtering. Mathematical relations are implemented to analyze each of these techniques. Through simulations, it is shown that the three techniques are effective in mitigating the effects of ICI.

Thesis Title: **PERFORMANCE ANALYSIS OF TURBO CODE OVER AWGN CHANNEL**

Submitted by: **Birendra Thapa**

Supervisor: **Rajendra Lal Rajbhandari**

ABSTRACT:

Shannon in 1948 discovered Channel Capacity Theorem. He calculated the limit for the rate of information transmission for which error free transmission was possible. Shannon also showed that by appropriate coding techniques this ultimate information transmission rate could be possible. Since then many researchers have tried to develop codes that could transmit information near Shannon limit. Recently various codes have emerged which could transfer information near Shannon limit. Among them the most promising one is Turbo Codes.

This thesis begins with a model of various error correcting codes including Turbo Code. An analysis is done by comparing Turbo Code with other codes like Block Code, Convolution Code, and Trellis Code in AWGN channel. It is shown that significant coding gain is achieved using Turbo Code. Performance of Turbo Code is investigated for various iterations and decoding algorithm. Linear-log-MAP algorithm offered the best performance among the three Turbo decoding algorithms.

Thesis Title: **LIVE SEQUENCE CHART: BREATHING LIFE INTO MESSAGE SEQUENCE CHART IN BRIDGING BETWEEN CUSTOMER AND DEVELOPER**

Submitted by: **Pranita Upadhyaya**

Supervisor: **Shashidhar Ram Joshi**

ABSTRACT:

The problem of software failure looms large in the modem world. A lot of efforts are being made in this field. "Software Engineering" was introduced in this regard to concentrate on reduction of software failure and development of the optimum software.

Message Sequence Chart (MSC) is a standardized (ITU-T.2.120) graphical and textual language for the description and specification of the inner action between system components.

Live Sequence Chart (LSC) is a rich extension of MSC, since it deals with specifying liveliness i.e things thai must occur.

Thus. the study proposes to identify an attractive visual effort to capture the system requirements during the early design phase of software engineering to reduce the software failure. Further, to propose the concept of bridging, to show how the effort called Message Sequence Chart can be used to capture the system requirements during the requirement analysis phase of software

engineering, which is demonstrated by means of "Automatic Teller Machine (ATM) ". And also to propose the concept of Live Sequence Chart: an extension of MSCs, since it deals with specifying liveliness i.e. things that must occur. The dissertation evaluates the best suitable one (either MSC or LSC) or both at the end of the study while bridging the gap.

Thesis Title: **CHANNEL ALLOCATION STRATEGIES IN WIRELESS CELLULAR NETWORKS**

Submitted by: **Dilli Ram Adhikari**

Supervisor: **Timila Yami Thapa**

ABSTRACT:

Wireless cellular network is a fast growing communication technology for supporting personal communication, data, and video transmission through the common air interface medium. The communication is carried out via the radio spectrum which is a scarce resource. The wireless channels are limited within the system but the user density is rapidly growing. Therefore a careful management of radio resources is the key challenge of modem wireless network designers. To optimize the wireless channel in the cellular network, different channel allocation strategies are carried out during the development of cellular network technology. But the development of new and most advantages and reliable channel allocation strategy is still the subject of research. The most common strategy is Static channel allocation strategy where the available channels are divided into groups and assigned into different cells in a cell cluster. But changing traffic distribution and load balancing is the problem of this policy. And then dynamic channel allocation strategy is come into practice in which all the channels are kept in the

central pool and assigned into the cell according to the call request so that the radio resource is greatly optimized. This method overcome some problem of static assignment but has some drawbacks too. The distributed and centralized allocation schemes are some of policies under the dynamic allocation strategies. Some times the combination of static allocation and dynamic allocation is employed to get the advantages of both allocation and this type of allocation is called hybrid channel allocation.

In this thesis work the study of general cellular networks, its performance evaluation and channel allocation policies are illustrated. Different channel allocation schemes with algorithms are presented, and performance is evaluated in different traffic distribution and network structure scenarios. Then the allocation policy is suggested according to the need of the operators.

Thesis Title: **STUDY AND ANALYSIS OF RADIO PROPAGATION FOR CELLULAR MOBILE SYSTEMS**

Submitted by: **Dirghayu Kumar Shrestha**

Supervisor: **Prof. Jagan Nath Shrestha**

ABSTRACT:

The main emphasis of this thesis is to predict the path loss suffered by a signal and the minimum power required for a transmitter for a sufficient link quality. If one can predict the path loss of a signal, then one can approach the installation of the antennas and other RF equipment with some degree of confidence that the signal received within a certain area will be of useful strength.

With the numerous parameters such as the natural terrain, the types of buildings present, the foliage conditions, and changes in weather, that can be taken into account, predicting the propagation loss of signals presents itself to be a formidable task. In fact there are commercial software pack-ages available which are designed to take into account these parameters, to predict the coverage plots for given cell cites. These packages may cost thousands of dollars. However one can develop and make use of simplistic propagation models which take into account only a limited number of these parameters, that still produce meaningful

results. Furthermore, using path loss models to predict the signal strength as a function of distance also accommodates the prediction of the SNR for a mobile communications system.

This thesis is concerned with the estimation of the coverage for the cellular networks, through the means of statistical modeling. The objectives of the thesis can be summarized as follows:

- To study different propagation models for the cellular mobile systems.
- To analyze coverage for different service probability.
- To estimate base station power for a good radio link.

This thesis is organized in the following manner. Chapter 1 presents some background information regarding the cellular concept, the frequency reuse, co-channel interference and system capacity, concept of handoff, architecture and development of wireless networks.

Chapter 2 presents some background information relevant to this thesis. The first of these discusses radio wave propagation, and introduces large-scale propagation loss, as well as small-scale fading. The second section discusses some classical and widely accepted propagation models for mobile radio systems. The last section discusses the different fading models.

Chapter 3 consists of four sections. The first section discusses the evolution of coverage estimation technique. This is followed by

traditional concept of cell edge reliability, cell area reliability and shadow fade margin. The third section is dealt with the determination of percentage of coverage area and the last section discusses the radio link power budget.

Chapter 4 presents the results of the statistical analysis and the major findings of the thesis. In chapter 5, the conclusion and some recommendations are made for the Held measurement (radio survey) to facilitate any work regarding the design of cellular networks.

Thesis Title: **RF OPTIMIZATION OF GSM NETWORK**

Submitted by: **Sujan Kafle**

Supervisor: **Rajendra Lal Rajbhandari**

ABSTRACT:

The main objective of thesis is to develop a GSM system that will effectively optimize the performance of a GSM networks on a band-limited system. During the system development we have consider the different important parameters of GSM such as frequency reuse, carrier to interference ratio, grade of service, maximum number of simultaneous call in a cluster for a different value of frequency reuse factor, capacity improvement techniques such as cell splitting, cell sectorization, cell tiering, different channels of GSM such as traffic channel and control channel and their impact in coverage, capacity and voice quality of a GSM networks. Beyond these parameters, it have also included some very useful design such as calculation of path loss and design of cellular concept using the Okumura-Hata model, concept of location update, emergency call concept, data of cell, data of users concept of mobile terminating call and mobile originating call etc.

Global system for mobile (GSM) is a second-generation cellular standard that was developed to solve the fragmentation problems

of the first cellular systems and it specifies digital modulation techniques and network level architectures and services. This thesis explains that how these features of GSM overcome the problem of first generation and the exact technique employed in that one. The objectives of the thesis can be summarized as follows:

- To implement a system that calculates the path loss using Okumura-Hata model.
- To implement a system that has a good coverage area.
- To implement a system that has a greater capacity.
- To implement a system that has a good voice quality.

Thesis Title: **AN ARTIFICIAL NEURAL NETWORK APPROACH FOR LOSSLESS VIDEO COMPRESSION**

Submitted by: **Barun Rangitkar**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT:

Video compression is a subset of the-general technique of data compression, whereby a 'Signal', which can be thought of as a series of numbers, is squeezed, or 'compressed' into a smaller set of numbers. These numbers will then take up less space on a hard drive, or take less time to transmit over a network. Before the numbers are used again, a 'decompression' algorithm is applied to expand the series of numbers to its original (or at least a similar) form. Video compression utilizes the fact that the signal is known to originate as digitized video, in order to increase the 'compression ratio', or the amount of squeezing thai can be applied to the series of numbers to be stored or transmitted. Significant compression of video and audio are considered 'lossy' algorithms, because they discard (or 'lose') some portion of the original information — the reconstructed number series does not exactly match the original. This is acceptable because the precision with which we view video and

audio, compared to the resolution of the digitization process, is not perfect. While the video signal may become slightly distorted, it is still recognizable.

All major digital video delivery methods are currently based on lossy compression techniques. The Real time lossy compression must sacrifice either image quality or overall compression level. Raw uncompressed video exceeds the data rate of all existing consumer hard drives, so it must be compressed before being written to the hard drive. To achieve a good level of compression, while maintaining both the real time requirements and losslessness is a non-trivial problem.

In this thesis, the neural network based video compression is considered for the lossless compression. The proposed technique includes steps to break down large video signal into smaller numbers and eliminate redundant information. Furthermore, the technique employs a neural network trained by a non-Iterative, direct solution method. An error back propagation algorithm is also used to train the neural network, and both training algorithms are compared. The proposed technique has been implemented in C++ on the Personal computer. A number of experiments has been conducted. The results thus obtained are compared with the general available compression software, such as WinZip, WinRar etc for the compression ratio.

Keywords:- Data Compression,' Lossless video Compression, Arithmetic Coding, Neural Network, Back Propagation.

Thesis Title: **PERFORMANCE EVALUATION OF DIFFERENT MODULATION TECHNIQUES OF UWB MULTI-ACCESS SYSTEM FOR HIGH DATA RATE COMMUNICATION**

Submitted by: **Adesh Khadka**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT:

The UWB system has traditionally been designed using baseband impulse, with radar system in focus, with the growing trend of use of UWB communication system, the new modulation techniques for different multiple access techniques are on research field. Time-hopping and Direct-sequence multiple access in conjunction with modulation like pulse position modulation and phase shift keying are most commonly used techniques. The IEEE is also pursuing the process of standardization of the UWB system with wireless standard like IEEE 802.15.3 with Multiband OFDM system; it has already developed the standard for MAC layer. This thesis focuses on the time-hopping and direct sequence methods, with assumed condition of AWGN channel and simple correlator receiver as optimum. The performance of the system is measured in terms of bit error-rate probability for limited number of multiple users in the system.

Thesis Title: **OPTIMAL CAPACITY DESIGN AND PERFORMANCE EVALUATION FOR CELLULAR MOBILE NETWORK INSIDE RING ROAD IN KATHMANDU VALLEY : A HANDOVER CONSIDERATION**

Submitted by: **Mohan Raj Kaphle**

Supervisor: **Prof. Jagan Nath Shrestha**

ABSTRACT:

Cellular mobile communication always encounter with two types of calls: newly originating calls and handover calls. Normally, vehicular users, who are moving with high speeds, demand handover. Since, there will be conversation in progress in case of handover calls, they should be served with high priority compared to newly originating calls i.e. Grade of Service for handover calls should be less than that for newly originating calls. Basically, there, are three channel assignment schemes, fixed, dynamic and hybrid channel assignment schemes, for handling newly originating and handover calls so as to get minimum blocking and maximum channel utilization with the high priority to be given to handover calls.

In this thesis work, capacity design for cellular mobile network in area of Kathmandu metropolitan and Lalitpur sub metropolitan cities lying inside ring road has been done according to the

findings of data collection conducted for estimation of area, population, road length and vehicular users inside ring road, as the pre-requisite for the prediction of total mobile traffic inside ring road and study and analysis of Nepal Telecom as mobile communication service provider to find the area requiring improvements & modifications to guarantee better quality of service. Capacity planning, in the area of interest, has been done with Grade of Service equal to 2 % for newly originating calls and 1 % for handover calls.

In addition to the capacity planning, efficient channel assignment scheme, among three mentioned above, in terms of blocking and throughput has been evaluated with optimal utilization of the designed capacity for getting minimum blocking for both newly originating and handover calls maintaining the blocking for handover calls always less than that for newly originating calls. The simulated values of Grade of Service and throughput for all fixed, dynamic and hybrid channel assignment schemes at different penetration have been compared and hybrid channel assignment scheme has been found to be most efficient among the three channel assignment schemes.

Thesis Title: **ANALYSIS ON IMPLEMENTATION ISSUES OF DOMAIN NAMES IN NEPALI LANGUAGE**

Submitted by: **Bikram Shrestha**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT:

This report describes the work done so far to analyze issues related domain names in Nepali Language as a final year thesis work for the completion of MS degree in Information and Communication Engineering. The thesis title lias been approved by the department and this work is conducted with close guidance of supervisor.

An Internet address or domain name is a distinctive and unique cyber address of a website/computer. In cyberspace all commercial activities and transactions lake place at the websites and companies spend millions of dollars to build and refine their websites to promote greater commercial activities from the visitors of their websites. Efficiency of domain name has been put into a question since it was only possible to have Internet addresses in English. More than about 70% of the world's populations do not use English as their mother-tongue language including Nepalese. The development and implementation of domain names in different languages other than English has been

marked recently, however no such work has been conducted for Nepalese language.

This thesis report mentions the problems for implementing Nepali Domain Names and also points out the objectives achieved during the thesis completion. The general methodology adopted for the completion of thesis work and issues related to implentation of Nepali domain names are well discussed. These issues are categorized into areas of technical issue, cultural issue and legal issues. Final conclusion of the report states that Nepali Domain names can be implemented with minimal technical difficulties and number of open cultural issues.

Thesis Title: **PERFORMANCE ANALYSIS IN PARALLEL COMPUTING**

Submitted by: **Surandra Kumar Thakur**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT:

This thesis gives idea about performance analysis in parallel computing. It covers both the techniques used to design parallel programs and the tools used to implement these programs. It contains parallel algorithm design, performance analysis, and program construction. It gives information about different models, design and analysis of the algorithm to solve the modeled problem computationally, implementation and finally its performance in analyzed.

Thesis Title: **PERFORMANCE ANALYSIS OF SECURITY SCHEMES USED IN WIRELESS LAN**

Submitted by: **Danda Beer Rawat**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT:

The emerging wireless technologies promise everywhere on demand access to the desired information, thereby exhibiting a great potential for efficiency improvement. As the popularity of wireless networks increases, so does the need to protect them. In recent years, many researchers have studied the limitations of the security mechanisms that protect wireless networks. There has also been much research in the power consumption introduced by the network card. It is shown that, while trying to solve the existing security problems, the introduced protocols feature new vulnerabilities themselves. Generic performance analysis of wireless LAN security schemes is presented, thereby focusing on the wireless security extension.

The Thesis will focus on the performance analysis and comparison of algorithms used in wireless LAN 802.11. The key parameters used to check the performance of algorithms are number of rounds, key size time and battery consumption. Then recommend the parameters required for different wireless

schemes used in wireless LAN for better security and higher throughput.

Graduation Year 2006

Thesis Title: **PERFORMANCE ANALYSIS OF GSM MOBILE SYSTEM OF NEPAL TELECOM IN HIGHLY CONGESTED AREA OF KATHMANDU CITY**

Submitted by: **Dipesh Shrestha**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT:

The cellular concept was a major breakthrough in solving the problem of spectral congestion and user capacity. The quality of a designed cellular mobile radio network does not only depend on performance of radio links, but also on dimensioning of capacity in the whole network to support the additional loading due to user mobility.

The objective of this thesis is to explore innovative approach to improve the Grade of Service (GOS) and quality by studying the performance of mobile cellular network in the highly congested area of Kathmandu City. The theory needed for it, including radio network design fundamentals, capacity analysis, radio wave propagation models (propagation analysis) such as Hata model, Walfish Ikegami model etc, link budget as well as frequency analysis is presented.

Detail study and analysis of various data related to GSM mobile system of Nepal Telecom has been done. The performance analysis is especially focused on TCH, Power, Handover, Receive Quality measurement report and minimum reuse distance. The results show that the congestion seems to be one of the major factors of the degradation of the network. The suggestions are made that the system can be improved by increasing more capacity (GoS improvement) to chosen sites by adding TRX in each sector provided that the 120° half-power beam width antenna should be used instead of 64°. By adding another directional antenna (64° half-power beam width) at each base station, the GoS improvement can also be done. The transmitted antenna power of each BTS should be determined based on cell radius.

Keywords: Mobile system, Nepal Telecom, Grade of service. Half-power beam width

Thesis Title: **PERFORMANCE ANALYSIS OF EXPLICIT CONGESTION NOTIFICATION IN TCP NETWORK**

Submitted by: **Krishna Prasad Bhandari**

Supervisor: **Dr. Subara Shakya**

ABSTRACT:

Congestion is perhaps the paramount challenge to the designers, implementers and users of the computer network and especially Internet & similar networks because of the increasing versatility and service coverage of the Internet technology and obvious limitation of vital resources like bandwidth and processing power.

Network congestion is chiefly caused by the lack of sufficient bandwidth in the intervening media as well as the packet processing/forwarding capacity of the intermediary routers that have to route packets between the source and destination. As there my be multitude of such devices in the network with different capacities and different traffic loads, getting an effective congestion control mechanism needs to take care of a number of different parameters.

Conventional congestion control mechanism have largely been based on a reactive concept: the sender of the traffic reduces the sending rate only after a timeout or packet drop is noticed.

However, such mechanism is not very effective in efficient utilization of resources while keeping packet losses under control. The concept of Explicit Congestion Notification (ECN) came to address this problem. What ECN does, in effect, is to notify the senders and receivers that congestion is imminent and prompt them to take actions to avoid or control it. This is accomplished by explicitly marking the TCP (Transmission Control Protocol, the reliable protocol of Internet) packets to indicate possible congestion. The very name of this technique indicates the explicit nature of information embedded in the packet that indicates probable network congestion.

This thesis has analyzed the performance or ECN in TCP network using the NS2 network simulator program. Various network parameters were tested with and without use of ECN and the result show that for a network where all the devices can understand ECN, the congestion control is best achieved by using ECN.

Key words: TCP, ECN, RED, Drop Tail, Congestion, Window Size, Queue Size, ECT, CWR, ECE

Thesis Title: **PERFORMANCE ANALYSIS OF TRELLIS CODED MODULATION**

Submitted by: **Bikram Dangol**

Supervisor: **Rajendra Lal Rajbhandari**

ABSTRACT:

Trellis-coded modulation (TCM) is one of the coded modulation techniques used in digital communications. It combines the choice of a modulation scheme with that of a convolutional code together for the purpose of gaining noise immunity over uncoded transmission without expanding the signal bandwidth or increasing the transmitted power.

In this thesis work I have analyzed the Bit Error Rate (BER) TCM schemes over the additive white Gaussian noise channels. I have developed the simulator to obtain BER as a function of the signal-to-noise ratio (SNR) for trellis codes. The performance of trellis codes and the uncoded M-ary Quadrature Amplitude Modulation (MQAM) schemes are also compared. The performance of TCM is analyzed on the basis of coding gain too.

Thesis Title: **STUDY ON ANALYSIS OF PATH PROFILE FOR MICROWAVE COMMUNICATION LINK**

Submitted by: **Jitendra Kumar Mishra**

Supervisor: **Rajendra Lal Rajbhandari**

ABSTRACT:

We are living in a high-tech and information era. Modem communications are becoming much more important in our daily life. Microwave communication is one of the necessaries, methods in modem communications. Since the 1950s, the terrestrial line-of- sight (LOS) microwave links have been one of the main means of long distance wireless communications. The lower position of the atmosphere, called the troposphere, and its refractive index are the main factors influencing LOS microwave systems. Microwave technology that was developed was used to send large numbers of long-distance telephone calls around the Nepal and other countries. The structures of the atmosphere directly affect microwave propagation. The atmosphere is not always well mixed throughout the range of elevations occupied by the transmission path. Various types of disturbances affect propagation. Almost invariably, these result in a loss in received signal strength. In this case the signal is said to fade and the process whereby signal loss occurs through such causes is called fading.

In this thesis work we mainly focus study of fading analysis of microwave communication link for existing Link and here for study we choose Patan Indrasthan microwave link communication. It is widely acknowledged that the k factor Plays key role in microwave link here some statistical characteristics of k factor for the locality and their utilization are introduced. The present research is mainly focused on reviewing and confirming k factor value and finally in this thesis, tools for the path profile analysis is developed.

Thesis Title: **PARTICLE TRACKING VELOCIMETRY USING GENETIC ALGORITHM**

Submitted by: **Sanjeeb Prasad Pandey**

Supervisor: **Shashidhar Ram Joshi**

ABSTRACT:

This paper presents a 3-D particle-pairing algorithm for particle tracking velocimetry using "Genetic Algorithms". Genetic algorithms are searching algorithms for obtaining an optimal solution based on the mechanism of evolution. The particle pairing between two tracer images with a constant time interval is needed to obtain a velocity vector field. Since the algorithm adopts fitness function, which totally evaluates the similarity between respective small particle patterns in the two tracer images over the field, it promises to give a more correct velocity vector distribution than the conventional Particle tracking velocimetry (PTV), which identifies each particle based on its local information. The genetic algorithm particle matching using two different fitness functions is applied to two time-differential datasets of three dimensional (3-D) particle coordinates of two standard PIV images (#351 and #352) which are obtained from the web site of the Visualization Society of Japan (http://piv.vsj.or.jp/image3d/image.html) with successful results.

Keywords: Visualization, 3-D PTV, Particle image velocimetry. Particle tracking velocimetry, Particle pairing problem, Genetic algorithm

Thesis Title: **SPACE TIME BLOCK LOADING FOR MULTIPLE ANTENNA COMMUNICATION SYSTEM**

Submitted by: **Santosh Prajapati**

Supervisor: **Shashidhar Ram Joshi**

ABSTRACT:

Wireless system designers are faced with a number of challenges, 'these include the limited availability of the radio frequency spectrum and a complex time-varying wireless environment (fading and multipath). In addition, meeting the increasing demand for higher data rates, better quality of service (QoS), fewer dropped calls, higher network capacity and user coverage calls for innovative techniques that improve spectral efficiency and link reliability. The use of multiple antennas at the receiver and/or transmitter in a wireless system, popularly known as space-time (ST) wireless or Multi Antenna communications is an emerging technology that promises significant improvements in these measures.

Multiple Antenna Communications is used to (dramatically) increase the capacity and quality of a wireless transmission. Multiple Antenna system exploits multipalh instead of mitigating it. Space time coding scheme allows for the adjusting and

optimization of joint encoding across space and time in order to maximize (he reliability of a wireless link.

Space-time coding finds its applications in cellular communications as well as in wireless local area networks.

In this thesis, we have tried to exploit the capacity and quality improvement of Multiple Antenna communication using Space Time Block Codes. We find out Capacity of Multiple Antenna Communications System, Performance Analysis of different rates Space lime block codes for different transmit antenna and computing capacity of space time block codes. The capacity is calculated in terms of bits/s/Hz for different SNR. The performance is analyzed in terms of Bit error rates for the fixed SNR.

Thesis Title: **RAYLEIGH FADING CHANNEL SIMULATOR**

Submitted by: **Purushottam Sigdel**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT:

Rayleigh fading may be considered the most critical disturbance in a wireless communication system. In its most general form, it is modeled as a multiplicative time continuous random (zero mean complex Gaussian) distortion of the transmitted signal. In order to achieve an efficient communication, the analysis of impact of the fading channel over the transmitted signal is needed. This thesis mainly address to generate statistically nearer to rayleigh fading channel used for mobile radio channel simulators, which are commonly used in the laboratory. Simulators are used in laboratory because allow system tests and evaluations which are less expensive and more reproducible than field trials. Many different approaches have been used for the modeling and simulation of mobile radio channels. This thesis also addresses fading impact of the channel on the transmitted signal with and with out considering the additive noisy channel. It also opens the door for the further research work in the field of selecting the proper signal representation, channel coding and pilot signal for adaptive equalization.

Keywords; Multipath Propogation, Rayleigh Fading Channel, Fading Channels Simulator, Channel Modeling, Channel Response.

Thesis Title: **COMBINING TECHNIQUES FOR MULTI-CARRIER CDMA RECEIVERS**

Submitted by: **Rajecdra Dev Adhikari**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT:

Code Division Multiple Access (CDMA) is a technique where a number of users simultaneously access a channel by spreading their information bearing signal with a preassigned unique signature sequence. This technique has been used in commercial communication systems for years. At the mean time, multi-carrier modulation scheme, called Orthogonal Frequency Division Multiplexing (OFDM), which possesses a capacity to support higher data rates, is gaming popularity in the formulation of new communication standards. OFDM is a transmission scheme where a high rate serial data stream is split up into a set of low rate substreams, each of which is modulated on a separate sub carrier. Techniques that combine OFDM and CDMA have gained popularity in research works as they seem to provide the advantages of both. Such a technique is named Multi-Carrier CDMA (MC-CDMA) and is the topic of the thesis. In MC-CDMA, the user's original data stream is spread over different sub carriers using a given spreading code in frequency domain. With this arrangement, the fractions of data symbol

corresponding to each chip of the spreading code are transmitted through a different subearrier. OFDM and hence MC-CDMA possesses an Important property that fading per narrowband subcarrier could be considered flat provided the symbol duration is smaller

than the coherence time of the channel and the subcarrier spacing is smaller than the coherence bandwidth of the channel. Such arrangement leads to the minimization of leu

and ISI and enables the realization of less complex receivers. In this thesis, effects of applying equal gain combining and maximum ratio combining in MC-CDMA receivers as equalization techniques are studied and the performances of these two techniques in the presence of Rayleigh fading channel in the uplink and downlink directions are analyzed and compared.

Thesis Title: **PACKET LOSS CONCEALMENT FOR VOICE TRANSMISSIONS OVER IP NETWORKS**

Submitted by: **Bijaya Kumar Roy**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT:

Voice-over-IP (VoIP), the transmission of packetized voice over IP networks, is gaining much popularity as a possible alternative to conventional public switched telephone networks (PSTN). At the moment, the much of this interest stems from an asymmetry in pricing structure between Internet access (which is generally flat rate) and normal telephone service (which is billed per minute). However, impairments present on IP networks, namely jitter, delay and channel errors can lead to the loss of packets (erasure of frames) at the receiving end. A packet loss is also declared when the packet doesn't arrive within its playout time on the receiver side. Due to packet loss, received speech becomes unintelligible and thus, results degradation of speech quality. To reduce the quality degradation caused by packet loss, there have several approaches been developed such as QoS control in the Internet (Intserv, Diffserv, RSVP), forward error correction methods, packet loss concealment methods etc.

The sender based algorithms e.g. forward error correction (FEC), however, are more effective than receiver based algorithms, they

require additional bits used for being processed when packet loss occurs. As excessive end-to-end delay impairs the interactivity of human conversation, active error control techniques such as retransmission methods cannot be applied. On the other hand, the receiver based algorithms including repetition based forward PLC and the interpolative PLC have advantages over the sender based algorithms since they don't need any additional bits and thus, already existing standard speech encoders can be used without any modifications.

This thesis work specifically focuses on the receiver-based packet loss concealment method for the ITU-T G.729 codec (CS-ACELP, 8 kbps), which is the widely used codec for VoIP systems due to its low bit rate requirement and good speech quality. The G.729 coder has built-in packet loss concealment algorithm, which considers only the previously received good packets. The built-in PLC works well for single packet loss but suffers from quality degradation when consecutive packet loss occurs. In this thesis, a new receiver-based packet loss concealment method for G.729 codec is presented. The proposed scheme considers the availability of future packets or lately received packets before their scheduled playout times. This scheme employs interpolative approach to estimate the adaptive parameters (pitch delay and gain) for the lost frame using both previously received and future good packets. This technique has

resulted in improved speech quality than the existing method, especially in case of consecutive packet losses. The proposed scheme has big advantage that it has been implemented without introducing any extra delay in processing for PLC as the lost packet is reconstructed within its scheduled playout time.

Thesis Title: **ANALYSIS OF LOW-BIT RATE SPEECH CODER**

Submitted by: **Bishwo Ram Koju**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT:

LPC vocoders are model based vocoders and the model used to represent the speech production mechanism is source-filter model. The problem in model based method is to precisely calculate the model parameters that correctly represent the source and filter The first main tasks in LPC vocoder are to obtain the filter coefficients to model the vocal tract correctly. The next main task is to represent the excitation signal by minimum bits as possible.

The preliminary work of this thesis is study of temporal and spectral properties of speech signal and determination of optimum LP filter order and optimum frame length of speech signal for LP analysis. The main job is to analyze different variations of LPC based vocoders. The tool used is MATLAB simulation. Three types of LPC vocoders, namely. Residue Excited LPC, Regular Pulse Excited LPC and Multipulse Excited LPC are simulated.

The simulation result shows that the LPC of order ten can precisely represent the formants of 4 KHz band limited speech

segment. And LPC coefficients and voiced/unvoiced information are enough to synthesize the understandable speech. The perceptual quality of synthesizes speech increase with accuracy of excitation signals. The more we can accurately represent the excitation signals, the more the synthesized speech is perceptually better.

Thesis Title: **A MULTIUSER DETECTION FOR DS- CDMA COMMUNICATIONS**

Submitted by: **Nirol Prasad Koju**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT:

Multiuser detection (MUD) techniques are one of the most important recent advances in communications technology. MUD deals with the optimal detection of mutually interfering digital streams of information that occurs on various communication systems. In this thesis, the case for CDMA MUD is considered. Optimal multiuser detection and problem associated with it is described. Mean squared error methods are studied in detail and it is implemented using gradient projection methods. It is found that MMSE detectors are more efficient than optimal MUD detectors and they converge more rapidly.

Graduation Year 2007

Thesis Title: **STUDY & PERFORMANCE ANALYSIS OF DETECTION SCHEMES IN WCDMA**

Submitted by: **Mohammad Anwar Hussain**

Supervisor: **Mr. Ram Krishna Maharjan**

ABSTRACT

The goal for the third generation of mobile communications system is to seamlessly integrate a wide variety of communication services such as high speed data, video and multimedia traffic as well as voice signals.

WCDMA as the radio access technology for the 3G has many advantages such as highly efficient spectrum utilisation and variable user data rates. The multipath signals can be used as a diversity to improve the system performance. All users can share the same frequency when the signals arc transmitted through mobile radio channel. This also creates the question, multiple access interference. So, the system is an interfered limited system. Multiuser detection technologies are very important for the system implementation. Simulation is an important tool to get insight into the problem.

In this thesis a signal level simulator in uplink is implemented according to the physical layer specification of the IMT-2000 WCDMA system. The analytical WCDMA system through the use of linear algebra techniques is shown. Channel model is built on the classical understanding of fading, Doppler spread and delay spread. PN sequence properties and generation are studied. Spreading and scrambling techniques are presented. RAKE receiver and multiuser detection are described. A simulation tool in Visual Basic, Turbo C++ is developed for single user as well as multi user detection.

In simulation, the data is spread, scrambled and transmitted through a time varying radio channel. The transmitted signal is corrupted by multiple access interference, and is further corrupted by AWGN at tlic front end of the receiver. In the receiver, despreading and descrambling, RAKE receiver, and multiuser detection are employed to improve the system performance. We investigate the hit error rate at uplink communication. The simulation indicates that spreading, RAKE receiver and multiuser detection are important techniques to improve performance of WCDMA system. Performance improvement due to processing gain, PN sequence, RAKE receiver, and multiuser detection are shown and compared with theory respectively. The simulator developed can be an

invaluable tool for investigating the design and implementation of WCDMA system.

Thesis Title: **PERFORMANCE ANALYSIS OF CHANNEL CODES ON USED STATIC FADING CHANNEL**

Submitted by: **Renu Shakya**

Supervisor: **Prof. Shashidhar Ram Joshi**

ABSTRACT:

This thesis is intended to provide a means to transmit signal in quasi static fading channel (QSFC). This type of channel has drawn more and more attention recently with the demanding need for higher capacity and more reliable wireless communication systems.

In this thesis, the analysis is done using two different codes- one which provides diversity and other without diversity. Since Turbo Codes behaves very well in AWGN Channel, analysis is done comparing the BER and PER of turbo codes in AWGN channel and QSFC. Secondly, Codes that provides diversity , Space Time Block Code have been analyzed using 2x1 transmit and receive antenna and 2x2 transmit antenna and their performance is compared in terms of BER and FER, Space Time Code provides a better performance in QSFC.

Thesis Title: **WATERMARK OF DIGITAL IMAGE IN WAVELET TRANSFORM DOMAIN**

Submitted by: **Ashok Chand**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

A wavelet-based watermark casting scheme and a non-blind watermark retrieval technique are investigated in this research. An adaptive watermark casting method is developed to first determine significant wavelet sub-bands and then select a couple of significant wavelet coefficients in these sub-bands to embed watermarks. A non-blind watermark retrieval technique that can detect the embedded watermark with the help from the original image is proposed. Experimental results show that the embedded watermark is robust against various signal processing and compression attacks. The technique uses a transform domain watermarking method to protect images from any basic image processing induced changes.

Keywords: Non-blind Watermark, Wavelet Decomposition, Watermark Embedding, Watermark Detection

Thesis Title: **PERFOMANCE ANALYSIS OF TURBO CODES ON WIRELESS CHANNELS**

Submitted By: **Rajendra Shakya**

Supervisor: **Assistant Prof. Rajendra Lal Rajbhandari**

ABSTRACT

Wireless Communication has been an integral part of life in the twenty-first century. And reliable wireless communication has always been a challenge to today's engineers and researchers. With the high speed data transfer requirement increasing day to day, reliability has always been a major issue. Turbo codes are basically developed for reliable forward error correction. With parallel concatenated coding turbo codes have been able to approach Shannon's channel capacity limit.

In this thesis performance analysis of turbo codes on wireless channels has been studied. Performance has been evaluated of awgn channel as a basis. Correlated Rayleigh fading channels and uncorrelated Rayleigh fading channels are modeled to mathematically represent wireless fading channels. With two SOVA decoders operating iteratively to achieve a better bit error rate, the reliability value is updated so as to achieve a satisfactory performance of turbo codes on wireless channels.

Keywords: Turbo codes, RSC encoders, SOVA, Rayleigh fading channel, awgn channel.

Thesis Title: **PERFOMANCE ANALYSIS OF POWER CONTROL ALGORITHS IN CDMA**

Submitted By: **Binay Pokhrel**

Supervisor: **Prof. Shashidhar Ram Joshi**

ABSTRACT

The control of transmit power has been recognized as an essential requirement in the design of cellular code-division multiple-access (CDMA) systems. Indeed, power control allows for mobile users to share radio resources equitably and efficiently in a multicell environment.

In this thesis, key concepts of CDMA are presented, along with a description of why power control is needed in the forward and reverse link. This is followed by the explanation of the algorithms that have been investigated, and an evaluation of the simulation results. It is concluded that the forward link power control is important and can improve the capacity of a system over a system with no power control by 1.52 times to 1.82 times (at 0% outage probability, minimum SIR -17dB).

Thesis Title: **NOISE ESTIMATION AND DENOISING IN REMOTELY SENSES IMAGES**

Submitted by: **Santosh Bhandari**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

Estimation of noise contained within a remote sensing image is essential in order to counter the effects of noise contamination. The application of convolution data-masking techniques can effectively portray the influence of noise. In this thesis, I have described the performance of a developed noise-estimation technique using data masking in the presence of simulated additive and multiplicative noise. The estimation method employs Laplacian and gradient data masks, and takes advantage of the correlation properties typical of remote sensing imagery. The technique has been applied to typical textural images that serve to demonstrate its effectiveness. The algorithm is tested using Landsat Thematic Mapper (TM) and Shuttle Imaging Radar (SIR-C) imagery. The algorithm compares favorably with existing noise- estimation techniques under low to moderate noise conditions.

Image denoising is the process of removing unwanted noise from an image. The noise can take a variety of forms and is introduced

in differing amounts at each step during the acquisition of the image. Various spatial and adaptive filters have been applied on noisy remotely sensed images as well as segments of remotely sensed images and their performance has been compared.

In this thesis clustering (Multilevel threshold K means algorithm) has been used to segment the local region encompassing each pixel. The number of segments will be used to segment the local region encompassing each pixel. The separation criterion will adapt to the level of additive noise, which may be supplied by the user or estimated automatically by the algorithm. The resulting segmentation provides a local approximation to the underlying pixel values which is used to denoise the image. The denoising apply on segment will be compared with spatial filtering methods applied before segmentation.

Thesis Title: **IMAGE ORIENTATION DETECTION**

Submitted by: **Jagadish Rauniyar**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

Automatic image orientation detection finds a number of applications in intelligent image processing such as photo manager, orientation free scanning, content based retrieval etc. There are various algorithms developed for detection of image orientation but they are specific to the type of images such as outdoor images. Two types of information are used for image orientation detection, first is low level visual information such as chrominance and structural information, and high level semantic cues such as face orientation detection. In the recent development, the two types of cues, low level cues and semantic cues, are integrated for this purpose.

By using face orientation detection, we assume the orientation of the image is same as the orientation of the face having assumed that the face is upright. But this algorithm suffers from a drawback that when the person is lying down on the ground or face is not upright, the classifier rejects the image and do not classify into correct orientation because of the conflict arise between the orientation detected by the low level visual content

and by face orientation detection (semantic cues) .In my thesis work, I have integrated the low level features and face orientation detection for orientation detection in a image containing a person when, either person is standing (face is upright) or lying down on ground (face is not upright by detecting whether a person lying down (face not upright) or standing on the ground (face upright).

Thesis Title: **TOPOLOGY CONTROL PROTOCOLS TO CONSERVE ENERGY IN MOBILE Ad HOC NETWORKS**

Submitted by: **Narayan Prasad Kusi**

Supervisor: **Mr. Ram Krishna Maharjan**

ABSTRACT

Ad hoc networks are the ultimate frontier in wireless communication. This technology allows network nodes to communicate directly with each other using wireless transceivers without the need for a fixed infrastructure. Each mobile node acts both as a host and a router. Mobile nodes can change their position in ad hoc nature. Thus their topology is always changing but the connectivity should be maintained in each case as more than one node are involved in routing the message from one source node to destination node. Multi-hop, ad hoc networking has been the focus of many recent research and development efforts. Wireless networks and multi-hop routing have application in military, commercial and educational environments including wireless office LAN connections, home networks of devices and sensor networks. A number of routing protocols have been proposed to provide multi-hop communication in wireless, ad hoc networks. Traditionally these protocols are evaluated in terms of packet loss rates, routing

message overhead, and route length. Since ad hoc networks will often be deployed using battery-powered nodes, comparison and optimization of protocol energy consumption is also important. As ad hoc networks are deployed using battery- powered mobile nodes, the network lifetime is determined by the energy resources of the mobile hosts. For scenarios such as sensor networks where energy use maps directly to lifetime and utility, energy use is the important metric. Such costs include energy dissipation in MAC -level retransmissions, RTS/CTS etc. So there should be a topology which minimizes the energy consumption as all nodes are not always in active or communication state. The topology control protocol should determine the states of these nodes to either active, idle or sleep.

In this study, the performance of routing protocol Ad Hoc On-Demand Distance-Vector (AODV) is analyzed in terms of network lifetime, packet delivery quality, routing overhead and mean energy consumption. The performance of topology control protocols GAF-b, GAF-ma combined with the routing protocol AODV is analyzed. The simulation result shows that the network lifetime is increased by the appreciably with the use of topology control protocol GAF with AODV.

Thesis Title: **TCP PERFORMANCE OVER MOBILE AD HOC NETWORKS**

Submitted by: **Roshan Regmi**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

One of the main reasons for TCP's degraded performance in wireless networks is TCP's interpretation that packet loss is caused by congestion. However, in wireless networks packet loss occurs mostly due to high bit error rate, packet corruption, or link failure. It suffers significant performance degradation in wireless networks due to their different characteristics, such as high Bit-Error Rate (BER), large and variable delay, and bursty traffic. TCP performance in wired/wireless networks may be substantially improved if the cause of packet loss could be detected and appropriate rectifying measures taken dynamically. The work in this thesis will focus on the analysis of TCP performance over wireless network and at the same time will recommend a link layer alternative to improve TCP performance in the case of delay and delay variations. The adverse effect of spurious fast retransmits and timeouts are taken care and the good put in increased.

Thesis Title: **STUDY ANALYSIS OF FADE DEPTH PREDICTION FOR WIRELESS MICROWAVE COMMUNICATION**

Submitted by: **Suresh Prasad Sah**

Supervisor: **Mr. Rajendra Lal Rajbhandari**

ABSTRACT

For microwave link communication, it is very likely to calculate the actual fade depth for more reliable communication. All possible chances of path loss are cause of fade depth and prediction of fade depth is very crucial.

Fading models which are applied to microwave wireless systems are Cellular system fading models, Point-to-point terrestrial LOS link fading models and Satellite link fading models are not appropriate for all type of applications. Detailed study and analysis of existing fading models is carried out in this thesis and limitations of analyzed models are studied. The two ray multipath model can be applied to links when the main contribution to fading is due to ground multipath because this model does not account for the atmospheric impairments. The Olsen-Segal model, being empirical in nature, accounts for all the fading mechanisms encountered in the terrestrial LOS links. Olsen-Segal model is valid for low elevation angles (below app.

2 degrees). The ITU-R model for fade depth prediction on satellite links is valid for wide range of elevation angles but the airborne link scenario is different from the satellite links scenario (antenna beamwidth, path geometry, frequency etc.). Surprisingly, it is found that in many practically important cases the fade depth depends on the path clearance angle only and the two-ray model predicts roughly the same fade depth dependence on the path clearance angle as the well-known Olsen-Segal Model.

New hybrid approach provides better reliable microwave communication than existing fading models and concentrate more on reliability rather than other parameters.

Graduation Year 2008

Thesis Title: **ADAPTIVE INMAGE DEBLURRING AND OPTICAL IMAGE STABILIZATION**

Submitted by: **Amit Kumar K.C.**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

Motion blur can degrade the quality of images and is considered a nuisance for computer vision problems. In conventional single-exposure photography moving objects or moving cameras Cause motion blurs. This exposure time defines a temporal box filter that smears the moving Object across the image by convolution and hence it destroys high frequency spatial details. The Relative motion between camera and the scene results in a blurred image in which high Frequencies are lost, due to which deblurring results in increased noise, ringing and other Artifacts. The result is that the deconvolution becomes an ill-posed problem.

Recently, Mitsubishi Electric Research Lab (MERL) has come up with flutter shutter to cope with motion deblurring. The idea is rather than leaving the shutter open for the entire exposure period, camera's shutter is opened and closed ("fluttered")

according to a binary pattern. The flutter changes the box filter to a broad-band filter and high frequency details are preserved. Thus, the deconvolution becomes well-posed problem. MERL has used an exhaustive randomized search for the determination of code.

This thesis implements genetic algorithm to find the best code which is supposed to provide largest merit factor, viz. Golay Merit Factor (GMF), which is used to flutter the shutter of camera.

Moreover, this thesis presents a blind deconvolution method of deblurring of motion-blurred images for the restoration of images degraded by linear, shift-invariant point spread function (PSF) in presence of Gaussian noise. This method is based on correlation of histograms of vertical and horizontal gradients of the blurred image. For deconvolution method, a neural network is implemented.

Keyword: Motion blur, III-posed system, Well-Posed System, Flutter Shutter, Genetic Algorithm, Golay Metric Factor, Point Spread Function, Gaussian Noise, Blind Deconvolution, Gradient Histograms, Circulant Matrix.

Thesis Title:	**MIGRATION TO IPV6-ONLY NETWORK; PROSPECTS & PROBLEMS, A TECHNICLA INVESTIGETION INTO THE DEVELOPMENT OF IPV6**
Submitted by:	**Babu Ram Dawadi**
Supervisor:	**Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

The internet has been using its protocol, IPv4, for more than a quarter of a century. The internet saw its deployment found the tipping point in early 1990s with the popularity of World Wide Web. This fast pace development, however, creates problems for IPv4 like address space exhaustion, NAT proliferation, security etc.

A new version of the Internet Protocol, IPv6, has been developed and is likely to replace IPv4. IPv6 has been developed to solve the problems regarding to IPv4 and also new features are designed to supposedly enhance network traffic. It is the time to have a transition from IPv4 to IPv6. The current internet age is running in its transition phase to the new generation internet addressing. In this perspective, this research tries to analyze the IPv6 RFCs for its implementation as well as explore about

migrating the current network into IPv6 only operation properly by analyzing different transition mechanisms and concludes on better approach for the successful migration.

Keyword:

IPv6, IPv4, Protocol, IANA/RIR/LIR, NAT, ICMP, Proxy, TOTD, DNS, DNS-ALG, NAT-PT, ARPANET, QoS, Header, Packet, Unicast, Anycast, Multicast, Interface, Tunneling, Subnet, MAC, PREFIX.

Thesis Title: **PERFORMANCE OF SELF ORGANIZING MAP PTV ON THE BASIS OF THE PIV STANDARD IMAGES**

Submitted by: **Basanta Joshi**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

Particle Tracking Velocimetry (PTV) is one of is a technique to measure velocity of particles. In this method the particle pairing between two tracer images with a constant time interval is possible, which in turn helps to develop the velocity diagram for the individual particle. The research incorporated implementation of PTV algorithms (Relaxation method and Self organizing Map esp. Labonte's SOM). The conventional PTV has a risk accordingly that some erroneous vectors appear in the measured flow field. Relaxation method measures a correct velocity vector field based on not a local area of the field but the whole flow field. The SOM neural network is considered as an increasingly promising approach for the use in the particle tracking velocimetry in the particle level.

The performance of these different PTV methods was examined using the PIV standard images on the Internet under varied experimental conditions. Comparison were be made with

reference to velocity diagram, number of particles paired and time for particles tracking. It was found that velocity profile was better in SOM with compare to relaxation method having more number of particles paired for higher iteration. However, the time for particle pairing was higher and the algorithm tested was only applicable for particle count of 1000 in SOM.

Keyword:
Visualization, Particle Tracking Velocometry, Relaxation Method, Self Organizing Map

Thesis Title: **IMPLEMENTATION OF TURBO CODE IN CDMA 2000**

Submitted By: **Damodar Kandel**

Supervisor: **Assistant Prof. Daya Sagar Baral**

ABSTRACT

For the reliable communication, channel coding is employed. Turbo Code as a powerful coding technique has been widely studied and used in communication system. In this Thesis, Turbo code is implemented in forward link of CDMA 2000. In the transmitter side, the signal is spreaded and in the receiver side, the signal is de spreaded to recover the original signal. Turbo code decoder algorithm will be studied in detail in this thesis. Comparison between Turbo code and Convolutional code is done.

Key Words: Turbo Code, Recursive Systematic Convolutional Code, Interleaves Puncturing, Pseudo random noise sequence, Spread spectrum, Turbo decoder.

Thesis Title: **ITERATIVE DECODING OF TURBO CODES**

Submitted by: **Dhaneswar Sah**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

This paper presents a Thesis which consists of a study of turbo codes as an error-control code and the software implementation of two different decoders, namely the Maximum a Posteriori (MAP) and Soft- Output Viterbi Algorithm (SOVA) decoders. Turbo codes were introduced in 1993 by Berrou et at [2] and are perhaps the most exciting and potentially important development in coding theory in recent years. They achieve near- Shannon-limit error correction performance with relatively simple component codes and large interleaves. They can be constructed by concatenating at least two component codes in a parallel fashion, separated by an interleaver. The convolutional codes can achieve very good results. In order for a concatenated scheme such as a turbo code to work properly, the decoding algorithm must affect an exchange of soft information between component decoders. The concept behind turbo decoding is to pass soft information from the output of one decoder to the input of the succeeding one, and to iterate this process several times to produce better decisions. Turbo codes are still in the process of

standardization but future applications will include mobile communication systems, deep space communications, telemetry and multimedia. Finally, we will compare these two algorithms which have less complexity and which can produce better performance.

Thesis Title: **ANALYSIS OF SLOTTED ALOHA BASED SCHEMES AT MAC LAYER FOR MOBILE ADHOC NETWORKS AND UNDERWATER ACOUSTIC SENSER NETWORK**

Submitted by: **Niraj Shakhakarmi**

Supervisor: **Prof. Dr. Subarna Shakya**

ABSTRACT

The challenging issue in the design of Slotted Aloha based schemes for ad-hoc networks and under water acoustic sensor networks is to efficiently convey information using an unreliable physical channel. Since such networks are dynamic, distributed entity, the optimal control of such a system should also be dynamic and adaptive. These networks must be tailored for the particular traffic pattern as well as the pertinent capacity constraints and propagation delays. The global optimal solution for the coordination of a dynamic distributed network can be achieved by continuously monitoring the global network status, which is not realizable, or at least not scalable, due to the overhead required to obtain such information. Although distributed coordination is realizable and practical, due to the lack of reliable coordination, its performance becomes unstable

as the network load increases and it cannot avoid the waste of valuable resources such as bandwidth and energy.

Slotted Aloha based Protocol architectures for mobile ad hoc networks and underwater acoustic sensor networks coordinate channel access through an explicit collective decision process based on available local information like Spatial range, Direction of arrival, Fibonacci Back off time, Underwater Acoustic Back off time as well as Lag time for carrier sensing and collision avoidance which outperform completely over the distributed approaches under a wide range of operating conditions in terms of throughput and energy efficiency without sacrificing the practicality and scalability of the architecture.

Thesis Title: **PAPR REDUCTION IN OFDM SYSTEM USING PULSE SHAPING TECHNIQUE**

Submitted by: **Prakash Bahadur Shahi**

Supervisor: **Lecturer Er. Daya Sagar Baral**

ABSTRACT

Orthogonal-frequency-division-multiplexing (OFDM) technique allow the transmission of high data rates over broadband radio channels subject to multipath fading without the need for powerful channel equalization However, they are very sensitive to nonlinear effects due to the high peak-to-average power ratio (PAPR) owned by their transmitted signals. This thesis proposes an efficient technique for reducing the PAPR of OFDM signals.

The proposed technique is data-independent and, thus, does not require new processing and optimization for each transmitted 01 DM block. The reduction in PAPR of the OFDM signal is obtained through a proper selection of a pulse shaping scheme that distributes the power of each modulated symbol over the OFDM block such that the average power of OFDM signal will not be far from individual symbol power. The obtained results show that this pulse shaping scheme is an attractive solution to the PAPR problem of OFDM signals.

It is shown, through computer simulations, that the PAPR of pulse shaped OFDM signals approaches that of single-carrier signals. The good improvement in PAPR given by the present technique permits the reduction of the complexity and cost of the transmitter significantly. The pulse shaping schemes also take advantage of the frequency variations of the communication channel and can provide considerable performance gain in fading-multipath channels.

Thesis Title: **PERFOMANCE EVALUATION OF HANDOVER IN 3G ENVIRONMENTS**

Submitted by: **Prakshet Thapa Chhetri**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT

Mobile terminals allow users to access services while on the move. This unique feature has driven the rapid growth in the mobile network industry, changing it from a new technology into a massive industry within less than two decades.

Handover is the essential functionality for dealing with the mobility of the mobile users. Compared with the conventional hard handover employed in the GSM mobile networks, the soft handover used in 3G has better performance on both link and system level.

This thesis paper will review handover classification, the principle of soft/softer handover and hard handover for voice in WCDMA systems and in-depth study of the soft handover effects on WCDMA networks will be carried out. The handover can be classified into hard handover and soft/softer handover, or intra-mode handover and inter-mode handover, or intra-frequency handover and inter-frequency handover, or intra -system

handover and inter-system handover. Softer handover is implemented within one base station between different sectors; it doesn't cause the system load increases as it implements within the base station. The implementation of soft handover can increase the coverage, capacity performance or balance the network load. Hard handover and comparison it with soft handover is also necessary and will be present in this thesis.

Thesis Title: **ANALYSIS OF DIFFERENT TYPES OF CLUSTERING ALGORITHM OF BRAIN MRI SEGMENTATION**

Submitted By: **Suman Shrestha**

Supervisor: **Prof. Shashidhar Ram Joshi**

ABSTRACT

Segmentation is an important step in many applications, being also important in those that deal with medical images. When a magnetic resonance image of the brain is segmented to detect a tumor and also its size, it is very important that the segmentation to give results as accurate as possible because a life of person could depend on it.

Brain tissue is particularly complex structure and its segmentation is an important task for many purposes i.e. for delineation of areas to be treated prior to radio surgery delineation of tumors before and after surgical or radio-surgical intervention for response assessment and for the calculation of area and volume occupied by different tissue structures of brain. MR I can also provide additional information about structural brain lesions which may compliment that available from CT. In this study the volume of white matter, gray matter, cerebrospinal

fluid, abnormal tissues of the magnetic resonance images of the brain are the matter of interest.

Different methods of clustering methodology will be discussed in this paper. The clustering algorithms that I will be dealing with in this thesis are: Gaussian mixture model, k means algorithm, fuzzy c means (FCM) algorithm and Genetic algorithm.

Thesis Title: **DIGITAL WATERMARKING OF AUDIO SIGNALS**

Submitted by: **Meen Bahadur Kakri**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

Research on information embedding and particularly information hiding techniques has received considerable attention within the last years due to its potential application in multimedia security. Several information hiding techniques has been proposed for digital images but only few are there for audio signals. This thesis describes a novel technique for embedding watermark bits into digital audio signals. The proposed method uses spread spectrum theory to generate a watermark resistant to different removal attempts and a psychoacoustic auditory model to shape and embed the watermark into the audio signal while retaining the signal's perceptual quality. Recovery is performed without knowledge of the original audio signal.

Key words: Information embedding, Data hiding, Digital watermark, Psychoacoustic model, Spread spectrum.

Thesis Title: **DESIGN AND SIMULATION OF SEPARATE L AND S MICROSTRIP ANTENNA FOR NAVIGATION PURPOSE**

Submitted by: **Rajeev Kumar Kanth**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

The main objective of this project work is to study, design and simulate two separate microstrip antenna operating at L and S Band respectively. Detailed literature survey has been carried out to study various proposed configurations of microstrip antenna.

In this Project attempt has been made to design and develop a compact & low profile antenna for two widely separated frequency bands.

A L and S band microstrip antenna has been designed and analyzed for achieving -4 dBi gain at ±50 degree. Different feeding techniques are also studied. However coaxial probe feeding technique is implemented for the ease of its implementation.

The dimension of the patch geometries are determined by the mathematical analysis technique using MathCAD 2000, simulation is carried out using Method of Moments (MOM) and Performance optimization is performed using Ansoft Designer software.

The designed topology of separate L and S band patch antenna can be employed for satellite navigation.

In this project report the effort has been made to develop a separate band microstrip antenna operating at specified frequencies L band at 1.176 GHz and S band 2.487 GHz to fulfill the partial requirement of thesis for Master of Science in Information and Communication Engineering in Department of Electronics and Computer Engineering, Institute of Engineering Tribhuvan University Nepal.

Graduation Year 2009

Thesis Title: **STUDY AND SIMULATION IF MIMO**

Submitted by: **Amit Khanal**

Supervisor: **Assistant Prof. Dr. Daya Sagar Baral**

ABSTRACT

Over recent years the MIMO (multiple input multiple output) has become a popular technique in wireless communication. MIMO is a system with multiple transmitting and multiple receiving antennas. ZF (Zero forcing) and MMSE (Minimum mean squared error) are the linear MIMO detectors while ML (Maximum likelihood) is an optimal MIMO detector. VBLAST (Vertical-Bell Labs Layered Space Time Architecture) is a special detector designed for the MIMO system. This thesis has compared the performance of ZF VBLAST (zero forcing VBLAST) with the ZF, MMSE and ML detector. The VBLAST algorithm uses iterative method to detect transmitted symbols and one transmitted symbol is detected in each iteration. Each iteration further consists of ordering, interference nulling and interference cancellation step. The thesis has also focused on the reduction of the computational complexity of the ZF VBLAST receiver by reducing the number of iteration.

The performance of various MIMO detectors is compared in terms of block error rate (BER).For simulation Rayleigh channel model has been considered with BPSK (binary phase shift keying) modulation at transmitting end.

Thesis Title: **IMAGE SEGMENTATION USING HIDDEN MARKOV RANDOM FIELD MODELS – FUZZY CLUSTERING ALGORITHM**

Submitted by: **Banti Shrestha**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

Image segmentation is an important step in many computer vision applications. It is the process of partitioning a digital image into multiple regions (sets of pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. There are various general purpose algorithms and techniques for Image Segmentation. The algorithm that is of interest in this study is based on Hidden Markov Random Field (HMRF) models and fuzzy clustering principles. Experiments are carried out on a series of synthetic and real-world image obtained from Berkeley Image Segmentation Database segmentation to compare the performance of combined approach over other competing methodologies.

Keywords: Fuzzy Clustering, Hidden Markov Models, Image Segmentation, Mean-field approximation

Thesis Title: **IMPROVING THE PERFOMANCE OF AODV POUTING PROTOCOL IN AD HOC NETWORK**

Submitted by: **Jagadish Shrestha**

Supervisor: **Assistant Prof. R.L. Rajbhandari**

ABSTRACT

Efforts to support mobility for hosts over the current Internet infrastructure started with the emergence of increasing, number of wireless devices and efficient wireless LAN technologies. A mobile ad hoc network is infrastructure less, self organizable, multi hop packet switched network. In ad hoc network, node movements results in dynamic topology and frequent link failures. Various routing protocols developed for routing in mobile ad hoc networks. They are classified into proactive (table driven), reactive (on demand) routing protocols. Studies shows that on demand protocols perform better compared to table driven protocols. Ad hoc On Demand Routing (AODV) is a popular on demand routing protocol. Various enhancements are provided for AODV to improve performance.

In this thesis, a new approach of preemptive route maintenance to mitigate the delays and overhead incurred during the original AODV has been proposed. The proposed scheme was implemented and simulated in NS-2.

Thesis Title: **CAPACITY AND COVERAGE ENHANCEMENT OF TDD-CDMA ISING RELAYING STRATEGIES**

Submitted by: **Kamal Bhattarai**

Supervisor: **Dr. Dinesh Kumar Sharma**

ABSTRACT

Relaying is found in Packet Radio and Ad-hoc networks whereby communications involving mobile terminals are carried out in a spotted manner through intermediate relay nodes. When implemented in a cellular network, this system can be regarded as an Opportunity Driven Multiple Access (ODMA) scheme where relaying is turned to when communications to and from the base station for a certain mobile terminal are weak due to a lack of LOS (Line of Sight) or strict multipath fading.

Relaying systems use several smaller communications links as a substitute of the conventional point-to-point transmission. This can allow for a lower power requirement and, due to the smaller broadcast range, bandwidth re-use may be more proficiently subjugated. Code division multiple access (CDMA) is rising as one of the most common methods for multi user access. Mixing CDMA with time division duplexing (TDD) provides a system that supports asymmetric communications and relaying

economically. The capacity of CDMA may be reduced by interference from other users; hence it is essential that the routing of relays is performed to minimize interference at receivers.

There are lots of unwrap challenges regarding relaying technology when incorporated into a cellular network, and they contain: routing (or relay node/path selection) algorithms, channel allotment for relaying purposes, radio signal transmission behavior between a small height terminals, and security.

This thesis is analysis of relaying in the framework of TDD-CDMA systems. Such a system was incorporated in the initial draft of the European 3G specifications as opportunity driven multiple access (ODMA).The Presented Results demonstrate that ODMA allows for a more flexible capacity coverage trade-off than non-relaying systems. A study into the interference character of ODMA shows that mainly interference occurs near the base station (BS). Hence it is possible that in-cell routing to pass up the BS may boost capacity. ODMA uses path loss as a metric for routing. This method does not stay away from interference, and hence ODMA shows no capacity increase with the mixture network. As a result, an interference based routing algorithm is analyzed in the context of TDD-CDMA. When at

least half the network is busy in in-cell transmission, the interference based system allows for a high capacity than a conventional cellular system.

The simulation outcome shows that with a excellent relay node/path selection scheme and power control, relaying can have a major improvement on the coverage. Furthermore, this enhancement is quite insensitive to the channel selection schemes.

Thesis Title:	**COOPERATIVE POWER MANAGEMENT IN IEEE 802.11 BASED AD HOC NETWORK**
Submitted by:	**Manoj Gyawali**
Supervisor:	**Assistant Prof. Dr. Sharad K. Ghimire, Dr. Seppo Vitrenan, Dr. Liang Guang**

ABSTRACT

Cooperative power management is a technique to save a battery power on the devices of wireless network. Various algorithms that implement power management have been proposed in ad hoc network. Fixed transmit power approach conserves more power even the necessary power may not be high. The IEEE 802.11 based network, offers different data rates. For each of the data rates a SNR threshold is defined at the receiver to determine the achievable data rate and transmission is made at that data rate at the maximum power. But the minimum power required to achieve the transmission successfully is usually lower than the maximum transmit power. So, there is wastage of power if fixed transmit approach is used. Since, power is an important issue in any kind of communication network proper power management must be implemented.

In this thesis, the effect of varying the transmit power of the nodes on the overall throughput of the network and the average power of the network is studied. The transmit power of the nodes is varied from the maximum transmit power to the minimum transmit power required to achieve the threshold SNR at the receiver for the chosen data rate. The cooperation in between the nodes is carried on rate selective approach which shows that if cooperation exist the transmit power can also be saved. Simulations experiments are carried by varying the maximum transmit power level, varying the orientation of nodes and the length of data packet.

The results showed that the cooperative power management can reduce the overall transmit power of the network.. Through simulation, 20 % reduction in the excess power seemed to satisfy the requirement of power saving without decrease of overall network throughput. Power saving percentage is varied on case to case. With this, significant saving in the network transmit power can be achieved. With the help of node cooperation which is based on minimum power level (receiver sensitivity) with rate adaptation can save power up to 40% for a certain traffic requirement. With this the power on the network can be saved to achieve a global efficiency.

Thesis Title: **EVALUATION OF PRACTICAL APPLICATION OF SOFTWARE DESIGN PATTERN IN THE CONTEXT OF OBJECT ORIENTED DEVELOPMENT PROCESS**

Submitted by: **Mukesh Regmi**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT

In this thesis, we perform an evaluation of "Gang of Four" design patterns devised by Gamma and his team during 1995 from practical and experimental point of view using Java 6 as the implementation language. In the thesis, we perform how the Java language feature affects the implementation of "Gang of Four" design pattern individually and collectively. Before, we perform the evaluation of 23 "Gang of Four" design pattern, we define a general evaluation approach first. On the basis of this, then we evaluate the implementation of "Gang of Four" design pattern individually and collectively. The primary purpose of this thesis is to implement all pattern functionality described in implementation of "Gang of Four" pattern description.

Using the predefined evaluation approach, we implement the "Gang of Four" design patterns using Java and its features.

During the evaluation, we group Java features into three different categories i) core language features (generics, abstract....), reflection (dynamic proxies, annotations etc), and special language mechanism (synchronization, serialization, cloning, etc). We then evaluate each of the patterns on the basis of these investigated features. Moreover we employed matrix based approach to detect pattern instances from our implementation model. We also performed a study on reverse engineering of source code to detect the particular class role in design pattern.

Thesis Title: **ANALYSIS AND COMPARISION OF PROACTIVE AND REACTIVE PROTOCOL USED IN AD HOC WIRELESS NETWORK**

Submitted by: **Niraj Tamrakar**

Supervisor: **Assistant Prof. Sharad Kumar Ghimire**

ABSTRACT

A Mobile Ad Hoc Network (MANET) is a collection of wireless hosts that can be rapidly deployed as a multi-hop packet radio network without the aid of any established infrastructure or centralized administration. Major application area of this network is search and rescue, disaster management, earthquake recovery and military warfare. Because there is no pre existing infrastructure, Ad Hoc Network is an efficient way of communicating between the different nodes in the network. Ad Hoc Network consist of many challenges in implementation due to mobility of the node. Major challenges concern in its implementation is dynamic topology, constrained power and unidirectional node. In Ad Hoc Network due to the lack central infrastructure also called access point each node not only act as host/receiver; it also perform the routing and forwarding of the message assisting in the multi hop communication. Many routing protocol have been proposed for the Ad Hoc Network they can

be broadly categorized as the proactive and reactive protocol. It is found for the wireless environment with such dynamic topology, the reactive protocol were far better than proactive protocol. Proactive protocols are slower in case of convergence of routing table and routing overhead is also high. Reactive protocol whereas, have fewer routing overhead due to its on demand nature. In reactive protocol, AODV outperform DSR in case of average end to end delay and packet delivery fraction at different mobility simulation. And according to the load offered simulation AODV is found more scalable to network topology. This suggests the appropriate flat routing protocol for wireless Ad Hoc network being AODV protocol.

Thesis Title: **ALIGNMENT OF LC-MS IMAGES WITH A PROFILE BASED METHOD**

Submitted by: **Nita Kiorala**

Supervisor: **Prof. Shashidhar Ram Joshi**

ABSTRACT

Mass spectrometry coupled with liquid chromatography has become a milestone in the field of proteomics. LC-MS is one of the key technologies that have been used in the field of biomarker discovery, protein identification and quantification. Protein biomarker discovery that has been used to find the significant difference between the healthy and unhealthy samples has to compare the LC-MS images. Hence the alignment of these images is essential.

The main aim of the thesis is to align the LC-MS images that are in the form of mass spectra by a profile based method. The thesis is divided into two parts: The first part of the thesis develops the algorithm to determine the correspondence between the landmarks in the two images and the second part implement the warping function so as to adjust the retention time according to the correspondences found in first part The total ion chromatogram is taken as lie profile data for the alignment whose peak values are taken as landmarks for finding the

difference in retention time between the identical peaks. The one-to-one correspondence between landmarks in two images is found with the help of Procreates matching and optimization. Several optimization techniques are studied and the most suitable one, the invisible hand algorithm, has been used which optimizes the linear assignment problem. The polynomial interpolation is used as the warping function for the transformation of retention time after the correspondences are verified.

Thesis Title: **PERFORMANCE EVALUATION OF MIMO IN WLAN**

Submitted by: **Rameswor Thakurathi**

Supervisor: **Assistant Prof. Dr. Subarna Shakya**

ABSTRACT

Wireless technology is being widely used today and the demand of higher capacity is always increasing. To meet the growing need for higher wireless link capacity a new technique named as MIMO has been introduced and is being widely investigated.

MIMO as name implies uses multiple input and output interfaces for transmitting and receiving data. Unlike SISO WLAN devices, which may also have multiple antennas connected to it but does not uses both antenna simultaneously for data transmitting and receiving rather select an interface with greater signal strength, MIMO uses all the interface simultaneously and combine the signal received from all the interfaces to form a stronger signal thus improving the throughput and the distance covered.

In case of legacy 802.11 devices, multipath signal is a major problem which limits the maximum attainable data rate. But, this drawback of legacy devices is a plus point for MIMO devices. MIMO devices collect all the multipath signal at the receiving

side weight them properly and combine them all to form a strong signal thus increasing the SNR of the system which in turn increase the throughput of the system.

Space diversity has been used in wireless communication to improve the performance of the link but in case of MIMO the space diversity can be extended to space time diversity opening a new dimension in the field of channel coding. By using proper space time codes, the performance of MIMO can be further enhanced by introducing two gains to the system i.e. diversity gain and coding gain. Even MIMO system can get benefits from array gain obtained by focusing the beam to the desired destination using adjusting phases at different transmitting antennas

In this research thesis performance of the MIMO technique have been investigated and compared with legacy WLAN technologies.

Thesis Title: **INVESTIGATING NIMBY ROUTING IN DENSE AD-HOC NETWORK**

Submitted by: **Shiba Raj Khanal**

Supervisor: **Assistant Prof. Sharad K. Ghimire**

ABSTRACT

One of the requirements in an ad-hoc network is to ensure equal access to the network resources which are shared amongst the nodes. The level of sharing is measured in terms of 'Fairness' and this sharing of resource is one of the responsibilities of the routing protocol. We evaluate two routing schemes on demand scheme 1 (OD Scheme 1) and on demand scheme2 (OD Scheme2) to alleviate the bottleneck in the routing paths toward the 'Access Nodes' from the transmitting 'Nodes'.

'OD Scheme**1'** and 'OD Scheme2' select less congested routes by adding an extra cost to the cost metric of the busier route. As a result the traffic is more uniformly distributed among the available routes than in the case of traditional routing schemes like 'Bellman-Ford' and 'Ad- hoc on demand distance vector (AODV)'. We found that by implementing these proposed routing schemes, the overall 'Fairness' of the network is increased relative to the standard 'Bellman-Ford' and 'AODV' routing schemes, however the total transmitted 'Power' of the

network is increased to achieve this greater ‘Fairness’ index, and this could generate more interference in the system. The simulations demonstrate the performance comparison of all four types of routing algorithm for the parameters ‘Fairness’ and ‘Power’.

Thesis Title: **ANALYSIS AND PERFORMANCE EVALUATION OF EQUALIZATION FOR TDMA MOBILE RADIO**

Submitted by: **Sujit Khadka**

Supervisor: **Rajendra Lal Raj Bhandari**

ABSTRACT:

In radio communication systems the channel distorts the transmitted signal. There are different forms of distortion that the channel can introduce such as, for example, signal attenuation (fading), additive noise etc. Intersymbol interference (ISI) caused by multipath in bandlimited (frequency selective) time dispersive channels distorts the transmitted signal, causing bit errors at the receiver. ISI has been recognized as the major obstacle to high-speed data transmission over wireless channels. TDMA digital cellular systems require adaptive equalization at the demodulator to combat intersymbol interference from the time-variant multipath propagation of the signal through the channel.

Selection of proper equalization method is the prime purpose of this thesis work. This thesis is totally concerned with the equalization of the channels distorted with the Intersymbol interference. Different equalization techniques including linear transversal equalizer, fractionally spaced equalization, decision

feedback, and adaptive equalization have been used to generate useful outcome.

Graduation Year 2010

Thesis Title: **POWER CONTROL ALGORITHM FOR WCDMA**

Submitted by: **Sujit Man Shakya**

Supervisor: **Prof. Dr. Sashidhar Ram Joshi**

ABSTRACT

Power control techniques in 3G WCDMA System have been studied during the entire period of this thesis. The basic power control techniques 3GPP Power Control Algorithm 1, 2 and Adaptive Step Power Control Algorithms are studied among which Adaptive Step Power Control Algorithm(ASPC) is the topic of main concern. The algorithm is based on an adaptive modification of the transmitted power update step size.

In the basic 3 GPP Power Control Algorithm, the power is updated with an unit step size of ldB for each iteration of the comparison. Whereas in ASPC technique the unit step size is multiplied or divided by certain sets of parameters and then the power is updated which results in the fewer number of iteration to achieve the desired SIR values. Hence the quicker convergence of the ASPC is the major target of the algorithm which is may give a capacity increase.

In this thesis, the result is achieved by the comparison of transmitted power and SIR values in number of iteration. SIR values indicates that the user is under the continuous service condition, variation in values of transmitted power shows the result ASPC algorithm which have occurred due to the update of power values by step size and the number of iteration gives the rate how fast the changing of transmitted power is done and SIR values are maintained around the particular desired value.

Thesis Title: **PERFORMANCE EVALUATION OF SPACE DIVERSITY FOR WIRELESS**

Submitted by: **Upaj Mahat**

Supervisor: **Mr. Rajendra Lal Rajbhandari**

ABSTRACT

In wireless communications, diversity techniques are widely used to reduce the effects of multipath lading and improve the reliability of transmission without increasing the transmitted power or sacrificing the bandwidth. For spectral efficiency and improved Bit Error Rate, diversity provides an attractive option. Providing different replica of transmitted signal to the receiver is called diversity. There are many diversity techniques and among them space diversity technique is taken into main consideration in this thesis.

During the detail study of Space Diversity one of the main reference paper was Sivash M. Alamouti 'A Simple Transmit Diversity Technique For Wireless Communication' 1998. This paper gives the possibility of transmit diversity with the use of BPSK as a modulation technique and Rayleigh as a fading model. Higher modulation technique such as QPSK is bandwidth efficient technique over BPSK and other fading model such as Ricean also exist in the environment. Rayleigh fading model is

used when there are many objects in the environment where the signal is transmitted, resulting in the scatter of the signal before arriving at the receiver end. If the environment is such that, there is a presence of dominant path along with scattering between transmitter and receiver, then such situation is better modeled with Ricean fading model. Implementation of QPSK modulation technique and Ricean fading model along with the essential finding of this paper will be a additional benefit in space diversity technique.

Simulated result shows that bandwidth efficient result with slightly higher BER in both receive diversity and transmit diversity is obtain from QPSK and very much low BER is obtain in Ricean fading model than that of the Rayleigh fading model which was proposed in the paper.

Thesis Title: **PROXY BASED HANDOVER ANALYSIS FOR MOBILE IPV6**

Submitted by: **Ramesh Raj Subedi**

Supervisor: **Mr. Babu Ram Dawadi**

ABSTRACT

Mobile IPv6 is a network layer IP standard which allows nodes to remain reachable while moving around in the IPv6 Internet. It enables a Mobile node to maintain its connectivity to the Internet when moving from one access router to another, a process referred to as handover. Although communications in mobile IPv6 networks can be preserved across handovers, there is a high possibility that these communications could be interrupted due to loss of packets during handovers. So if handovers occur frequently, quality of communications can drop significantly.

This thesis, at first, describes the operation of mobile IPv6 networks and points out the problems that degrade the communication performance across handovers. Then after a proxy based handover analysis is done which focuses on how to keep lost packets on proxy agent so that the packets can be recovered quickly after handovers. The research is carried out to design a mechanism that filters and stores lost packets which are used for fast and efficient retransmission after handover occurs.

After completion of this project, a proxy based solution will be proposed for better communication performance across handovers. In addition to the proposed solution, the thesis also discusses on design and implementation issues by creating the test environment simulated in a local area network with both physical and virtual hosts.

Keywords: Mobile node, Home agent, PAR, NAR, CN, CoA etc.

Thesis Title: **PERFORMANCE ANALYSIS OF HIGH DATA RATES MODULATION TECHNIQUES OF WCDMA IN MULTIPATH FADING CHANNELS**

Submitted by: **Sujan Shrestha**

Supervisor: **Mr. Sharad Kumar Ghimire**

ABSTRACT

The trend is towards finding a modulation scheme that uses more bits to represent a symbol to achieve higher data rate while maintaining a low BER (Bit Error Rate) at a low power and keeping high frequency utilization. High data rate M- ary Quadrature Amplitude Modulation (QAM) and Quadrature Phase Shift Keying (QPSK) modulation schemes are considered in a Wideband-Code Division Multiple Access (W-CDMA) system. The BER performance of these modulation techniques are evaluated when the system is subjected to a number of users as well as noise and interference in the channel. Additive White Noise Gaussian (AWGN) and multipath Rayleigh fading are considered in the channel. A study is carried out to investigate the effect of diversity scheme that alleviates the problem of multipath fading. It is discovered that the performance of 16-QAM is significantly degraded in all channel conditions compared to that of QPSK and the diversity scheme combats

multipath. Error correction coding is needed to be used in this system particularly with 16-QAM to ensure better performance of WCDMA system.

Thesis Title: **PERFORMANCE EVALUATION OF 3GPP LONG TERM EVOLUTION**

Submitted by: **Kamal Lamichhane**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

This master's thesis mainly investigates long term evolution's performance based on peak to average power ratio (PAPR) and symbol error rate (SER) for uplink and downlink radio channel. Uplink and downlink modulation techniques in LTE are SCFDMA and OFDMA. SCFDMA has different subcarrier mapping techniques and hence SCFDMA can be analyzed under these different subcarrier mapping techniques. From user's perspective, high bandwidth, large throughputs, service access delay and better quality of service related parameters like paging, successful call connection rate handoff rate, call drop rate etc are the highly attractive features of 3GPP LTE. This technology is near to 4G and having maximum data rates up to 100 Mbps in downlink and 50Mbps in uplink. Technically LTE is based on Release 7 and Release 8 specifications as prescribed by 3GPP. The reason behind high data rate is based on use of digital modulation schemes like QPSK, 16QAM and 64QAM. The modulation techniques may vary with the distance of subscriber's from the transmitting station to the mobile station as well as the

noise in channel and MIMO technology with different matrix combination in uplink and downlink .Peak to average power ratio is highly reduced in SCFDMA in comparison with OFDMA that has been demonstrated in simulation. SCFDMA is a single carrier modulation technique and OFDMA is a multi-carrier modulation technique. This may also be one of the causes of high PAPR in OFDMA i.e. amplifier in receiver has more nonlinear characteristics for multicarrier signal amplification. Low PAPR helps to minimize the inter-symbol interference and it is also a good technical solution to save the power consumption of the user's terminal while communication is in uplink mode. Multipath fading, white Gaussian noise and different kinds of fading are the source of noise and interference in LTE channel. Noise effect may vary between pedestrian and vehicular channels. These all factors should be under consideration while simulating the channels performance in terms of symbol error rate (SER) or bit error rate (BER).

Thesis Title: **BRAIN IMAGE SEGMENTATION USING EXPECTATION MAXIMIZATION AND K-NEAREST NEIGHBOR ALGORITHMS**

Submitted by: **Binod Chandra Shrestha**

Supervisor: **Prof. Dr. Sashidhar Ram Joshi**

ABSTRACT

Segmentation of an image entails the division or separation of the image into regions of similar attribute. Segmentation is one of the main problems in image analysis. Expectation Maximization (EM) and K-Nearest Neighbor (KNN) Algorithms have been used for segmentation of Magnetic Resonance (MR) image of brain.

The main objective of this thesis is to segment and classify brain image into Gray Matter (GM), White Matter (WM) and Cerebral Spinal Fluid (CSF) using EM algorithm and KNN algorithm.

Thesis Title: **QOS AWARE ADAPTIVE RADIO RESOURCE MANAGEMENT FOR MIMO-OFDMA SYSTEM**

Submitted by: **Pradip Pausyal**

Supervisor: **Mr. Sharad Kumar Ghimire, Dr. Andras Gabor, Dr. Laszlo**

ABSTRACT

Now the customer demands for wireless communication is increasing and the existing networks will not be able to fulfill the high data rate and low latency requirements of future communication services. Therefore, the spectral efficiency of future wireless networks needs to be further improved allowing for increased flexibility to serve a large number of simultaneous users and different services. Orthogonal Frequency Division Multiple Access (OFDM) can be used in conjunction with "Multiple-Input Multiple-Output" (MIMO) transceiver to increase diversity gain and/or system capacity by exploiting spatial domain. Because the OFDM system effectively provides numerous parallel narrow band channels, MIMO system is considered as a key technology in high data rate and reliable transmission system. MIMO-OFDMA based cellular systems are currently being standardized by 3GPP for LTE and by IEEE for WiMAX.

Radio resource management in MIMO-OFDMA system is very interesting research topic since past few years. There are many existing MIMO-OFDMA RRM algorithm these suboptimal algorithms have good performance even though they can't guarantee the required QoS among the users and high data rate of the system.

Here, I have proposed subcarrier, power and bit allocation algorithm for MIMO- OFDMA system. This QoS aware radio resource management technique for MIMO- OFDMA system is to maximize the capacity and QoS of the system. This proposed scheduling algorithm takes account queue status, transmission rates, channel state information and priority of the user for subcarrier, power and bit allocation in MU- MIMO-OFDMA system. Subcarrier selection is based on the priority of the user and eigenvalue "product criterion" and "water-filling algorithm" is adapted for bit loading and power allocation problem. System level evaluation is performed in order to assess the impact of a realistic multi-cell environment on the performance of a cellular NINO-OFDM system. Simulation results show that this algorithm can not only increase the data rate of the system, but also QoS of the user. This algorithm can also maintain required QoS for each user.

Keywords- Capacity, cellular system, cooperative MIMO-OFDMA, SVD, radio resource management, eigenvalue product criterion, "water-filling algorithm", adaptive modulation, packet loss rate and priority of the user.

Thesis Title: **PERFORMANCE EVALUATION OF WiMAX/IEEE 802.16 PHYSICAL LAYER**

Submitted by: **Min Prasad Aryal**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

The advancements in broadband and mobile communication has given many privileges to the subscribers for instance high speed data connectivity, voice and video applications in economical rates with good quality of services. WiMAX is an eminent technology that provides broadband and IP connectivity on "last mile" scenario. Orthogonal frequency division multiple access uses adaptive modulation technique on the physical layer of WiMAX and it uses the concept of cyclic prefix that adds additional bits at the transmitter end. The signal is transmitted through the channel and it is received at the receiver end. Then the receiver removes these additional bits in order to minimize the inter symbol interference, to improve the bit error rate.

This report includes the study of the technological aspects of WiMAX standards and evaluate/analyze the performance of WiMAX physical layer in different perspectives. In this research work, I investigate the physical layer performance on the basis of bit error rate, signal to noise ratio etc. The performance would be

analyzed in different aspects such as with the variation of different modulation techniques, cyclic prefix, coding, channel models etc. The different techniques employed are studied to know the impact of variations of different parameters causing the variation in the desired output thus maximizing the system throughput and improving BER performance.

There are also other different Broadband Wireless Technologies which provides broadband solutions to the customers such as 3G, WCDMA, HSPA, WiFi, LTE etc. In this thesis, I have studied in brief on different BWA technologies and also compare other BWA technologies with respect to WiMAX in the key dimensions.

Thesis Title: **NEWER ALGORITHM IN PARTICLE TRACKING VELOCIMETRY**

Submitted by: **Deepen Chapagain**

Supervisor: **Prof. Dr. Sashidhar Ram Joshi**

ABSTRACT

Particle tracking velocimetry is one of the various methods used for determining the velocity of fluids. In this method a few tracer particles are injected in the fluid of concern. The assumption is that the particles obediently follow the flow of liquid. An experimental setup is so adjusted that different images are taken at one spatial point across various points in time. The images are preprocessed to extract [4] the particle information. Then a suitable particle pairing algorithm is used to pair a particle from one image to a particle on the other image. When all pairs are identified then the displacement can be calculated and with proper experimental data about the time difference between snapping the two pictures the velocity can be determined. Of the two processes, the process of particle pairing has been of great concern lately. Clearly it is a NP-hard problem and various algorithms have been proposed. The neural network methods and optimization on them have proven to be the best.

In this thesis, the particle pairing problem in PTV has been solved using two different algorithms viz. "Simulated annealing algorithm for PTV" and "Hopping ant algorithm for PTV". In the simulated annealing for PTV, the particles are paired randomly and each pairing is considered as a state. The sum of the distance between the paired particles is taken as the energy, and the algorithm moves on to minimize this energy. In the hopping ant algorithm for PTV, each particle in the two images are considered as a node, and an ant alternates between a node from first image to a node of second image. The sum of the distance between each node of first image to the corresponding node of second image is summed up and taken as the distance for minimization. The best case for simulated annealing for PTV could solve the pairing problem for 400 particles with an error of 8 pairs. In case of ant algorithm, the best case for 400 particles had 35 erroneous pairs. The former was computationally better than the latter.

Keywords: Particle tracking velocimetry; simulated annealing, hopping ant

Thesis Title: **DECISION SUPPORT SYSTEM MODEL FOR HEART ATTACK RISK ANALYSIS USING NEURAL NETWORK**

Submitted by: **Bhupesh Kumar Mishra**

Supervisor: **Prof. Dr. Sashidhar Ram Joshi, Dr. Keshav Dahal**

ABSTRACT

Diagnosis of disease in medical science is a critical job. Treatment of any disease is based upon the diagnosis. Diagnosis and hence the decision making regarding the precaution or medicine are based upon previous medical histories and few investigations. Risk analysis is the major challenge for the medical science especially for the critical diseases like heart attack. Diagnosis of heart disease is done on various medical investigations especially electrocardiogram, angiography any few others complex laboratory tests as well. A computerised tool using artificial neural network can be applied for the risk analysis for medical decision support. Heart disease has diverse symptoms i.e. the risk analysis of heart attack is not free from false assumptions though there are several key factors that help to diagnose heart attack risk. A neural network approach could be applied to the risk analysis on the bases of those factors. Some key factors are taken as the input parameters and a class of

outputs could be predicted. Neural network need to be trained with th^ warehouse pre-processed data. Data need to be refined in the terms of potential input from the warehouse. A multi-layered network will be designed with one layer of hidden layer and trained with the set of data. Back- propagation approach will be applied to adjust different parameters such as link weightage and learning rate. Once a stable network designed it will be tested with some test data. While developing the neural network the input parameters will be divided in groups of simple non-laboratorial and laboratorial data set. Developing of model will be focused mainly based on the non-laboratorial data input for the medical decision for the case of heart attack risk analysis.

Thesis Title: **CHARACTERIZATION OF FIBER BRAGG GRATING**

Submitted by: **Niraj Ram Shrestha**

Supervisor: **Mr. Rajendra Lal Rajbhandari**

ABSTRACT

The discovery of fiber optics has revolutionized the field of telecommunications making possible high quality, high capacity and long-distance communications. With discovery of photosensitivity in optical fiber, new class of optical device has been developed called fiber Bragg grating. In recent years, many research and development projects have focused on study of fiber Bragg grating. The fiber Bragg gratings have been recognized as key components in the modern optical telecommunications systems and optical sensing systems. Thus accurate characterization of fiber Bragg grating is very important for designing and manufacturing the systems based on them. For fiber Bragg gratings problems, number of theories and numerical methods are available that can apply for analyzing, synthesizing and simulating them. Thus focus of this work is to identify the various numerical tools for accurate characterization of fiber Bragg grating and characterized the uniform fiber Bragg gratings based on transfer matrix method derived from the coupled theory. The results obtained by multilayer structure and transfer

matrix method were compared with transmission line modeling method. The study is also extended to characterize the non-uniform fiber Bragg gratings such as chirped, apodized grating.

Thesis Title: **MULTIPLE INPUT MULTIPLE OUTPUT ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING (MIMO-OFDMM) TECHNIQUE FOR WIRELESS COMMUNICATION SYSTEMS**

Submitted by: **Shree Krishna Sharma**

Supervisor: **Mr. Sharad Kumar Ghimire, Dr. Mohmmad Patwary, Prof. Hongbian Yu**

ABSTRACT

Orthogonal frequency division multiplexing (OFDM) is a spectrally efficient technique for high data rate transmission. Multiple Input Multiple Output (MIMO) Systems are often combined with Orthogonal Frequency Division Multiplexing (OFDM) to eliminate the effect of ISI and to increase performance and reliability. In this thesis work, the problem of enhancing the performance of MIMO-OFDM based systems has been considered. Firstly, the performance of a basic OFDM system has been compared with traditional modulation scheme in AWGN and Rayleigh fading channel. It has been observed from the result that BPSK with OFDM provides almost 2 dB improvement in $\mathbf{E_b/N_0}$ at BER value of 10^{-3} in Rayleigh fading channel. The performance of (2 x 2) Alamouti scheme has been compared with (2 x 1) Alamouti scheme and with SISO system.

Transmit and receive diversity schemes are also compared in this work. Furthermore, performance of different channel estimation techniques, combining techniques and equalization techniques have been compared. The performance of MIMO-OFDM combined system has been compared with MIMO and SISO systems in AWGN and Rayleigh fading channel.

In this thesis work, the concept of fractional sampling (FS) has been exploited to enhance the performance of MIMO and OFDM based systems to take advantage of multi-path diversity created due to FS. A low-complexity MIMO-OFDM receiver using the concept of FS has been proposed in this work. The performance analysis of the MIMO-OFDM system with baud rate sampling and proposed MIMO-OFDM system with FS has been carried out in terms of signal to noise ratio (SNR). From the simulation results, it has been found that FS can enhance the performance of MIMO-OFDM system almost by 2 dB at BER of 10^{-3} when FS rate 3 times the baud rate sampling is applied. The BER performance analysis of OFDM system, MIMO system, Alamouti (2 transmit, 1 receive) scheme and MIMO-OFDM system with FS are carried out in AWGN and Rayleigh fading channels. It has been noted from the results that the performance gain increases with FS rate in diminishing order and it is a non-linear function of FS rate. After FS rate 6, it has been observed

that there isn't notable performance improvement due to FS technique because of correlated nature of noise.

Thesis Title: **PERFORMANCE ANALYSIS OF REAL TIME STREAMING IN 3G STANDARDS**

Submitted by: **Chinmay Anand**

Supervisor: **Prof. Dr. Sashidhar Ram Joshi**

ABSTRACT

The Third Generation (3G) of Mobile Communication has two different streams of its development. One is from the GSM stream based on CDMA technology called WCDMA and the second one is from CDMA One called CDMA 2000.

UMTS (Universal Mobile Telecommunications System) is "third-generation (3G)," broadband, packet-based transmission of text, digitized voice, video, and multimedia at data rates up to and possibly higher than 2 megabits per second (Mbps), offering a consistent set of services to mobile computer and phone users no matter where they are located in the world. With UMTS, one directly dives straight into the mobile multimedia wave.

CDMA 2000 is a 3G technology consisting of voice and data traffic. Voice traffic is often referred to as CDMA 2000 IX and data as CDMA EV-DO. CDMA 2000 delivers the highest voice efficiency in the wireless industry, and EV-DO is clearly the market leader for high speed wireless mobile broadband.

Real time streaming of Multimedia in both of these technologies requires high data rates which by specification are built-in in either standard which is more than 2 Mbps. The performance analysis in the worst case scenario in both the standards is the theme of this thesis.

Keywords: GSM, WCDMA, CDMA, EV-DO, 3GPP, 3GPP2, Diversity, Erlang, HSDPA, HSUPA, Fading, Macro, Micro, Urban, Suburban, Multipath, UE, BS, UTRAN, CN, TCP, FTP, Uplink, Downlink

Thesis Title: **CAPACITY OF MIMO SYSTEMS FOR SPATIAL CHANNEL MODEL SCENARIOS**

Submitted by: **Dinesh Chandra Panthy**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

In the research process of wireless systems and in the race for the development of the new technologies, MIMO (Multiple Input, Multiple Output) is getting more attention as it uses two or more antennas at each end of a connection to send and receive data, enabling transmitter and receiver to accept signals more efficiently than with a single antenna and thus overcomes the problems and restrictions compared to the conventional system. Particularly, this thesis investigated MIMO system capacity using the Spatial Channel Model (SCM), proposed by standardization bodies (3GPP-3GPP2) for third generation systems and compared this to one of the physical geometrical model i.e., One Ring channel model and to a theoretical model i.e. independent and identically distributed (i.i.d.) model.

In this thesis, system model for investigating the MIMO system is presented first which is followed by detail Investigation of channel parameters and capacity analysis. A simulation tool is

developed to evaluate the capacity of Non line of sight (N-LOS) MIMO systems in SCM with multipath propagation scenarios and compared with i.i.d. and One-Ring channel model. The results show that capacity increase is almost linear with the number of antenna but rate of linearity is high in water filling power allocation scheme and is low in equal power allocation scheme.

In the second part of analysis, since compact MIMO systems are desirable in practical implementation, the effect of mutual coupling due to closely spaced antenna elements is investigated. The results show that the mutual coupling lead to increase in capacity for the spacing less than approximately 0.4 times wavelength.

When evaluating SCM, all of three popular environments viz.: Sub-Urban Macro, Urban Macro and Urban Micro cell are considered separately and in capacity calculation pathloss is not considered.

Keywords: SISO, MISO, SIMO, MIMO, Capacity, Equal power, Waterfilling, Suburban Macro, Urban Macro, Urban Micro, Multipath, Mutual Coupling, i.i.d., One Ring, SCM, scatterers, fading, MS, BS, 3GPP-3GPP2, Induced EMF.

Thesis Title: **COMPARATIVE ANALYSIS OF FACE RECOGNITION METHODS**

Submitted by: **Manish Shrestha**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

Biometric systems have been researched intensively for security issues. Biometric systems can uniquely identify a particular identity. Among the biometric systems face recognition system is one of the most popular. In this approach the individuals are identified by the feature of face. Research has been in progress since 1980's with numerous applications henceforth. Currently, many face recognition applications are available commercially for criminal identification, security system, image processing etc.

Face recognition is a popular research area where there are different approaches studied in the literature. The goal of face recognition system is straightforward; Compare the captured images with images stored in database and recognize the faces already stored in database. In this thesis, a holistic Principal Component Analysis (PCA) based method, namely Eigenface method, Linear Discriminator Analysis (LDA) based method, namely Fisherfaces and Independent Component Analysis (ICA)

based method are studied in detail. These algorithms are studied in detail and these three methods are compared.

Graduation Year 2011

Thesis Title: **COMPARATIVE ANALYSIS OF SIP WITH H.323 AND ITS HIGHER VERSION**

Submitted by: **Mahesh Dhungana**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

Among the different solution providing multimedia teleconferencing services over IP network, two approaches are of major important; H.323 standardized by the ITU-T and SIP standardized by the IETF.

Some comparisons on a system level, protocol architecture performance evaluation of these individual protocols have been published but the comparisons in terms of delay measurement have rarely been addressed in literature yet. The report outlines the major guidelines in my master thesis research. The primary focus is to provide a rigorous, correct and unbiased comparative analysis of two signaling protocols the ITU recommended H.323 and Session Initiation Protocol (SIP) recommended by the IETF.

These two protocols have basic differences in the supplementary services architecture. H.323/H.450 has been defined as sophisticated enterprise solution and is well suited to support complex multimedia call involving widely interoperable supplementary services. SIP on the other hand, represents a more universal approach. SIP uses more generic syntax and semantics regarding features, definition and session description.

Thesis Title: **PERFORMANCE COMPARISON OF DIFFERENT CHANNEL ALLOCATION SCHEME IN CELLULAR MOBILE COMMUNICATION**

Submitted by: **Nilesh Joshi**

Supervisor: **Mr. Sharad Kumar Ghimire**

ABSTRACT

This research work concentrates on the efficient use of the available radio resources in .cellular mobile communication system. In this research work, performance of different channel allocation schemes is investigated. This dissertation work has been divided into two parts. In first part already available channel allocation schemes are examined and performance comparison between them is done. In the second part, new channel assignment scheme is proposed and performance comparison between proposed channel allocation scheme and already available channel allocation schemes in literature is done.

Obtained simulation result shows that the proposed channel allocation scheme significantly performs better compared to dynamic and hybrid channel allocation scheme in terms of blocking probability. Proposed channel allocation scheme considerably reduced the total number of block call and hence

can serve more number of calls with same number of channels as compared to other scheme.

Thesis Title: **SIMULATION OF PERFORMANCE DUE TO RELAY IN LTE TECHNOLOGY**

Submitted by: **Saroj Pradhan**

Supervisor: **Mr. Sharad Kumar Ghimire**

ABSTRACT

The last decade has seen the tremendous growth in the development of communication technology. The market of electronic goods has grown exponentially. The possibilities of newer services are increasing. There is ever increasing demand of higher bandwidth for services based on data, voice and video with new constraint of mobility being added. From the network operator's view, they demand for being able to deliver higher bandwidth and throughput to the subscribers. Network operators prefer to have systems which are easier to install, maintain, consuming less power, scalable, compatible with the previous version of the system. They seek reliability of the system and traceability of the faults that occur in the system. One of the concerns is the system that is efficient in the use of scarce resources like frequency for which the operator have to pay a heavy fees to the regulatory authority.

Requirement dictates the development of technologies. There is development of wireless telephony from first generation to fourth

generation till date targeting the fulfillment of such requirements. Fourth generation of mobile telephony tries to exploit as many diversity as possible, such as time division multiple access, frequency division multiple access, space division multiple access, in order to meet the subscriber's requirements. One of the problems faced in cellular architecture is the degraded performance at the cell edge and lack of coverage in the shadow regions. Relay has been proposed as the solution to this problem. In this thesis work, downlink physical layer using OFDM technology has been simulated and the results are obtained for BER (bit error rate) and throughput against the different SNR values. The downlink physical layer between eNodeB and Relay, and between Relay and User Terminal, use OFDM technology. With the relationship between SNR and distance, and the given behavior of channel, it is possible to suggest the position of relay keeping in view maximizing the performance in terms of BER and throughput.

Thesis Title: **INTELLIGENT CLUSTERING OF LOG STREAMS FOR ANOMALY DETECTION**

Submitted by: **Manoj Ghimire**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT

Computer systems generate log messages for every event happening in the system. Log analysis is the method of producing actionable information out of those unstructured log data. Because of the various reasons like unstructured data, data volume, lack of domain expert for interpretation, real-time streaming data; logs analysis is resource consuming.

In this thesis, an algorithm is proposed for locality sensitive hashing, which hashes a log message into a numeric value. This value is used for nearest neighbor detection for real-time clustering of log messages. A minimalist CEP engine is implemented to run continuous queries against the log streams. With the experimental setup, a proof-of- concept is demonstrated where statistical anomaly in a system can be detected without any expert input with fair level of accuracy.

Keywords: locality sensitive hashing, log mining, streaming data algorithm, complex event processing

Thesis Title: **PERFORMANCE ENHANCEMENT OF COGNITIVE RADIO SYSTEM BY DISTRIBUTED INTERFERENCE WITH MAC LAYER**

Submitted by: **Sapan Raj Aryal**

Supervisor: **Prof. Dr. Subarna Shakya**

ABSTRACT

The cognitive radio, built on a software-defined radio, is defined as an intelligent wireless communication system that is aware of its environment and uses the methodology of understanding- by-building to learn from the environment and adapt to statistical variations in the input stimuli. Thus the two most popular research areas when it comes to cognitive radios are spectrum sensing and interference management and resource allocation. Spectrum sensing is the ability to find available frequencies/timeslots to transmit in. Research in the area of interference management and resource allocation consists of how to allocate power in channels to maximize capacity while minimizing interference to other users.

This thesis will explore the aspect of interference and resource management in cognitive radio, to see how this can be exploited to enhance the performance of a cognitive radio system.

Especially the aspect of simultaneous transmission between secondary (cognitive) and primary users is of interest, as this could potentially enhance the performance of cognitive systems.

So, this thesis proposed an algorithm which utilizes Medium Access Control layer mechanisms for message exchange between secondary nodes that operate in license exempt spectrum bands, in order to achieve interference mitigation. Also, this thesis successfully implements Fuzzy Logic to Cognitive radio in order to deal with complex and vague environmental conditions.

Thesis Title: **PERFORMANCE ANALYSIS OF POWER CONTROL ALGORITHMS IN CDMA SYSTEM**

Submitted by: **Narayan Tiwari**

Supervisor: **Prof. Dr. Shashi Dhar Ram Joshi**

ABSTRACT

Power control is an important radio resources management method in CDMA systems, where co-channel interference is the capacity limiting factor. Power control targets to control the transmission power in such a way that acceptable quality of service to the user is maintained in minimized interference environment.

As choice of appropriate power control algorithms is of prime importance which aims to increase overall efficiency of system, in this thesis work, the performance of power control algorithms is studied and analyzed. Specially, uplink power control algorithms are compared through simulation on the basis of performance metrics like signal to interference ratio (SIR), probability of outage and number of iteration.

The aim of this thesis is to develop, analyze and compare power control algorithm in terms of converge speed and solve the issue

of oscillation as the mobile toggles near SIR threshold which degrades the quality of service. The results obtained from the simulation work are used to demonstrate that modified adaptive power control algorithm requires much less iteration to reach the desired probability of outage and solves the issue of oscillation near SIR threshold.

Thesis Title: **SPECTRAL EFFICIENCY AND BER ANALYSIS OF IEEE 802.16E (MOBILE WiMAX) IN OFDM PHYSICAL LAYER**

Submitted by: **Lekh Nath Subedi**

Supervisor: **Mr. Sharad Kumar Ghimire**

ABSTRACT

Spectrum being nature's gift; needs most wise use of it. OFDM system is an excellent way to utilize the spectrum. OFDM is a parallel data transmission system which promises the high data rate with minimum degradation of the quality of service relative to serial communication techniques. In OFDM, a single channel utilizes multiple sub-carriers on adjacent frequencies. In addition the sub-carriers in an OFDM system are overlapping to maximize spectral efficiency. Ordinarily, overlapping adjacent channels can interfere with one another. However, sub-carriers in an OFDM system are precisely orthogonal to one another. Thus, they are able to overlap without interfering. As a result, OFDM systems are able to maximize spectral efficiency without causing adjacent channel interference. In order to obtain the orthogonality the subcarrier frequencies must be spaced by a multiple of the inverse of symbol duration. Other than spectral efficiency OFDM has many, advantages, as immunity to impulse interference, resilient to RF interference, robustness to channel

fading, resistance to multipath, much lower computational complexity(collectively, they reduces bit error rate). Also, WiMAX being one of the standards which is using OFDM, has excellent spectral efficiency but there are no , limits for researcher's, that is inspiration for "spectral-efficiency and BER analysis in 802.16e". As we know that with "differential - modulation" over either time samples (Doppler problem) or sub carrier (tone correlation & phase rotation problem) cause a problem. So the suitable modulation techniques are trade-off between SPECTRAL EFFICIENCY & BER, in simple words as level of modulation is increased BER get degraded but spectral-efficiency get improved. However, an improvement in BER can be achieved using combinations of different FEC coding but at the cost of spectral-efficiency. In this thesis work, the performance of IEEE 802.16e (Mobile WiMAX) in OFDM Physical Layer with RS and CC combination with adaptive modulations is analyzed. Also effect of cyclic prefix has analyzed for BER improvement, without much loss in spectral efficiency in different channel environment conditions. In this thesis work, different BWA technologies are studied and also comparative study of WiMAX with its closely related technologies is done according as their features.

Thesis Title: **A JINI BASED APPROACH TOWARDS DYNAMIC CLUSTER MANAGEMENT AND RESOURCE UTILIZATION**

Submitted by: **Pramod Kumar Chaudhary**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

With the commencement of Electronic Transaction Act, 2063, Nepal has taken further step in the field of information and communication technology. With government offices nowadays have started using computers; there lies ahead many challenges to maximize the utilization of computing resources offered by each computer and minimize the overall cost. With many computers, so many idle resources are being wasted unnecessarily. Jobs can be distributed out to idle servers or even to idle desktops. Many of these resources remain idle during off office hours or even during office hours with many users under utilizing the computing as well as memory resources. Different policies could be setup that allows jobs to go only to computers that are free of resources allowing others to run normally and hence maximize the throughput as well as minimize cost. The proposed model not only utilizes resources to optimum but also makes the architecture more modular, adaptive, provides dynamic fail over recovery and linear scalability. The motivating

factors of this research is to understand and identify the architectural constraint in the existing distributed application and annotate additional constraint in order to investigate and propose new architectural style thereby contributing to the literature.

Keywords: JINI, River, javaspace, cluster, Space based Architecture, Grid Computing, JCMRU

Thesis Title: **TCP PERFORMANCE EVALUATION OVER UNTS-HSDPA SYSTEMS**

Submitted by: **Santosh Kumar Baral**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT

This thesis is undertaken to analyze the performance of TCP over UMTS-HSDPA networks in broadband cellular mobile communication. First, The TCP modeling is done and the implications to implement TCP in wireless Networks are presented. Various solutions to implement TCP in wireless networks are presented. Then the architectural concepts regarding UMTS and HSDPA are presented. The simulation of UMTS-HSDPA systems is carried out with the help of EURANE extension to NS2 because NS2 itself cannot simulate HSDPA. The simulation of TCP performance over UMTS-HSDPA is performed with respect to the throughput, TCP variants, Buffering at nodes, and the scheduling at the Node B. After analyzing the trace files created after running the corresponding TCL scripts, the parameters are plotted with the help of MATLAB. The performance analysis is based upon those plots and some references whenever necessary.

TCP throughput in wired and wireless conditions is compared. Results show that the throughput decreases with increasing congestion rate but due to HARQ implemented in HSDPA, the decrease in throughput is not so drastic. The TCP throughput depends also on the type of solutions implemented in each TCP variant. Generally, more buffer in node B increases throughput but not always as increased buffering increases delay in retransmission. The delay in RR scheduler increases twice as the throughput increase. Max C/I the increase in delay is linear than throughput with increase of buffer size. FCDS scheduling, it is better for a moderately large buffer size.

The TCP throughput in UMTS-HSDPA can be increased with the use of hybrid schedulers, introducing proxy server, and using buffer adaptive buffer size as per application requirement. The use of MIMO OFDM technology can be used to increase the throughput as in HSDPA+.

Thesis Title:	**UNSUPERVISED TEXT CLASSIFICATION AS TOPIC ANNOTATION**
Submitted by:	**Nitu Bharati**
Supervisor:	**Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

Multi-class Text Classification is the task of classifying a given text into one or more than one classes taken form a set of predefined classes. A class can be a topic of a text, for example, a class of any text about a movie can be "entertainment". In this research I investigate unsupervised learning to accurately identify the topic of a given text. The cost involved in labeling a large amount of data and availability of huge amount of unlabeled data makes unsupervised learning an ideal choice. The probabilistic algorithm used for text classification can be termed as topic modeling and is capable to extract multiple topics within a single text of a document. LDA model used in this report exploits co-occurrence patterns of words in documents to extract semantically meaningful probabilistic clusters of words called topics .Each of those clusters is labeled using the significant terms selected in each cluster. Semantic distance between the significant terms from the clusters and Wikipedia documents is measured to identify labels for each cluster.

Thesis Title: **PERFORMANCE EVALUATION OF MIMI-OFDM SYSTEM BY PAPR REDUCTION AND CHANNEL ESTIMATION**

Submitted by: **Hariom Dhungana**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT

There are no limit of human desire so day by day we need much higher data speed to facilitate our need but every physical resources like frequency band, transmit signal strength are finite. Within the given limited resource higher data speed is accomplished by new proficiency called Multiple Input Multiple Output (MIMO), Orthogonal Frequency Division Multiplexing (OFDM) system. MIMO-OFDM fulfills the high data rate requirement through spatial multiplexing gain and improved link reliability due to antenna diversity gain. With this technique both interference reduction and maximum diversity gain are achieved by increasing number of antennas on either side.

Performance of MIMO-OFDM system depends on various factors like channel characteristics, SNR, fading, etc. Among them peak to average power ratio (PAPR) and channel estimation are major parameters that must be primarily addressed. In the

thesis various PAPR determining factors such as no of subcarriers, oversampling rate and modulation scheme are studied and their effects are analyzed. Clipping, coding, symbol scrambling, adaptive predistortion and DFT-spreading technique for PAPR reduction are thoroughly discussed. Furthermore, comparison among their characteristics is simulated in MATLAB and useful conclusion is delineated.

Received signal in MIMO-OFDM system is usually distorted by multipath fading. In order to recover the transmitted signal correctly, channel effect must be estimated and repaired at receiver. In this thesis several channel estimation methods are mediated and appropriate solution is recommended. To relieve from overhead of training symbols, which significantly shrink the system bandwidth efficiency, blind channel estimation algorithm is compared with training based channel estimation technique.

Thesis Title: **TRELLIS CODED MODULATION FOR HIGH DATA RATE DIGITAL TRANSMISSION DECODER DESIGN**

Submitted by: **Praswish Maharjan**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

The Trellis Coded Modulation is the way of combining coding and modulation with results in the improve performance of the system without changing system bandwidth. The basic idea of TCM is that by trellis coding onto an expanded signal set (relative to that needed for the uncoded transmission), both power and bandwidth efficiency can be achieved. This thesis is an attempt to design a decoder system for a particular type of Trellis Coded Modulation called 4-D 8PSK TCM.

The recommendations are given by international "Consultative Committee for Space data System" (CCSDS) and the detail architecture for the encoder implementation is given by CCSDS. The Objective of this Master's Thesis is to design, the decoder system for the receiver part.

Thesis Title: **NETWORK ANALYSIS AND MANAGEMENT**

Submitted by: **Mukesh Kumar Keshari**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

Nowadays the popularity of World Wide Web is increasing rapidly. Websites are playing very crucial role to convey knowledge and information. Hence discovery of hidden information about the users is very crucial. This information can be helpful to optimize web server usage. If web logs are mined properly they can provide many useful information for the decision making process.

The thesis has discussed various monitoring software that are currently used by internet service providers for the monitoring of their web server log information. The limitations of the existing software is also discussed.

In the thesis data mining techniques has been used for the analysis of the log information of the web server. The various existing clustering algorithm is used to create the web uses pattern. Those pattern will be useful for any organization to identify the user interest and also helpful for the business

intelligence process. Finally an existing algorithm is modified to create better clustering pattern. Its performance is also compared with the other existing algorithm.

Thesis Title: **PERFORMANCE ANALYSIS OF MIMO DETECTORS**

Submitted by: **Sagun Manandhar**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

During these years, Multiple Input Multiple Output (MIMO) has become a popular technique in wireless communication. However, despite of advances in electronics, receiver design and battery life, the complexity of MIMO systems still remains an issue which is a limitation over more widespread use of this technology. Hence simplifications in receiver design and improvement in the performance of simple architectures have become a key issue in current MIMO technology research.

In wireless communication, Multipath fading is constantly limiting and challenging the ability to achieve the full potential of wireless communications. Since the transmitted power is regulated and bandwidth is precious, there's need for techniques which requires no additional bandwidth and transmitted power. Diversity techniques are very powerful techniques that makes use of two or more copies of a signal and combine those signals to combat multipath fading.

Among many diversity techniques known, space diversity technique is very popular due to simplicity and bandwidth efficiency. Space diversity can be implemented in both the transmitting end as well as the receiving end. This thesis provides detail explanations of space diversity technique. The emergence of transmit diversity led to the evolution of Multiple Input Multiple Output (MIMO) systems. The decoding section is an indispensable part of MIMO systems. This thesis compares the Block Error Rate (BER) performance of various MIMO decoding schemes like Zero forcing (ZF), Minimum Mean Squared Error (MMSE), Maximum likelihood (ML), Linear Least Square Estimation (LLSE), and ZF-VBLAST by performing various simulations.

Finally, when there is a presence of strong line of sight (LOS), Rician fading channel is appropriate for modeling the channel. This fact motivated the comparison between the various MIMO decoding schemes under Rayleigh and Rician channel environments in this thesis.

Thesis Title: **CROSS LAYER FRAMEWORK FOR EFFICIENT MPEG-4 VIDEO STREAMING OVER IEEE 802.11E EDCA IN MANET**

Submitted by: **Ujjwal Pokharel**

Supervisor: **Dr. Subarna Shakya**

ABSTRACT

Cross layer design framework is a new model in network architecture design that takes into account the dependencies and interactions among layers and supports optimization across layer boundaries. The new idea behind this research is a cross layer framework between Application and MAC & MAC and Network layer. It is carried out for efficient MPEG-4 video transmission over 802.1 le Enhanced Distributed Channel Access. The joint optimization between Application and MAC is proposed to provide adaptive mapping of video frames based on its priority information and network traffic load. The MAC and Network layer is jointly optimized to design congestion adaptive routing protocol that will allow video streaming in a multi hop mobile ad hoc networks. The proposed algorithm have been evaluated with the help of performance parameters such as Average End to End Delay, Throughput and Packet Delivery Ratio. The PDR and throughput of the proposed system is improved than EDCA and

static mapping approaches. The average end to end delay is higher than that of EDCA but less than that of static approach.

Thesis Title: **FACTORS AFFECTING THE PARTICLE TRACKING VELOCIMETRY AND APPROACH TO THE NEW PARTICLE TRACKING ALGORITHM**

Submitted by: **Pramod Ghimire**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

The Particle Tracking Velocimetry (PTV) can be splitted into three sub-processes; the recording of the experiment, the image processing and determination of the velocity components. It is essential that each of the three steps be accurate to determine the actual velocity components. Many factors can affect the end result in the particle tracking velocimetry. These factors are scattered in many papers. This thesis collects all the factors that can affect the velocity components in each three steps. The thesis then deals with the modified relaxation based algorithm for tracking the tracer particles between the two image frames. The effect of the maximum threshold value used in the relaxation method on the matching percent and the time for computation is deducted.

Thesis Title: **PERFORMANCE EVALUATION OF COOPERATIVE DIVERSITY IN WIRELESS AD-HOC NETWORK**

Submitted by: **Ishwar Gautam**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT

Wireless communication performance is severely affected by channel fading. Diversity technique is used to reduce the impact of fading on wireless channel by conveying data over multiple independent fading channel paths and combine them at the receiver.

Cooperative diversity in wireless milti-hop network is an attractive new technique to increase throughput and to provide resistance to the channel fading effects [3].Cooperative diversity is a cooperative multiple antenna techniques which exploits user diversity by decoding the combined signal of the relayed signal and the direct signal in wireless multihop networks.

In this thesis, the performance of the cooperative system and different strategies for cooperation has been analyzed. An ad-hoc network with a sender, a destination and a third station acting as a relay is analyzed. To evaluate the performance of cooperative

system the probability of error of cooperative system has been measured using simulation and compared with SISO system.

Different cooperative diversity protocols(Amplify and forward, Decode and forward, Detect and forward) and different combining methods (Equal gain combining, Maximum ratio combining and Signal to noise ratio combining) are compared in different fading channel (Rayleigh channel, Ricean channel). The results shows that cooperative diversity has better performance than single link transmission. Among three protocols DCF has best performance than AAF and DTF with SNRC in Ricean channel.

Thesis Title: **DETECTION OF TUMOR USING IMAGE SEGMENTATION**

Submitted by: **Durga Prasad Bhandari**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

Abstract

Image segmentation is an important and challenging factor in the medical image segmentation. Detection of cancer tumors has variety of segmentation problems. Filters are being used to remove the noise and generate effective features for segmentation purpose. Breast cancer is currently one of the leading causes of death among women worldwide. This thesis presents an approach for detecting breast tumor not only the detection, an early stage of tumors can also detectable. The difficulty of image segmentation found is the misclassified pixels which lead to ambiguity at correct detection of boundary. The effective classification is required to correct the error and fix the boundary to locate the exact spreading of Cancer Tumor and remove the boundary errors around it.

Selection of proper segmentation method is the prime purpose of this work. The thesis is totally concerned to the segmentation of Mammograms of breast and the analysis and performance of different segmentation technique that can be employed in the

segmentation process. The different segmentation technique including edge based segmentation, thresholding, region-based approached, clustering are used to generate useful outcome.

Graduation Year 2012

Thesis Title: **RECOGNITION OF CANCER CELLS USING IMAGE PROCESSING**

Submitted by: **Archana Gurung Shrestha**

Supervisor: **Prof. Dr. Sashidhar Ram Joshi**

ABSTRACT

Cancer accounts for the most dangerous diseases diagnosed causing deaths in the world. In cancer cell diagnosis pathologists manually examine biopsies to detect the cancer cells. Nuclei separation process is very important because the nucleus of the cell is the place where cancer cells are observed. They have to face the problem of cells and their nuclei separation from the rest of the image content for diagnosis. They perform cancer detection manually under a microscope and hence their experience directly influences the accuracy of cancer detection. In a large hospital, pathologists typically handle number of cancer detection cases per day which is a very difficult and time-consuming task. Thus an image processing technique that performs automatic cancer detection can assist the pathologists by providing subsequent opinions, reducing their workload and alerting them to cases that require closer concentration. An endeavour has been put through this thesis for the recognition of

cancer cells in biopsy image using the image processing techniques like histogram equalization, image segmentation, image enhancement - extraction of information and, image restoration - removing degradation in images.

Keywords: cancer detection, biopsy image, wiener, histogram equalization, canny operator, morphological segmentation

Thesis Title: **CONNECTED DIGIT RECOGNITION IN LOW BIT RATE CODING**

Submitted by: **Devendra Kathayat**

Supervisor: **Mr. Sharad Kumar Ghimire**

ABSTRACT

This thesis deals with the recognition of digits uttered in continuous manner in noisy coded environment (i.e. uttering a telephonic data like phone number). Experiments are carried out in Nepali language, but limited to ten digits (0-9). First acoustic training model with clean data is constructed. Testing for clean data shows 100% recognition. With noisy, coded and noisy coded conditions recognition performance degraded significantly. But with spectral preprocessing method it yields better recognition performance. Three different noises (babble, factory and machine gun) with three different signals to noise ratio (10dB, 15dB and 20dB) are used for noise addition. Babble noise with 10 dB SNR (signal to noise ratio) has lowest recognition rate whereas machine gun noise with 20 dB SNR has highest recognition percentage. GSM (Global System for Mobile Communication) and CELP (Code Book Excited Linear Prediction) are used for coding.

Keywords: Hidden Markov Model, Global System for Mobile Communication (GSM), Code Book Excited Linear Prediction (CELP), Spectral subtraction,

Thesis Title: **EMOTION CATEGORIZATION FOR NEPALESE LANGUAGE**

Submitted by: **Ganga Subba**

Supervisor: **Prf. Dr. Subarna Shakya**

ABSTRACT

Emotion recognition from the speech signal is the task of identifying a speech into one of the emotional state of a person. It has been research topic since, many years. The recognition of emotional states using speech is one of the current challenges in field of speech processing. To identify the emotions from the speech signal, many systems have been developed. Emotions are specific and consistent collections of physiological responses triggered by internal or external representations of certain objects or situations, such as a change in the person's body that produces pain, or an external stimulus such as the sight of another person; or the representation, from memory, of a person, or object, or situation in the thought process. Database consisting of acted emotion samples in Nepalese language is used for evaluation purpose. Mel-Frequency Cepstral Coefficients (MFCC) is used as the feature vector extraction method. The work focuses on four main emotional states: sadness, anger, happiness and fear.

Experimental evaluations showed that the proposed algorithm produces 42.5 % recognition accuracy in text independent and speaker dependent and 83% in case of text dependent and speaker dependent emotion recognition experiments for four specific emotions. This confirms the potential of the proposed algorithm.

Keywords: Speech Emotion Recognition, MFCC, Feature extraction

Thesis Title: **SYSTEMATIC APPROACH FOR ANALYSIS OF MIMO AND MIMI-OFDM SYSTEM**

Submitted by: **Kiran Chandra Dahal**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

This thesis studies the fundamentals of multiple-input single-output (MiSO) and multiple-input multiple-output (MIMO) radio communication systems with space- time codes. This thesis propose a systematic method for a space-time orthogonal MIMO scheme that employs two transmitting and Receiving antennas and evaluate (through simulation) the performance. A MISO system and MIMO systems are analyzed using multicarrier modulation (MCM). MCM is incorporated with orthogonal frequency division multiplexing (OFDM) which implements binary phase shift keying (BPSK). The system is simulated based on the design, which tests in flat fading Rayleigh channel. The receiver design is incorporated with the maximal ratio combiner (MRC) receiving technique with perfect knowledge of channel state information (CSI). The theoretical performance of MIMO and MIMO OFDM based on b**it** error rate (BER) vs. signal to noise ratio (SNR) is derived for the channel and are compared with the help of simulation results.

Keywords: Orthogonal Frequency Division Multiplexing (OFDM), Binary Phase Shift Keying (BPSK) Raleigh Fading Channel, Multiple Input Single-Output (MIMO), Multiple Input Multiple Output (MIMO), Additive White Gaussian Noise (A WON) Channel.

Thesis Title: **CALL BLOCKING ANALYSIS IN WCDMA CELL**

Submitted by: **Kirti Giri**

Supervisor: **Mr. Sharad Kumar Ghimire**

ABSTRACT

WCDMA is the air interface for UMTS which is a 3G standard technology. When traffic offered to the system increases there would come a situation that the system cannot handle any more call, this is known as call blocking. Analysis of call blocking is very necessary to plan new network as well as for the upgrade of existing network.

In WCDMA, different services like emergency call, voice call, video call and data are categorized in different service classes with different priorities. In this study three classes of traffic is taken into consideration. Blocking analysis in terms of probability has been done in this research by introducing a term known as BBU (Basic Bandwidth Unit) which is the basis for dimensioning of traffic as well as capacity of the system. In this thesis "Call blocking analysis In WCDMA cell", change in blocking probability has been studied by fully-availability group approximation of WCDMA cell with change in offered traffic

per BBU. The result shows that FAG approximation of WCDMA cell is an easy tool to analyze the capacity of a WCDMA ceil.

Keywords WCDMA, FAG, BBU

Thesis Title: **DIRTY PAPER CODE DESIGN FOR MULTIUSER MIMO BROADCAST CHANNEL**

Submitted by: **Krishna Prasad Phelu**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

Dirty paper code (DPC) can be used to presubtract interference non-causally known to the transmitter and to achieve capacity as if no interference is present at all. In this thesis, DPC based on nested trellis code is designed using Trellis coded quantization/trellis coded modulation (TCQ/TCM) scheme. Rate 1/2 convolutional code is cascaded with rate 2/3 Trellis coded modulation (TCM) to form DPC. TCM code acts as channel code to protect transmitted signal against channel noise where as cascading of both convolutional and TCM codes act as source code which implements vector quantization using Viterbi algorithm. Gain obtained from DPC can be increased using stronger source and channel codes which can be achieved by increasing number of states, because gain of both channel code and source code increases with states of encoder. DPC is the best candidate for precoding in multiuser multiple inputs multiple outputs (MU-MIMO) broadcast scenario. In MU-MIMO broadcast channel, signal transmitted to a user acts as

interference for other users and this interference is non-causally available to base station because code for all users is encoded by same base station. So, in MU- MIMO broadcast channel interference to a user due to signal transmitted to another user can be nullify using DPC. This thesis implements DPC for MU-MIMO broadcast channel with base station containing multiple antennas and multiple receivers each equipped with single antenna.

Keywords: DPC, TCQ/TCM, source code, channel code, vector quantization, viterbi algorithm, precoding, multiuser MIMO, Broadcast channel

Thesis Title: **FUZZY CLUSTERING BASED BLIND ADAPTIVE OFDM SYSTEM**

Submitted by: **Krishna Sundar Twayana**

Supervisor: **Prof. Dr. Sashidhar Ram Joshi**

ABSTRACT

Adaptive modulation system is one of the key techniques in building a broadband communication network because of increasing shortage of wireless communication channels. Fixed modulation systems use only one type of modulation scheme, so that either performance or capacity should be compromise. Adaptive modulated systems are superior to fixed modulated systems as they change modulation level in order to cope with sudden changes of noise condition.

This paper present blind adaptive modulation for OFDM system. Automatic recognition of the modulation format of detected signal and blind identification/estimation of SNR is a major task of an intelligent receiver presented here. In this paper, modulation classification is performed by fuzzy c- means clustering followed by new approach of modulation classification, fuzzy template matching considering the constellation of the received signal. In addition, SNR estimation and modulation order for the next transmission is carry out by

Fuzzy Logic Interface based upon the heuristics. The simulation that has been conducted shows high capability of recognition of modulation level, almost perfect estimation of SNR and adaptive with considerable BER in an Additive White Gaussian Noise channel. The performance of proposed system is simulated in computer simulation tool, MATLAB 7.0.

Keywords: Fuzzy logic, Adaptive modulation, Non data aided SNR estimation, OFDM, Fuzzy c-means clustering, Modulation classification.

Thesis Title: **DECENTRALIZED TDMA SCHEDULING FOR WIRELESS SENSOR NETWORK**

Submitted by: **Laxman Palikhel**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

Energy conservation is a major issue in Wireless Sensor Network (WSN). In order to obtain energy conservation, Time Division Multiple Access (TDMA) has been discussed as one of the potential solution. Many researchers proposed TDMA as a Media Access Control (MAC) in order to conserve energy. The main advantage to using TDMA MAC is avoidance of collision of data packets during transmission and the added facility to use sleep modes. The use of sleep mode enables switching off the radio antennas thus reducing the energy conservation.

Prior to usage of TDMA MAC, scheduling of the sensor nodes, i.e. providing time slot to the sensor nodes must be performed. Efficient scheduling of transmitting time slot in a TDMA is important for low power Wireless Sensor "Network. This thesis deals with the issue of scheduling.

In this thesis, two decentralized scheduling algorithms "Distributed Randomized TDMA (DRAND)" and "Deterministic Distributed TDMA (DDTDMA)" are compared. In these algorithms, flowing the messages among the sensor nodes the scheduling is performed by assigning transmitting time slot to each node. So, their efficiency is analyzed based on schedule length, message complexity and convergence time to obtain scheduling. It is shown that DDTDMA is efficient algorithm than ORAND in terms of schedule length, message complexity and convergence time.

Thesis Title: **RF AND MICROWAVE RADIATION SAFETY AND ASSESSMENTS**

Submitted by: **Naresh Kumar Chaudhary**

Supervisor: **Dr. Nanda Bikram Adhikari**

ABSTRACT

This thesis entitled "RF and Microwave Radiation Safety Study and Assessments" is aimed to study microwave radiation (namely, from cellular base stations around some pin areas of Kathmandu valley) exposures and its analysis comparing with some major safety standards. The thesis first identifies the problem related to the health hazards due to the Electromagnetic Radiation (EMR). Limiting exposures to harmful EMR are then studied in both theoretical and observational approaches. The research then focuses on the analysis of the actual measurements taken on different sites, namely of Lalitpur District. The different places were chooses on the basis of Radio Frequency (RF) sources and public access. RF field strength probe along with a Global Position System (GPS) were used to map the radiation intensities over the corresponding geo-location and record the EMR levels. The obtained results are presented in the form of both digital maps and statistics. Also, in a separate study, a spectrum analysis is performed to quantify the EMR of each local radio transmitters. The obtained observational statistics are

analyzed comparing with different international standards; and radiations over the observed domain found within the safety margins. Analytical analysis however shows some excessively radiating zones where safety precautions are necessary especially for longer exposures. The study finally, outlines some recommendations that need to be formulated by concerned authority to standardize and regulate RF radiation safety exposures.

Thesis Title: **WiMAX SECURITY ENHANCEMENT AND PERFORMANCE ANALYSIS**

Submitted by: **Pintu Kumar Karn**

Supervisor: **Dr. Nanda Bikram Adhikari**

ABSTRACT

World Wide Interoperability for Microwave Access (WiMAX), as one of the promising broadband wireless technologies has many salient advantages like high data rates, quality of service, scalability, and mobility. However this technology is not completely secured. Many sophisticated authentication and encryption techniques have been embedded into WiMAX but it still exposes to various attacks in. Many security problems remain to be addressed in different modes and for different user types. As well, WiMAX performance analysis in terms of different operational parameters is yet a matter of study. This thesis is therefore aims to study the security enhancement system and analyze the performance of WiMAX.

Two traditional approaches that used to address security threats in WiMAX (namely, Privacy and Key Management Protocol Versions 1 and 2 (PKMvland PKMv2» are studied first. A solution to WiMAX security using a so-called Identity Based Cryptograph (IBC) is then studied and analyzed; and a hybrid

model using IBC and X.509 (a standard formats for public key certificates) certificate is proposed and compared with PKMv2. A simple analysis of the proposed hybrid model in a mesh mode shows improvements is term of security threats and communication overhead.

On the other fold, performance analysis of the WiMAX is performed based on the parameters of throughput, packet loss and media access control (MAC) layer delay. A simulation framework so-called OMNET++4.lis used for this study, where WiMAX quality of service (QOS) is analyzed with different configuration scenarios and five QOS classes of service which are Unsolicited Grant Service (UGS), enhanced real time polling service (ertPS) , real time polling service(rtPS) non real time Polling service (nrtPS), and Best Effort (BE). Overall the simulation results revels that throughput of different QOS class are more or less is stable and suppressing packet loss. Also MAC layer loss is increased and decreased according with variation in distance of subscriber from base stations.

Thesis Title: **ADAPTIVE MODULATION IN MIMO SYSTEM**

Submitted by: **Rajeev Prajapati**

Supervisor: **Mr. Rajendra Lal Rajbhandari**

ABSTRACT

Over recent years the MIMO (Multiple-Input Multiple-Output) system has become a popular technique in wireless communication. MIMO is a system with multiple transmitting and multiple receiving antennas. With increasing the number of transmitting and receiving antennas significant improvement in the bit error rate (BER) and increased data rate of the system was observed than that with single transmitting and single receiving antenna system. Hence considerable improvement in an information rate.

Performance of the bit error rate probability of the channel with variable signal to noise ratio will change with channel quality in case of the non adaptive modulation scheme. In some application, system will require the minimum BER. Hence fixed modulation scheme will not perform better in such application. With the use of the adaptive modulation scheme (used in wireless communications to denote the matching of the modulation), system will automatically cope up with the

changing channel condition and accordingly selects the modulation scheme for maintaining minimum required BER. The throughput of the system was found improved with the use of adaptive modulation in MIMO system. For simulation Rayleigh channel model has been considered.

Thesis Title: **PERFORMANCE ANALYSIS OF COMP (COORDINATED MULTIPOINT TRANSMISSION AND RECEPTION) IN LTE ADVANCED**

Submitted by: **Rajendra Dulal**

Supervisor: **Prof. Mari Carment Aguayo Torres**

ABSTRACT

Third Generation Mobile standards are not sufficient to cater the ever increasing bandwidth demand of subscribers in the long run. LTE-Advanced being one of the contender for fourth generation Mobile network standard (IMT-Advanced), uses different techniques to enhance LTE in terms of throughput, coverage and latency. COMP (coordinated multipoint transmission and reception) is one of the key technologies, to be used in LTE-Advanced for better performance. In this thesis entitled "Performance simulation of COMP in LTE- Advanced", I aim to measure the performance of COMP in LTE-Advanced in terms of better cell edge coverage and throughput.

Thesis Title: **SOFT FREQUENCY REUSE FOR INTER-CELL INTERFERENCE CO-ORDINATION IN LTE BASED CELLULAR NETWORK**

Submitted by: **Rajesh Kumar Paudyal**

Supervisor: **Dr. Sanjeeb Pd. Panday**

ABSTRACT

In Third generation partnership project (3GPP) Long Term Evolution (LTE), the frequency planning with reuse of one is aim to provide high bandwidth service to the user but such a frequency planning strategy can lead to unacceptable inter-cell interference levels experienced especially by users located at the cell edge area. In this thesis work two methods. Fractional Frequency Reuse (FFR) and Soft Frequency Reuse (SFR) are proposed as interference management scheme in order to enhance overall per user quality of service (QoS) and throughput as per basis on signal to interference plus noise ratio (SINR) metrics. Both of them are analyzed on the basis of probability of coverage and acceptance rate by considering the average SINR experienced by the user. Along with individual analysis, comparative analysis of each approach is undertaken. From comparative analysis of traditional reuse method, FFR and SFR, it is found that FFR and SFR have relative better performance in

terms of per user acceptance rate and coverage probability. Among them Soft frequency reuse improves the cell capacity with seven percent in coverage and thirty five percentage in rate than FFR but it still suffers from more interference than FFR.

Keywords*:* Soft frequency reuse (SFR), Fractional frequency reuse (FFR), Traditional frequency reuse, Inter-cell interference coordination (ICIC) techniques, Cellular networks, SINR.

Thesis Title: **PERFORMANCE ANALYSIS AND ENHANCEMENT OF ADAPTIVE MODULATIONS TECHNIQUE IN WiMAX SYSTEM IEEE 802.16 PHYSICAL LAYER**

Submitted by: **Rajib Bikram Adhikari**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

WiMAX is an eminent technology that provides broadband and IP connectivity on 'last mile' scenario. It offers both line of sight and non-line of sight wireless communication. Orthogonal Frequency division multiple access is used by WiMAX. Orthogonal frequency division multiple accesses use adaptive modulation technique such as Quadrature Phase Shift Keying (QPSK), Quadrature amplitude Modulation (QAM). The signal is transmitted through the channel and it is received at the receiver end. Then the receiver removes these additional bits in order to minimize the inter symbol interference, to improve the bit error rate and to reduce the power spectrum. This analysis is useful for performance evaluation of different Modulation technique used in WIMAX. Cyclic prefix is used to reduce the data errors caused by multipath reception. Here we estimate the channel to know the condition for adaptation in data rate. Channel

estimation is used because amplitude and phase shift causes error in wireless channel. Then using Adaptive equalizer bit error rate for all modulation techniques are improved. Here we used with and without decision feedback equalizer to change the bit error rate. Least mean square algorithm is used for implementation of equalizer. LMS algorithm is used with decision feedback and without decision feedback. Here we used adaptive modulation technique analyzing the channel condition by investigating the received data. We just change the modulation technique by analyzing the received bits and accordingly changing the modulation technique as the code bits sent through feedback channel.

Keyword: Orthogonal frequency division multiplexing, Adaptive modulation, cyclic prefix, Adaptive equalizer, Quadrature amplitude modulation, Throughput

Thesis Title: **WAVELET TRANSFORM METHOD FOR THE ANALYSIS OF ECG SIGNALS FOR AMBULATORY CASES**

Submitted by: **Rita Thapa**

Supervisor: **Prof. Dr. Sashidhar Ram Joshi**

ABSTRACT

The electrocardiograph (ECG) is a common clinical and biomedical tool used for diagnosis of heart patients. The thesis is aimed towards the development of beat detection algorithm with high level of accuracy for ambulatory monitoring of arrhythmia patients. The thesis has been inspired by the need to find an efficient method for ECG signal analysis which is simple and has good accuracy. The initial task for efficient analysis is the removal of effect of noise. It actually involves the use of wavelet fillers which extract the required cardiac components by rejecting the background noise and the second task is that of R peak detection. Efficiency of the method is measured in terms of sensitivity and positive predictivity. The development, simulation and the evaluation of the methodology is done in MATLAB environment and the database of M1T-BIH is used for the purpose of the evaluation. The accuracy of the algorithm is evaluated against the MTT-BIH arrhythmia database, giving an

average sensitivity of 99.71% and positive predictivity of99.64% respectively.

Keywords: Electrocardiogram, Motion artifacts, Mexican hat wavelet, First derivative of Gaussian, Confeiuous Wavelet Transform.

Thesis Title: **ALGORITHM DEVELOPMENT FOR BEAT DETECTION AND R-PEAK SEARCH OF ECG AND PERFORMANCE ANALYSIS OF ITS REAL TIME IMPLEMENTATION IN THE ULTRA-LOW POWER WIRELESS ECG SYSTEM**

Submitted by: **Sachin Shrestha**

Supervisor: **Prof. Dr. Subarna Shakya**

ABSTRACT

The low power consumption along with the reliable higher performance is one of the basic needs of the emerging technology in the medical field. The thesis work has been carried out on the research on the possibility of obtaining the lowest possible operating power with the high level of accuracy for the detection of R peak of ECG. The algorithm for the R peak search of ECG with a high level of accuracy, combining the optimized band power extraction method and the CWT computation that can be implemented using very low power consumption has been researched and developed in this thesis topic and has been entitled Optimized R peak detection algorithm. The accuracy of the algorithm is evaluated against the MIT-BIH arrhythmia database, giving an average sensitivity of 99.22% and positive predictivity of 99.86%, as well as against imec database with

ambulatory data, giving an average sensitivity of 99.77% and positive predictivity of 99.82%. The power consumption of the algorithm has been estimated by implementation in a commercial low power microcontroller (TI MSP430) to 71.42 μW. The algorithm has been tested in a hardware system using applied signals at varying signal to noise ratio as well as on human volunteers.

Keywords: Electrocardiogram, Assisted signal processing, Continuous wavelet transform, Band power processing of ECG, Ultra low powered ECG system.

Thesis Title: **ANALYSIS OF SPECTRUM SENSING TECHNIQUES IN COGNITIVE RADIO FOR SPECTRUM SHARING**

Submitted by: **Sanjay Kumar Roy**

Supervisor: **Mr. Rajendra Lal Rajbhandari**

ABSTRACT

With the advancement of wireless communications, recent researches by the FCC (Federal Communication Commission) shows that large portion of the available licensed spectrum band lies unused, that is only used by licensed users (primary users). The bandwidth becomes expensive due to a shortage of frequencies. Therefore for efficient utilization of the spectrum band, FCC allowed secondary (unlicensed) users to utilize the licensed band without interfering the primary (licensed) users when it is not in use by primary user named it as Cognitive Radio. Cognitive Radio (CR) defined as:"A radio system employing technology that allows the system: to obtain knowledge of its operational and geographical environment, established policies and its internal state; to dynamically and autonomously adjust its operational parameters and protocols according to its obtained knowledge in order to achieve predefined objectives; and to learn from the results obtained.

This thesis work analyses the performance of the energy detector based on MAP for identifying the status of the primary user. Matlab simulation is used for received signal from Cognitive radio networks and energy detector to find whether the spectrum being used or not by the primary user and later thesis tries to establish relationship between signal to noise ratio and the detection of primary user signal by using maximum a posteriori energy detection method. This thesis work also analyzes the spectrum detection schemes based on dynamic threshold algorithm. Spectrum detection based on fixed threshold are sensitive to noise uncertainty, the energy detection and the matched filter detection are analyzed for the case of noise uncertainty and dynamic threshold algorithm and found that energy detection based on dynamic threshold can improve the antagonism of noise uncertainty; get good performance of detection without increasing the computer complexity and improves the detection performance for the schemes that are sensitive to noise uncertainty.

Thesis Title: **MIMO DETECTION SCHEMES FOR WIRELESS COMMUNICATION**

Submitted by: **Sanjivan Satyal**

Supervisor: **Mr. Sharad Kumar Ghimire**

ABSTRACT

Multiple Input Multiple Output (MIMO) system is one where multiple antennas are employed at transmitter side as well as receiver side in order to improve the spectral efficiency in wireless communication. Since transmitting side, receiving side and channel, all are responsible for the overall performance in MIMO technology however this thesis focus on MIMO detecting part. Based on the bit error rate, the performance of various detections schemes in Rayleigh and Rician Channel have shown. Different aspects have been considered in the evaluation of performance such as; channel characterization, signal to noise ratio, transmitter and receiver antenna number. From comparative analysis of various detection methods, it is found that Maximum Likelihood has better performance however it has complexity issues with the number of transmitting antenna increased. Hence to mitigate such a problem low complexity detection algorithms such as zero forcing, minimum mean square error detection methods along with Successive Interference Cancellation (SIC) and bell labs layered space time architecture

are used to manage complexity. Among these detections algorithm, it is observed that vertical bell labs layered space time with minimum mean square error has optimal solution.

Keywords: Bit Error Rate (BER), Multiple Input Multiple Output (MIMO), Zero Forcing (ZF), Minimum Mean Square Error (MMSE), Successive Interference Cancellation (SIC), Vertical Bell Labs Layered Space Time (VBLAST), Signal to Noise Ratio (SNR).

Thesis Title: **PERFORMANCE ANALYSIS OF DIGITAL VIDEO BROADCASTING - SECOND GENERATION TERRESTRIAL (DVB-T2) SYSTEM**

Submitted by: **Subodh Nepal**

Supervisor: **Mr. Sharad Kumar Ghimire**

ABSTRACT

This thesis analyzes the performance of the DVB-T2 (Digital Video Broadcasting- Second Generation Terrestrial) system for the stationary reception. The aim of this thesis is to implement all the functional blocks as specified in the DVB-T2 specification and analyze the bit error rate performance of the system.

This system is able to measure and analyze the performance of bit error rate (BER) versus signal to noise ratio (SNR) in additive white Gaussian noise (AWGN), Rayleigh, Ricean and Digital Television Group (DTG) channel models. This shows that the schemes which have higher data rates are more prone to error than the schemes with lower data rates. The performance of the Ricean channel is remarkable and it is the less effected channel as compared to Rayleigh channel. This also analyses the effects of constellation rotation for different channels, code rates and modulation schemes. It is seen that improvement in SNR is about

1-2.5 dB depending on Code rate and modulation and depending on transmission channel.

Another part of this thesis studies the robustness of DVB-T2 with respect to impulse noise which mainly focuses on the effect of impulse noise in the DVB-T2 standard. Several configurations of the latter are considered with respect to the time interleaves It is shown that increasing the interleaving depth results in significantly improving the robustness of the system against this kind of impairment. The application structure, its functions and tool used are described herein together, with some preliminary results that are shown and discussed.

Keywords: Digital Video Broadcasting-Second Generation Terrestrial (DVB-T2), Bit error rate (BER), Signal to noise ratio (SNR), Constellation rotation, Impulse noise, Time interleaver.

Thesis Title: **PERFORMANCE ANALYSIS OF MIMO OFDN UNDER VARIOUS CHANNELS**

Submitted by: **Suman Gautam**

Supervisor: **Mr. Daya Sagar Baral**

ABSTRACT

With the evolution of the wireless system the demand for high speed data services have been increasing day by day, which is impossible to be achieve by the conventional serial data transmission system without trade-off between high speed data services and Quality of Service (QoS) without increasing the band width of the system. In order to overcome this problem new parallel data transmission system was proposed, which is known as Orthogonal Frequency Division Multiplexing (OFDM) system. The performance of OFDM system can be further improved by using multiple antennas at transmitting and receiving side to provide spatial diversity. A Multiple Input Multiple Output (MIMO) system takes advantage of the spatial diversity that is obtained by spatially separated antennas in a dense multipath scattering environment. In this thesis, OFDM and MIMO OFDM system has been analyzed under different channel conditions. Performance of OFDM with different values of Guard Interval has been evaluated with the aid of modulation schemes namely Quadrature Amplitude Modulation (QAM) and

Phase Shift Keying (PSK). As from the various results obtained it was found performance of OFDM system has improved significantly using cyclic prefix as guard period. Further Performance of MIMO OFDM under Additive White Gaussian Noise (AWGN), Rayleigh and Rician with different modulation schemes shows better results and improvement in terms of Bite Error Rate (BER). Also the result of the analysis suggest for the better technique in order to improve the BER characteristic of the MIMO-OFDM system.

Keywords: Multiple Input Multiple Output (MIMO), Orthogonal Frequency Division Multiplexing (OFDM), Cyclic prefix, Guard period, Zero padding.

Thesis Title: **ANALYSIS AND PREDICTION OF SALES OF THE COMPANY USING DATA MINING**

Submitted by: **Sumit Khadka**

Supervisor: **Prof. Dr. Subarna Shakya**

ABSTRACT

This thesis helps us to predict the future sales of the company on the basis of historical data and also to analyze the sales of the company. In this thesis different prediction or forecasting model is used to predict the future sales of the company and analyze the sales values given by die corresponding model and also, which prediction based model perform and predict better when no of training data increases and check dependencies of model with number of data sets in database and also which algorithm perform better on short term forecasting, mid-term forecasting and long term forecasting on the basis of performance indices.

Thesis Title: **ANALYSIS OF PASTRY: THE PEER TO PEER OVERLAY SYSTEM USING OVERSIM**

Submitted by: **Ujjwal Man Singh Bania**

Supervisor: **Prof. Dr. Shashidhar Ram Joshi**

ABSTRACT

The goal of peer-to-peer (P2P) networks is to store and retrieve data in a decentralized manner hence provides cost-effective alternatives over the traditional client/server architecture. Efficiency remains the major challenge in the P2P network. Proximity awareness between the peers is one part of the efficiency in P2P network. In this thesis Pastry algorithm, DHT based structured P2P Overlay system is studied and its proximity awareness is analyzed by simulating an application over it.

Keywords : Peer to Peer Overlay Network, Distributed Hash Table, Pastry, Oversim

Thesis Title: **ADAPTIVE POWER CONTROL ALGORITHM ON CDMA SYSTEM**

Submitted by: **Yagnya Murti Pokhrel**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT

Power control is an important issue in CDMA cellular communication systems, where power control is the primary capacity-limiting factor. Power control aims to control the transmission power levels in such a way that acceptable quality of service for the users is guaranteed with lowest possible transmission powers. Without power control base station far away from the transmitting mobile station receives less power than the mobile station nearer to it due to path loss and shadowing effects. The mobile station with higher transmit power, captures the base station and increases the noise floor without letting other mobiles to transmit. This effect is known as "near far effect". To combat "near far effect" power control must be done.

In this thesis a modified algorithm of variable step size power control algorithm called adaptive step size closed loop power control algorithm for CDMA cellular communication systems is proposed. The aim of this thesis is to study various types of

already existing algorithms and proposed algorithm and to compare their performance based on convergence, outage probability and bit error probability. This proposed algorithm is a modified form of variable step size closed loop power control algorithm which controls power adaptively rather than at fixed steps. Exponential function which has both increasing and decreasing characteristics has been used for controlling the power updates. Performance of power control algorithms discussed in thesis is being studied for both single cell and multi-cell CDMA systems. The performances of the proposed algorithms are evaluated through both analysis and computer simulations, and compared with well-known algorithms. The results indicate that significant performance improvements are achievable with the proposed algorithm.

Graduation Year 2013

Thesis Title: **PERFORMANCE EVALUATION OS SOM AND ACO BASED PTV**

Submitted by: **Basanta Aryal**

Supervisor: **Dr. Sanjeeb Prasad Pandey**

ABSTRACT

Particle Tracking Velocimetry (PTV) is a method of flow visualization using the measurement of the fluid velocity. It is a very challenging problem in the fluid flow measurement systems. In past the majority of the previous researches were done in 2-D flow measurement however, nowadays tracking of 3-D fluid flow are in more practice. There are so many methods for Particle Tracking. The latest and highly promising research methods are Self-Organizing Map (SOM) based PTV and Ant Colony Optimization (ACO) based PTV.

In this regard this thesis deals with the performance evaluation of SOM and ACO based PTV. In the case of SOM, competitive of Self Organized Learning method is implemented. In this method the neurons compete themselves to become a winner neuron. The winner neuron has the least Euclidean distance with the input neuron. While Ant Colony Optimization is the meta-heuristic

technique based on the behavior of social insects especially ants in their search for the shortest path in between the nest and the food sources. The biological research shows that in the search of foods by the social insects, the path in between the food sources and the nest is eventually short. This concept is applied to the Particle Tracking where the distance between the second frame particle and first frame particle was reduced by using the simulated ants called agents.

The comparison result between SOM and ACO depicted that both the SOM and ACO detected same number of particles when the particle density was less than 600. Although both of the algorithms detected same number of particles, ACO took less time than SOM for particle pairing. .When particle density was above 600, ACO gave less particle matching errors than SOM but at the cost of more time.

Keywords: Particle Tracking Velocimetry (PTV), Particle Image Velocimetry (PIV), Ant Colony Optimization (ACO), Self-Organizing Map (SOM), Particle Tracking, Particle matching, Performance.

Thesis Title: **GRID COMPUTING BASED GENETIC ALGORITHM FOR IMAGE SEGMENTATION**

Submitted by: **Basu Dev Aryal**

Supervisor: **Dr. Sanjeeb Prasad Pandey**

ABSTRACT

Image segmentation is a crucial, time & resource consuming problem in image processing and can determine the final outcome of many image processing tasks. Genetic algorithms (GA) have been shown to be a viable method to segment an image. However, little research has been done in developing a parallel genetic algorithm for a grid computing environment, which consists of heterogeneous and non-dedicated resources. In this regard, this research focuses on the implementation of grid based GA for image segmentation independently on grid nodes. Existing parallel genetic algorithm models are adapted for the Grid computation and the results from the segmentation experimentation are used in producing a Grid-based genetic algorithm solution for image segmentation. To be specific, GA is applied in image segmentation and the segmented result is compared with single threshold binarization method for segmentation. The comparison result shows that GA segmented image is better than image segmented using single threshold

binarization method. Similarly, the results from simulation of grid verify the increase of processing capacity and time saving. The hardwired implemented grid based GA for image segmentation confirms the efficiency of grid based GA in terms of utilization of time and resources.

Keywords: Image processing, grid computing, genetic algorithm, image segmentation.

Thesis Title: **SVD BASED LWT-DCT METHOD FOR DIGITAL WATERMARKING**

Submitted by: **Chandra Tara Lama**

Supervisor: **Dr. Arun K. Timalsina**

ABSTRACT

The advent of new and complex technology and widened digital world, digital data either image, text, audio or video are easily available and modified. The copyright and ownership are hard to maintain over these intellectual properties. Thus to secure the digital data from illegal modification and transmission various methods have been proposed. Among them Digital watermarking is so far the best. Many techniques have been proposed in Digital image watermarking. It can be used in spatial domain or in Frequency domain. In Spatial domain, Least Significant Bit (LSB), Intermediate Significant Bit (ISB), check sums are common method. In frequency domain, Common methods are Discrete Cosine Transform (DCT), Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Discrete Wavelet Transform (DWT), Lifting Wavelet Transform (LWT) etc. In the proposed method, both DCT and LWT have been used to exploit their advantages along with the SVD (Singular Value Decomposition). SVD is used in image watermarking because of its strong mathematical processing features. It can be used to

convert higher dimensional matrix to a lower dimensional representation. A tradeoff between imperceptibility and robustness is achieved by varying the scaling factor for watermark embedding. Experimental results on various images show that this method has better imperceptibility and recovery features even after different attacks at the cost of marginal execution time complexity.

Keywords: Lifting Wavelet Transform, Discrete Cosine Transform, Singular Value Decomposition, LWT-DCT-SVD watermarking, Digital Watermarking, Image Watermarking.

Thesis Title: **ADAPTIVE MODULATION IN MIMO-OFDM SYSTEM**

Submitted by: **Chayan Hada**

Supervisor: **Dr. Rajendra Lal Rajbhandari**

ABSTRACT

Over the recent years the demand for high speed data rates has been increasing day by day, to achieve a higher data rates either bandwidth or power has to be increased, but both are limited. To overcome this problem new technique of using Multiple Input Multiple Output (MIMO) system has become popular which achieves high data rates with better Quality of Services (QoS). The performance of MIMO system can be further improved by using Orthogonal Frequency Division Multiplexing (OFDM) that uses multiple sub carrier technology.

In this thesis OFDM, MIMO-OFDM and Adaptive modulation has been used. Performance of OFDM, MIMO-OFDM and Adaptive modulation has been analyzed under various levels of M ary Quadrature Amplitude Modulation (QAM) for different antenna number combinations. The fading channel considered in this thesis is Additive White Gaussian Noise (AWGN), Rayleigh and Ricean fading channels. As from various result obtained it was found that the performance for equal number of transmitting

and receiving antenna was much better than that for unequal antenna number. The Bit Error Rate (BER) performance for lower antenna system was better than for higher antenna system. By increasing the antenna number and using lower order modulation the throughput of the system was found to increase with better BER than with lesser antenna number with Mgher order modulation. The throughput of the system was found to improve with tie use of adaptive modulation technique for changing channel conditions.

Thesis Title: **BER ANALYSIS OF MIMO BASED WIMAX SYSTEM**

Submitted by: **Chiranjeevee Kuthumi Ri**

Supervisor: **Prof. Dr. Dinesh Kumar Sharma**

ABSTRACT

Broadband Wireless Access (BWA) systems are capable to transmit higher data rates over larger geographical areas. However, the bit error rate increases with increase in receiver velocity and this adversely affects the quality of service needs. Wireless interoperability for microwave access (WiMAX) is one of the standard technology enabling the delivery of fixed and mobile, last mile wireless broadband access as an alternative to cable and digital subscriber line (DSL). IEEE standard 802.16e (mobile WiMAX) provides fixed, nomadic, and mobile wireless broadband connectivity without the need for direct line-of-sight (LOS) with the base station. In wireless communication multipath fading sets bottleneck for achieving high data rate in BWA system. In this regard, antenna diversity technique, Multiple-Input Multiple-Output (MIMO) system is considered to be essential. MIMO-MiMAX system can be implemented to get the benefits of both WLMAX and MIMO systems. In this thesis, the performance of WiMAX system under Rayleigh fading channel has been evaluated implementing different combination

of MEMO-WiMAX systems with different terminal (receiver) velocities in terms of Bit Error Rate (BER). The analysis shows that for higher terminal velocities, the higher order i.e. (3x4) MIMO-WiMAX system outperformed all other lower order (2x2), (3x3) MIMO systems.

Keywords: Bit Error Rate (BER), Cyclic Prefix (CP), Multiple Input Multiple Output (MIMO), Maximum Likelihood (ML), Minimum Mean Square Error (MMSE), Orthogonal Frequency Division Multiplexing (OFDM), Signal to Noise Ratio (SNR).

Thesis Title: **EFFECT OF NEPALI LANGUAGE FEATURES ON NEPALI NEWS CLASSIFICATION USING VECTOR SPACE MODEL**

Submitted by: **Dinesh Dangol**

Supervisor: **Dr. Arun K. Timalsina**

ABSTRACT

With an increasing trend of publishing news online on website, automatic text processing becomes more and more important. Automatic text classification has been a focus of many researchers in different languages for decades. This thesis attempts to study various Nepali language features and their impact on the classification of Nepali news using Vector Space Model. The total number of dimensions used in Vector Space Model for classification is very large. The results show that the number of dimensions can be reduced by 37.715% using Nepali language specific techniques such as filtering most common-words, word replacements and removal of word suffices using morphology. The average precision and recall increased by 0.539% and 1.317% respectively when common-words were filtered and replacement of words were done. Average precision increased upto 1.217% and average recall increased upto 1.558% with addition of Latent Semantic Indexing.

Keywords: Latent Semantic Indexing, document similarity, Nepali text classification, Nepali news classification, natural language processing, cosine similarity, morphological analysis, Nepali stopwords, vector space model.

Thesis Title: **PERFORMANCE ANALYSIS OF ATC RADAR USING PULSE COMPRESSION TECHNIQUES**

Submitted by: **Khem Narayan Poudyal**

Supervisor: **Dr. Sanjeeb Prasad Pandey**

ABSTRACT

Air Traffic Controller (ATC) Radar is an object detection system which uses radio waves to determine the range, altitude, direction, or speed of aircraft to distinguish those returns from ground clutter. Pulse compression techniques allow for the transmission of a low peak-power, long-duration coded pulse and attain the fine range resolution and improved detection performance of a short duration, high peak-power pulse system. In this thesis, this is accomplished by widening the bandwidth of the transmitted pulse by coding it in frequency, which yields a finer range resolution when compared with a conventional radar system using an uncoded pulse. The received echo waveform is then processed using matched filter to transmit coding scheme which compresses the long pulse to a short duration pulse. Evolutionary windowing function are applied to optimally choose the parameters of stepped frequency Linear Frequency Modulated (LFM) pulse train to achieve reduced grating lobes, low peak side lobe and narrow main lobe width.

The simulation generates time series reflectivity along with different Swerling function, spectrum width, and SNR from various input pulses which are then used to evaluate the performance of pulse compression in conjunction with matched and inverse compression filters. Further, using different windows function such as Kaiser, Kalman and Chebysev, the range-time side lobes is suppressed to levels that are acceptable for operational applications. Finally, Comparative analysis of existing pulse radar transmission techniques at Tribhuwan International Airport (TIA) without compression and with compression is made which shows that the compressed pulse transmission gives better radar reception.

Index Terms—Pulse compression, Swerling function, Matched filter, Side lobes, LFM, Windows, ATC Radar

Thesis Title: **SPATIAL DATA MINING: AN APPROACH FOR CLASSIFICATION OF GEO-SPATIAL DATASET BASED ON MODIFIED DECISION TREE**

Submitted by: **Om Prakash Dhakal**

Supervisor: **Prof. Dr. Subarna Shakya**

ABSTRACT

Although decision trees (DTs) have been successfully applied to non-geographical data, their application to spatial data needs to consider the impact of the spatial dimension on the selection of appropriate classification criteria in order to avoid poor classification performance. The fact that the population of an input dataset is located in space leads us to consider not only objects of interest itself but also neighbors of the objects, in order to extract useful and interesting patterns, which is not the case in non-spatial data where each observation is assumed independent. The principle of this solution is to take into account the spatial autocorrelation phenomena in the classification process, within a notion of spatial entropy that extends the conventional notion of entropy and builds a spatial DT based on a spatial diversity coefficient. Such spatial entropy based DT integrates the spatial autocorrelation component and generates a classification rules adapted to spatial data. The work done presented in this thesis is

primarily focused on the implementation of a conventional decision tree (CDT) and spatial decision tree (SDT) using Iterative Dichotomiser 3 (ID3) algorithm and comparing the results of both implementations in various aspects. CDT and SDT models are built on synthetically generated spatial accident dataset and real accident dataset. Obtained results are analyzed and compared on the basis of several aspects. Result shows the significance of SDT over CDT when applying on spatial dataset.

Thesis Title: **COMPARATIVE STUDY OF SPECTRUM SENSING TECHNIQUES IN COGNITIVE RADIO**

Submitted by: **Rupesh Dahi Shrestha**

Supervisor: **Dr.Samuel Handali**

ABSTRACT

The aim of the thesis work is to study spectrum sensing techniques in cognitive radio which is a recently introduced technology in order to increase the spectrum efficiency. Spectrum efficiency can be increased by utilizing the unused frequency band opportunistically. The two most popular research areas when it comes to cognitive radios are spectrum sensing and interference management and resource allocation. This thesis focused on the spectrum sensing part only. There are different spectrums sensing techniques in cognitive radio. Among them energy detection and cyclostationary feature detection are studied in details and comparative analysis of two are given. The mathematical model and probabilistic models of these techniques are also studied and results are obtained in the form of probability of detection and probability of false alarm. Signal to noise ratios of different signals are also considered in the study. Lastly, Simulation of cognitive radio using periodogram energy

detection is also provided. All simulations are done in MATLAB R2010a.

Thesis Title: **PERFORMANCE ANALUSIS INTRUSION DETECTION SYSTEM USING DECISION TREE AND SUPPORT VECTOR MACHINE**

Submitted by: **Trishna Singh**

Supervisor: **Prof. Dr. Subarna Shakya**

ABSTRACT

This thesis work presents a hybrid model to detect anomalous behavior in the network data through a combination of two machine learning approach that is Support Vector Machine (SVM) and Decision Tree (DT). Feature selection and reduction is based on the rules learned by the decision tree classifier. The reduced dataset is then passed on to the classifier module which uses SVM to construct a maximum-margin classifier. For the evaluation Nai've Bayes (NB) classifier is used as the baseline model. The main task of detection accuracy of the classifier has been increased significantly as compared to the baseline classifier. Further works on reduction on the model building time of the classifier has to be done.

Keywords*:* Naitve Bayes (NB), Support Vector Machine (SVM), Decision Tree (DT), Intrusion Detection, DT Filtering