The success rate showed a decrease as the age increased. A 100% success rate was obtained when 90 degree steering wheel turn thought signals were input. Great deal of effort was taken to get the EEG signal in maximum error free state while the measurement was carried out and hence the model can be a stepping stone for a modified upper limb prosthesis than the one in current market.

Time 2:15 - 2:30

Topic: Energy Aware Survivable Routing Aproaches for Next Generation Networks (NGNs) Design

Presenter: *Bing Luo*

Summary: With the significant growing of multi-service traffic demands in Next Generation Networks (NGNs), there is a need for reducing energy consumption in telecommunication networks due to its environmental impact and potential economic benefits. However, the most existing green networking approaches take no or less consideration to network survivability aspect. Our research aims to tackle the trade-off problem between energy efficiency and network survivability. This talk firstly introduced our three energy aware survivable routing algorithms, which are modelled using Integer Linear Programming (ILP) formulation. They are Energy Aware Backup Protection 1+1 (EABP 1+1), Energy Aware Backup Protection 1:1 (EABP 1:1), and Energy Aware Shared Backup Protection (EASBP). From energy efficiency aspect, we integrate several energy efficient approaches into them, such as energy aware routing, sleeping mode, and energy consumption rating. For network survivability concern, EABP 1+1, EABP 1:1, and EASBP are embedded with 1+1 backup protection, 1:1 backup protection, and shared backup protection mechanism respectively. The three models have been implemented and validated by using IBM ILOG CPLEX Optimization Studio. Moreover, we have developed and integrated the three models into TOTEM (TOolbox for Traffic Engineering Methods) network simulator for better visualization. The extensive results of case studies have confirmed that EASBP could be a promising approach to tackle the trade-off problem between energy reduction and network survivability. This model consumes significantly less capacity with a small sacrifice on energy expenditure, especially under the condition of large traffic demands flowing in NGNs.

Program

- 1:00 pm Adnan Al-Anbuky
  Brief overview on SeNSe Group
- 1:15 pm Hakilo Sabit
  Distributed Incremental Data Stream Mining for WSN
- 1:30 pm Alireza Gheitasi
  Fault Recognition Using Distributed Signature Analysis
- 1:45 pm Sivakumar Sivaramakrishnan
  Energy Efficient Opportunistic Connectivity for WSN
- 2:00 pm Blessy Varghese
  Prosthetic Limb-Human Interface
- 2:15 pm Bing Luo
  Energy Aware Survivable Routing for NG Networks
- 2:30 pm Adnan Al-Anuky
  Closing Remarks
- 2:40 pm
  Refreshments and Networking

Sensor Network & Smart Environment Research Group

- **Event** SeNSe Research Group Celebration
- **Venue** WF 710
- **When** 1:00—3:00PM

  Wednesday 1st May 2013

AUT UNIVERSITY

Time 1:15 - 1:30

Topic: Distributed Incremental Data Stream Mining For Wireless Sensor Network (http://hdl.handle.net/10292/5258)

Presenter: *Hakilo Sabit*

Summary: Wireless sensor networks (WSN's), are capable of providing multi-projection view of the phenomena that they have been deployed at to monitor and generate large amount of data. Most applications demand the data to flow continuously at high speeds and from distributed locations. This will leave the sink to be overwhelmed with computation and resulting in significant time lag when trying to map the dynamics of the phenomena over the physical space. On the other hand the wireless sensors in a WSN are inherently constrained in terms of power, computation, bandwidth and memory resources and hence present a unique set of challenges.

Considering these conflicting demand-capacity requirements this thesis has developed a resource efficient distributed data stream processing framework for WSN. The framework integrates autonomous cluster based data stream mining technique (fuzzy subtractive clustering) and two-tiered hierarchical WSN network architecture to suit the distributed nature of WSN and on the fly data stream processing requirements. The framework demonstrates resource efficient and uniquely multi-dimensional stream mining and context based clustering capabilities. The efficiency of the framework in terms of power, computation, bandwidth and memory is evaluated by undertaking a case study on the Canadian FWI forest fire monitoring system. The thesis has introduced a new high spatio-temporal resolution forest fire monitoring system concept. The Micro-scale forest fire monitoring network that could complement the existing national weather monitoring system has the potential for absorbing the computational requirements on the fly and provides better spatio-temporal resolution than existing systems.

Time 1:30 - 1:45

Topic: Motor fault recognition using distributed current signature analysis (http://hdl.handle.net/10292/5280)

Presenter: *Alireza Gheitasi*

Summary: Detection and diagnosis of faults in electrical motors using electrical signals is one of the important interests of the power industry. One of the main challenges is that of the interferences among various propagated signals through the power network. Operational parameters like size of motors, speed of rotation, spatial distribution of network components and others ention problem. This thesis investigates the significance of propagated fault signatures through distributed power systems, aiming at explaining and quantifying different observations of fault signals and hence diagnoses of machine faults with a higher accuracy. A systematic approach has been employed in modelling the key acting parameters in a typical industrial distributed motor system. The effect of typical faults as they travel through the network has been studied. A framework has been developed to estimate the origin of fault signal by employing propagation patterns and estimating anticipated fault representatives around the network.

Analytical results demonstrate significant improvement in isolating interferences amongst electrical motors that work together in electrical power system networks. This leads to a simple strategy for identifying the ownership of fault signals and hence having more accurate diagnostic results.

Time 1:45 - 2:00

Topic: Energy Efficient Opportunistic Connectivity for Wireless Sensor Network (http://hdl.handle.net/10292/5281)

Presenter: *Sivakumar Sivaramakrishnan*

Summary: Wireless sensor networks are networks built using large number of small sensor nodes having limited battery life. Their radio range is short, which leads to break in connectivity when nodes become mobile. A typical scenario is that of traceability of wild animals with sensor nodes attach on each animal. This thesis analyses the impact of mobility, node density and a limited transmission range for an energy efficient connectivity of such networks. It proposes a protocol for delay tolerant opportunistic connectivity called ECO-DETOUR. Connectivity in cellular networks has the advantage of a fixed centralised infrastructure that can provide wide communication coverage. Mobile wireless sensor networks are inherently decentralised. The decentralised architecture presents the challenge of identifying nodes in a varying density network for establishment of connectivity. Opportunistic connectivity is a technique where mobile node establishes communication whenever a window of opportunity arises. This thesis models a novel approach in Opportunistic connectivity that provides energy efficient communication during both the node discovery phase and data exchange phase of the opportunistic connectivity process. The concept involves four key components. These are adaptive sampling, adaptive coverage, handoff and directional communication. These act on the minimisation of energy cost incurred. The window of communication time is extended in an energy–efficient manner through coverage, handoff and direction for such delay–tolerant networks. These have significantly improved the successful utilization of the communication opportunity.

The overall contribution of this thesis is the ECO-DETOUR protocol designed for delay tolerant opportunistic connectivity. The concept implementation has been modelled on a wildlife example where traceability of preserved animals is of importance. The protocol conducts spatio-temporal learning of the patterns for animal distribution and mobility. It accordingly utilises this knowledge to balance the distribution of the dedicated energy between the communicational and computational actions and hence manage the conservation of node and network energy. The concept may also benefit a wide range of application domains like health care, traceability of lost people, post-harvesting and food traceability, vehicular network and traffic traceability and others.

Time 2:00 - 2:15

Topic: Prosthetic Limb– Human Interface

Presenter: *Blessy Varghese*

Summary: The progress in the study of Brain-Computer interface technology (BCI) has given real advancement in the development of neuro-prosthetic devices such as prosthetic limb. In a BCI based prosthetic system, the translation algorithm and the digital signal processing which is the interfacing section, plays the main role in converting electrophysiological inputs into the output control for the prosthetic device.

By analyzing an amputee it came to light that EMG based prosthetic systems doesn't work in all cases. Hence the reason for considering BCI based system in which EEG signals are taken as the physiological input. The study, was conducted using a standardized protocol for the analysis of the brain signals of a drinking movement thought, which controls an elbow joint performing a 90◦ flexion-extension with the shoulder joint and wrist fixed. EEG signals from five healthy subjects from an age ranging from 30 – 75 were measured, analyzed and processed using Biosignal analyzer in Biomedical Lab at SIM University, Singapore. The drinking movement was analyzed using Vicon Motion analysis system. A Simulink model for interfacing the prosthesis, which includes filtering the required signals, extracting the feature and necessary classification using power spectrum ratio intensity method was developed. The performance of the model showed a success rate of 70% in extracting and classifying the β wave (8-13 Hz) when a drinking movement thought occurs, on an age group in early 30's.