Wireless Sensor Networks (2018-Spring)

Mini-Project Proposals

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Mini-project 1:
Is power control efficient to save energy in WSN?

- Mote_A sends packets of size 128 Bytes to Mote_B start at Ptx= -5 dBm,
  - The packet includes the transmission power value.
  - Then Mote_B sends feedback of the received RSSI value at the same transmission power as Mote_A,
  - When Mote_A receives the feedback from Mote_B, Mote_A executes a simple power control algorithm. The goal is to let the RSSI at Mote_B close to -85 dBm (i.e, not higher than -85dBm and not lower than -85dBm.)
  - Demonstrate the results of the power control algorithm using the oscilliscope java program to show the RSSI value at Mote_B.
  - Analyze energy consumption with and without power control
  - Can you think about other alternative way to save energy instead of power control?

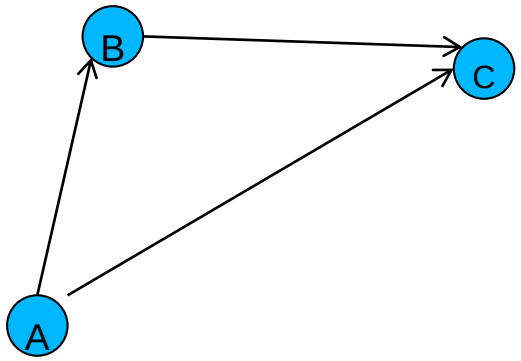
Mini-project 2: Evaluation of Efficient Link Reliability Estimator for WSNs

- To create Empirical Traces of packet reception under variable channel
- To implement different link reliability estimator, e.g.
  - Exponentially weighted moving average (EWMA) estimator
  - Flip-Flop EWMA
  - Window Mean with EWMA (WMEWMA)
  - Etc.
- To evaluate the implemented estimator and to discuss the observation and relationship between agility, stability, and amount of history required for estimation
- Following the research methodology in [1]

[1] Alec Woo and David Culler "Evaluation of Efficient Link Reliability Estimators for Low-Power Wireless Networks"
http://digitalassets.lib.berkeley.edu/techreports/ucb/text/CSD-03-1270.pdf

Mini-project 3:
Design a relay protocol: To hop or not to hop

- Node A needs to transmit packets to node C, varying C's position in different scenarios. Sometimes C is at a bad location and could suffer deep fading and could not receive the packets from A.
- Therefore, there is a motivation to get assistant from a relay node B.
- The advantage with a relay node is that it can increase the successful reception rate at node C but on the expense extra energy cost at node B.



Mini-project 3: cont.

- The project is to design a relaying protocol by yourself, i.e.
  - The protocol should decide when the relay node should reply the packets
  - How the ARQ should work
- Evaluate the designed replaying protocol in terms of total energy consumption and packet reception rate

- Set packet size 128 Bytes, Ptx=-25 dBm, A sends the packets.
- let B at position in the middle between A and C. let C be at different positions to create different packet reception rate in C.
  - Or you could artificially let C discard certain percentage packets to emulate packet loss in C

Mini-project 4: Dynamic Packet Length Control in WSNs

- To investigate the relation between packet size and packet reception rate (PRR), as well as packet size and transmission efficiency through measurement in real environment.
  - Transmission efficiency is defined as received useful bytes divided by the overall transmitted bytes.
- To implement the dynamic packet length control (DPLC) scheme based on [2].
- To evaluate the DPLC performance using a simple testbed
  - Single-hop transmission is mandatory
  - Multi-hop transmission is optional

- [2] W. Dong et al., "DPLC: Dynamic Packet Length Control in Wireless Sensor Networks," 2010 Proceedings IEEE INFOCOM, San Diego, CA, 2010, pp. 1-9.

Mini-project 5:
Does packet size matter under interference?

- The Mote_A transmits packets to the sink
  - With different packet size, e.g. 32 Bytes, 128 Bytes
  - With different transmit powers, Ptx=-25dBm and Ptx = -10dBm
- Scenarios, e.g.
  - With WiFi interference
    - At a channel with heavey WiFi interferece or you generate dedicated interference traffic
    - At Channel 26, no interference
  - With interference from other TelosB motes
    - At Channel 26, let the other two motes create strong interference

Mini-project 5:
Cont.

- The sink measures relevant metrics e.g. the average SNR and the packet loss rate
  - each measurement should have sufficient samples.
  - You might use PacketSniffer_802_15_4 to measuring the on-going traffic in the channel.
  - https://github.com/tyll/tinyos-2.x-contrib/tree/master/tub/apps/PacketSniffer_802_15_4

- Analyze the relation between packet loss ratio, packet sizes, and LQI and SNR, and its relation with the interference traffic.

- Study the length of the burst loss with different packet size

Mini-project 6: “Disco” Neighbor discovery

- Two nodes are asynchronous and have different duty cycle.
- Study the basic Disco neighbor discovery protocol in the reference [3] section 3.1
- Implement the basic Disco neighbor discovery protocol
- Visualize the neighbor discovery procedure
- Analyze the performance of the protocol
  - Energy
  - Discovery latency

- [3] Prabal Dutta and David Culler, “Practical Asynchronous Neighbor Discovery and Rendezvous for Mobile Sensing Applications”, Sensys’08

Mini-project 7: "Birthday" Neighbour discovery protocol

- Two nodes are asynchronous and have different duty cycle.
- Study the basic birthday neighbor discovery protocol in the reference [4] section 2 and 3.1
- Implement the basic birthday neighbor discovery protocol
- Visualize the neighbor discovery procedure
- Analyze the performance of the protocol
  - Energy
  - Discovery latency

- [4] Michael J. McGlynn et al. "Birthday protocols for low energy deployment and flexible neighbor discovery in ad hoc wireless networks" MobiHoc '01

Mini-project 8: Image Compression using TelosB mote

- Load a black and white image file from PC to a TelosB mote. The image is of size 256X256, each pixel of 8 bits.
- Basic requirement:
  - Make a simple compression operation of the image
  - Transmit the compressed image to the sink
  - The sink reconstructs the image
  - Analyze the energy consumption with w/o compression.
- Advanced study:
  - Apply different compression operations of the image
  - Compare different compression algorithm in terms of computational cost and recovered image quality

Mini-project 9: Open proposal

- Welcome to propose your own interested project
- Send the proposal to qz@eng.au.dk , including
  - Project motivation
  - Brief project plan
  - Expected project goal
- If the proposal gets approval, you can start!

Group registration & Project selection:

- 3-5 students per group
  - One student of one group is NOT an option, due to limited number of TelosB motes
- Register group info at the link here by 23/02 including
  - Choosing innovative group name, e.g., SenCom…
  - Student **full names**, Student IDs
  - Selected project with preference
- Maximum THREE groups work on the same project
  - Project reservation base on FCFS