

CS/CE 6390 ACN

Programming Project Description

Energy Efficient Communication in WSN

Project Objective

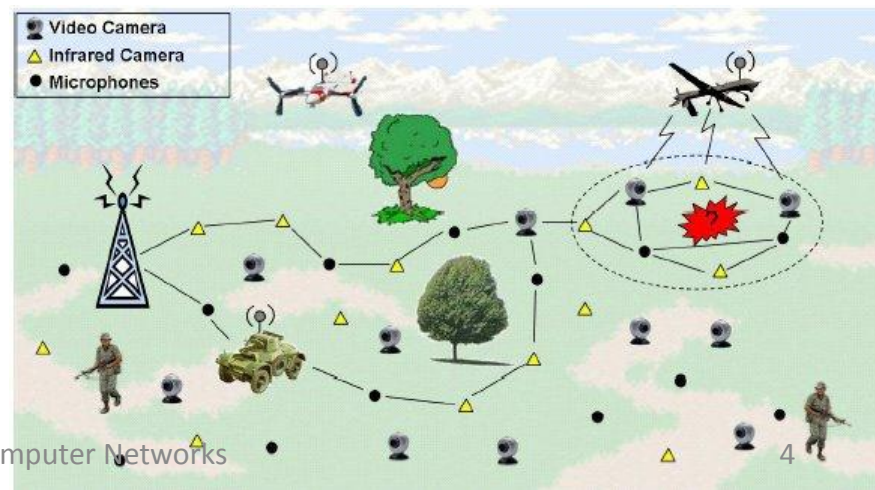
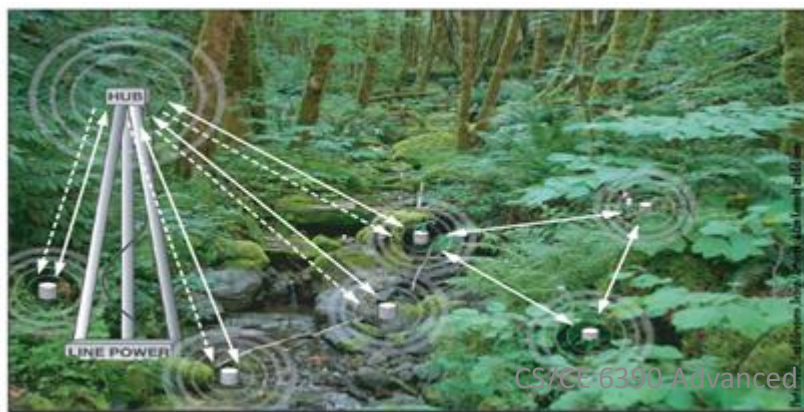
- Objective
 - Design a spanning tree construction algorithm for efficient dissemination of query messages and a protocol for energy efficient data aggregation method of the requested query message in the wireless sensor networks.
 - Implement your proposed energy efficient communication application

What is WSNs (1)

- Wireless Sensor Networks
 - Wireless Sensor Networks are networks that consists of sensors which are distributed in an ad hoc manner.
 - These sensors work with each other to sense some physical phenomenon and then the information gathered is processed to get relevant results.
 - Wireless sensor networks consists of protocols and algorithms with self-organizing capabilities

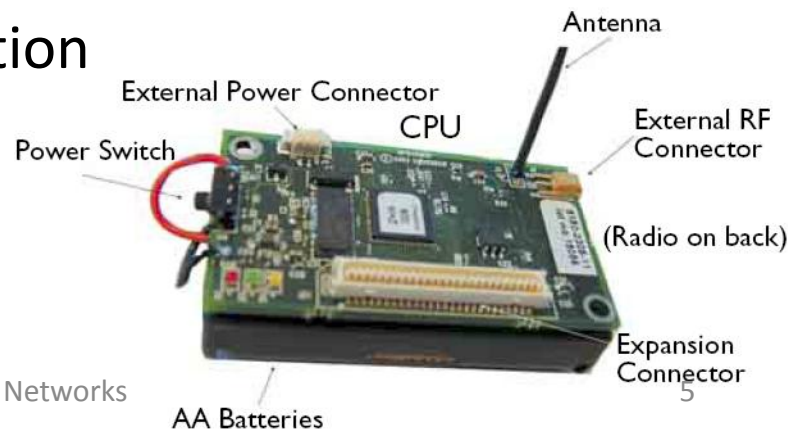
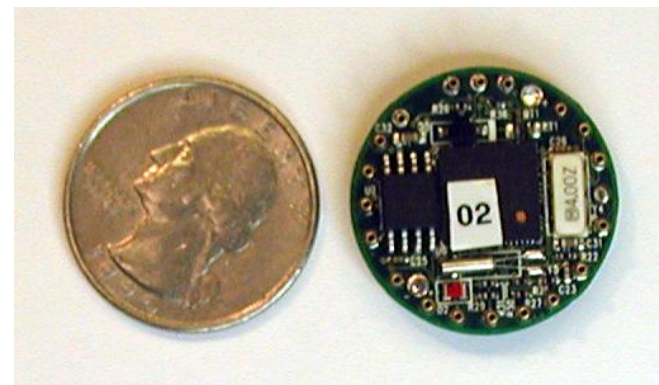
What is WSNs (2)

- Application of WSNs
 - Environmental and Habitat monitoring
 - Military Surveillance
 - Health monitoring and Home automation
 - And more ...



What is WSNs (3)

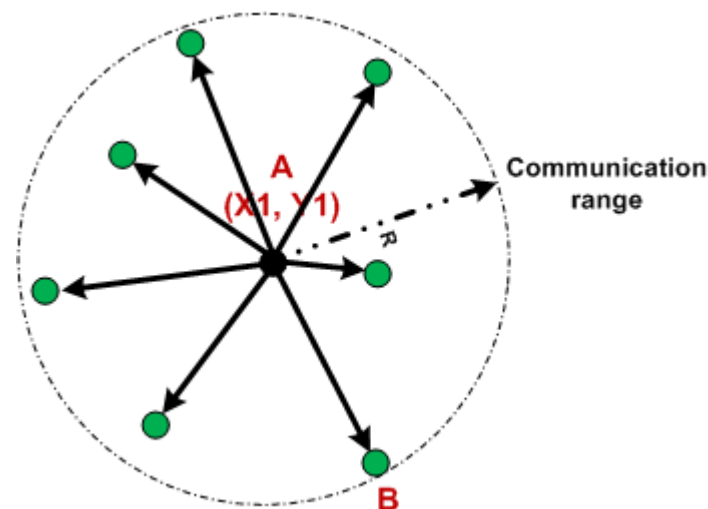
- Characteristic of WSNs
 - Wireless Communication
 - Low power
 - Limited memory
 - Energy constrained due to their small size
 - Main Issue: energy consumption



Energy Efficient Communication in Wireless Sensor Networks

Wireless Communication (1)

- Omni directional coverage
 - How to emulate it in the project
 - UDP communication
 - Euclidean distance
 - $D(A,B) \leq r$
- \Rightarrow B node can receive message from node A



Wireless Communication (2)

- Design in a way to ensure energy efficiency in communicating the response back to the sink node.
 - Communication consumes more energy than computation
 - A large message consumes more energy than a short message

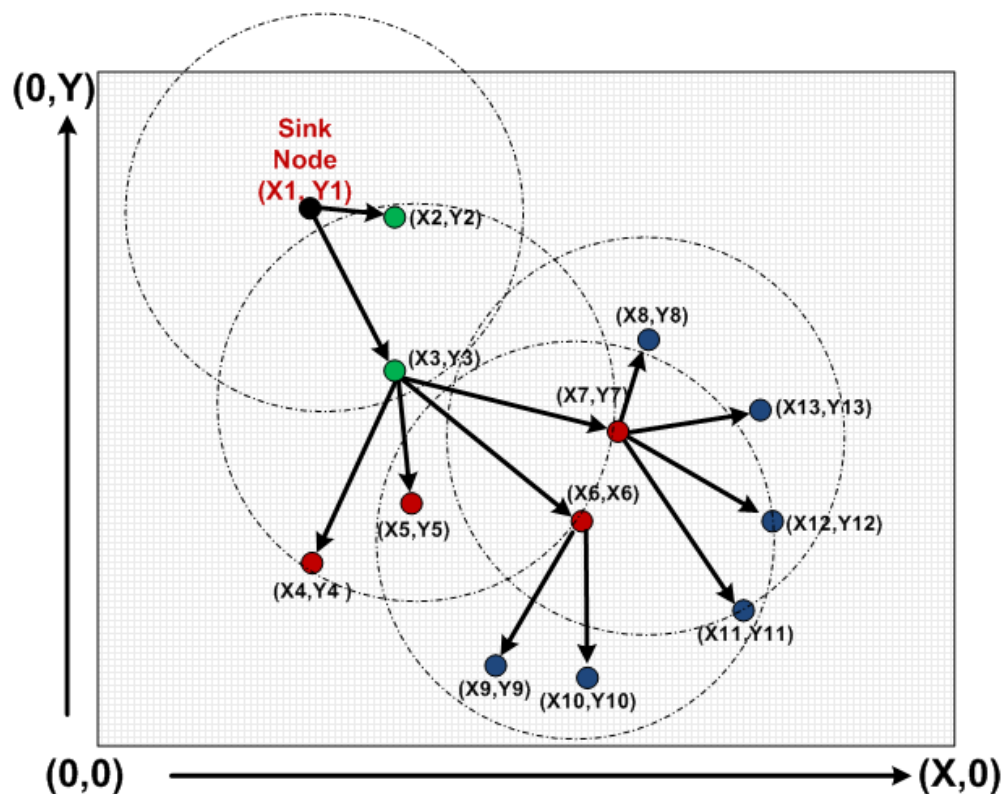
Building a Spanning Tree (1)

- At the Sink node, you do the following:
 - The topology of the entire network including (x,y) coordinate locations and IDs of each sensor node in the network
 - Compute a spanning tree -> in a centralized way
 - Disseminate this information to the nodes on the spanning tree

Building a Spanning Tree(2)

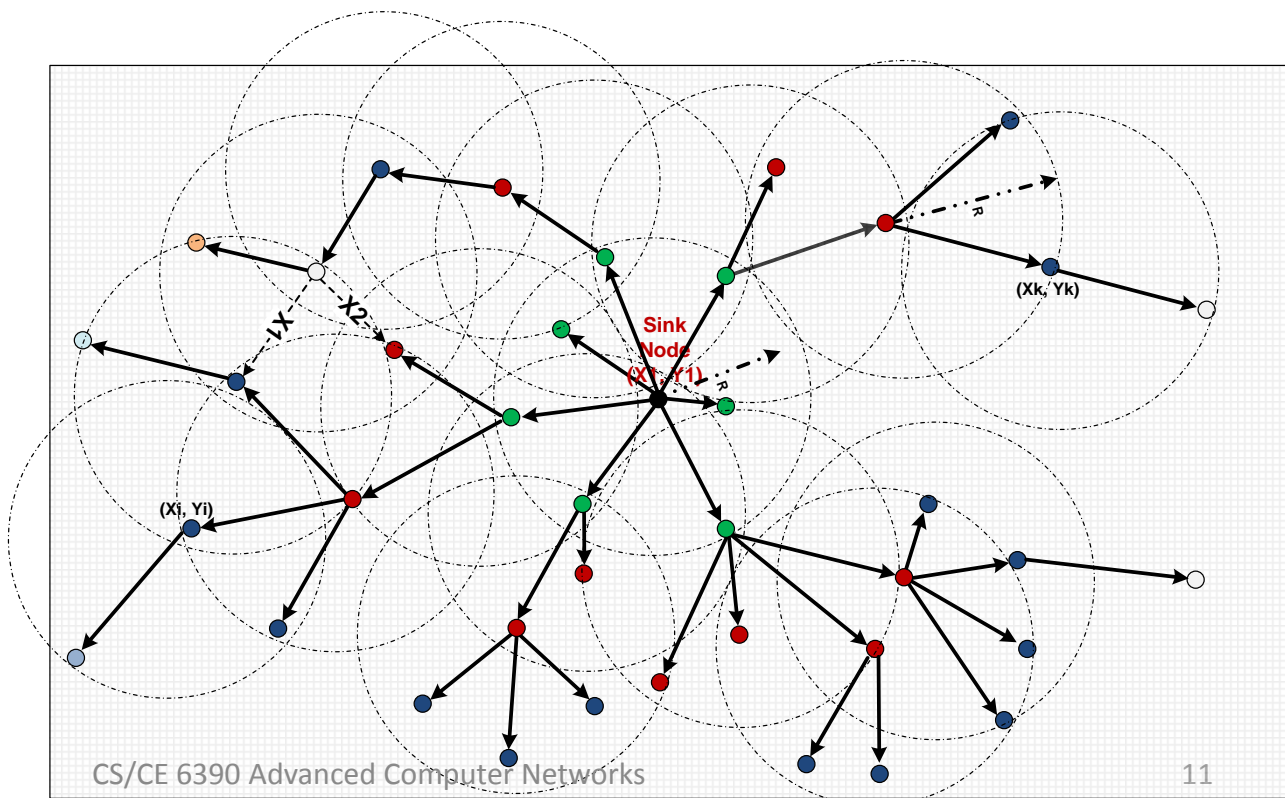
- Sensor deployment

Node Id	Location	Address/port number
1	(X1, Y1)	129.110.92.15/8080
2	(X2, Y2)	129.110.92.16/8080
3	(X3, Y3)	129.110.92.17/8080
.	.	.
20	(X20,Y20)	129.110.92.35/8080



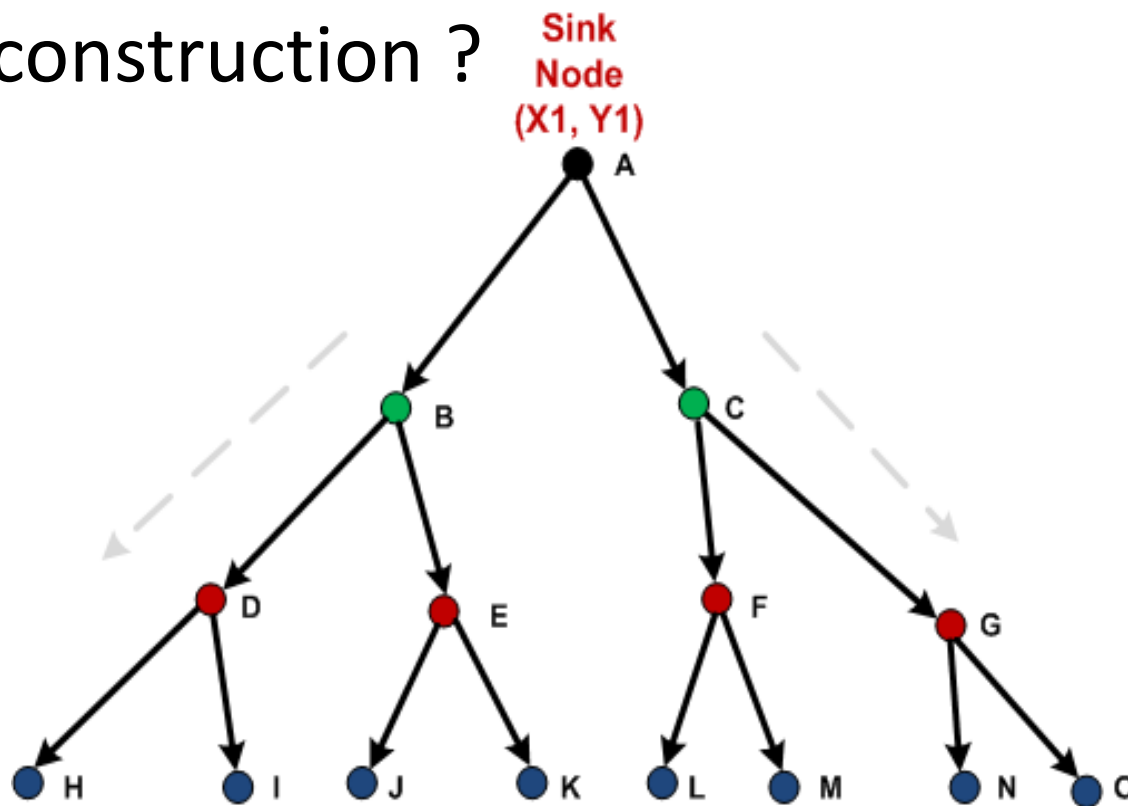
Building a Spanning Tree (3)

- Tree Construction



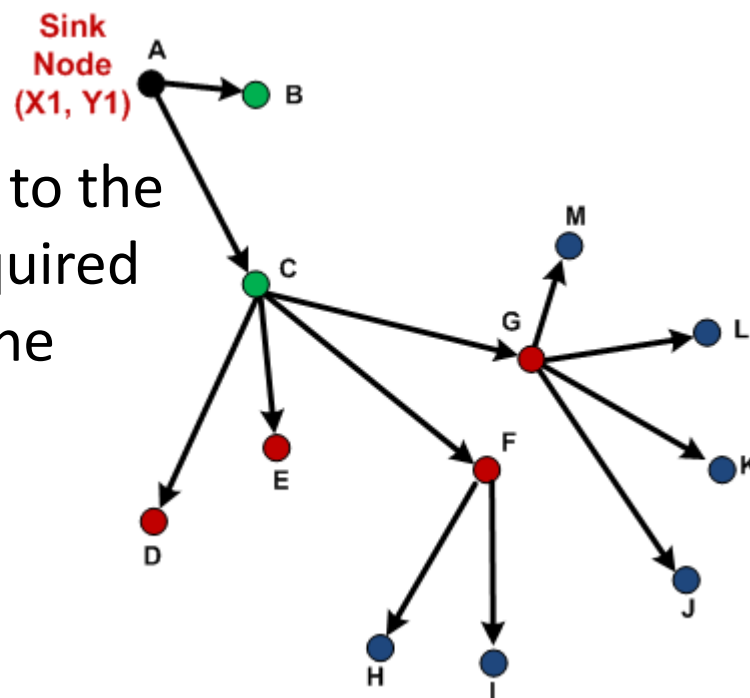
Building a Spanning Tree(4)

- How to disseminate a spanning tree information after tree construction ?



Network Operation (1)

- Sink node will do this
 - Query Dissemination
 - Send out query messages to the network to collect the required information to compute the requested value.



Network Operation(2)

- Query Response Collection

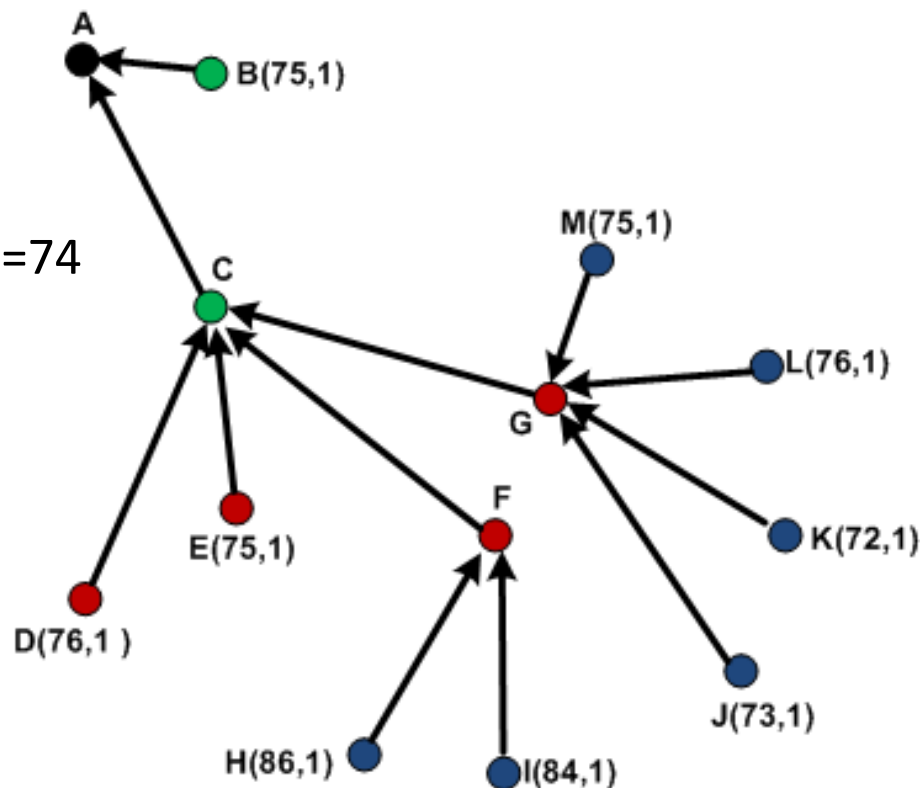
- Temperature collection

- J,K,L,M => G

- $75+76+72+73+74=370/5=74$

- H,I => F

- $86+84+85=255/3=85$

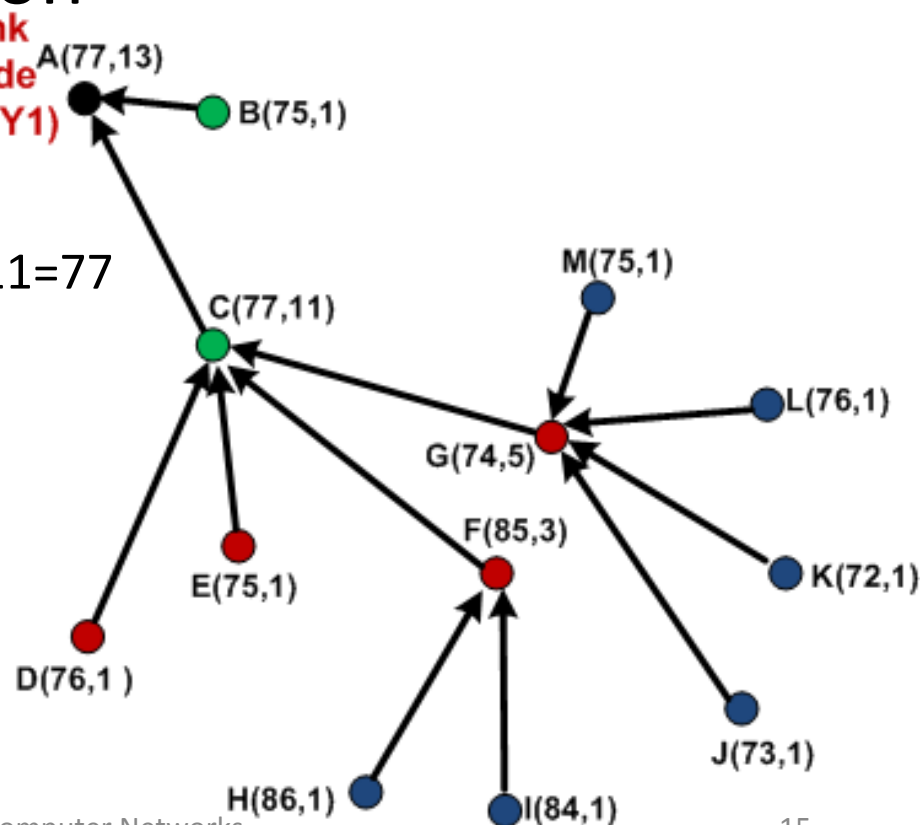


Network Operation(3)

- Query Response Collection

- Temperature Collection

- D,E,F,G => C
 - $76+75+255+370+71=847/11=77$
- C,B => A
 - $847+75+79=1001/13=77$



Implementation (1)

- Each sensor node
 - A process running on netxx.utdallas.edu
 - Read topology file to learn its location and the location of its neighbors
 - Sink will learn the location of all to use in spanning tree construction
 - No node except for sink will use the network topology file for the locations of any other non-neighbor node
 - Broadcast communication
 - Emulated by using UDP message

Implementation (2)

- Sink node
 - Know the entire topology
 - Compute its spanning tree
 - Disseminate spanning tree information
 - Temperature data gathering

Node Id	Location	Address/port number	Temperature	Radius(communication range (meter))
1	(X1, Y1)	129.110.92.15/8080	X	X
2	(X2, Y2)	129.110.92.16/8080	X	X
3	(X3, Y3)	129.110.92.17/8080	X	X
.
20	(X20,Y20)	129.110.92.35/8080	X	X

Logistics

- Submit design document
 - Tree construction and data collection protocol
 - Nov 9th
- Submit final project
 - Dec 14th
- Project Demos
 - Dec 15th
 - Dec 18-19th => Preferred. Can do earlier if needed