Design Objectives

- High reliability and low latency
- Urgent information should be prefered according to their importance
- Self-organizing and distributed behavior
  - A WSN should be adaptive to the scale of an emergency and dynamically changing conditions
  - A globally-organized behavior emerges as results of reactions to the surroundings of each node and local interaction among nodes
- Simplicity
  - A sensor node has limited resources

Outline

1. Introduction
2. Design Methodology
3. UMIUI Architecture
4. Simulation Experiments
5. Conclusion

Design Methodology

Combining simple mechanisms working in different spatial and temporal levels

- Mechanisms work independently with each other
- Quick-acting local mechanisms complement slow and global mechanisms
- No additional mechanisms to identify the scale or situation of the event
Overview of UMIUSI

Our architecture

Application Layer
- Building automation, public surveillance...

Network Layer
- Data gathering scheme
- Multihop routing + Sleep scheduling

MAC Layer
- Contention based MAC

UMIUSI Architecture (contd.)

- Five mechanisms are incorporated
  - Priority queuing
  - Rate control by local congestion detection
  - Hop-by-hop scheduled retransmission
  - Assured Corridor Mechanism (ACM)
  - Rate control by backpressure

Assured Corridor” Mechanism

- Keep surrounding nodes quiet
- Avoid packet loss caused by collisions
- Keep forwarding nodes awake
  - Avoid delay caused by sleeping of forwarding nodes

Contribution of Mechanisms

In a small-scale event
- It takes a while for ACM to take effect
- Priority queuing and rate control do not help much

In a large-scale event
- ACM does not work since collisions occur among emergency packets
- Rate control is effective to mitigate congestion

Simulation Experiments

Using ns-2 with IEEE 802.15.4 MAC
- Broadcast-based routing [14]
- Parameter Settings
  - 200 nodes in 20 m x 20 m region
  - Transmission range: R = 2.5 m
  - After 390 sec: for initialization, make randomly chosen nodes move to EMG_SEND and get back to WORMAL state 180 sec. later. Terminated at 500 sec.
  - one critical class EMG_SEND node in the small scale event scenario
  - four critical class and 29 important class EMG_SEND nodes in the large scale event scenario
  - Interval of emergency packet transmission $f_{avg} = 0.5$ sec.
  - Maximum number of retransmission: 2
- 100 simulations

Thank you