Viability Analysis of GPS-Assisted Ant Routing Algorithm

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Group #10

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PRESENTATION OVERVIEW

- Introduction
- Project Scope
- Related work
- Ant Routing – Overview
- Antnet
- GPS-assisted Antnet
- Simulation Setup
- Simulation Scenarios
- Simulation Result (vs. Distance)
PROJECT SCOPE

- Mobile ad-hoc network
- All nodes acts as hosts and routers
- Dynamic topology changes
- Need algorithm for routing messages
- Must be adaptive, low computation requirement
RELATED WORK

- **Dynamic Source Routing (DSR)**
  - Source sends small packet with destination info to all neighbors
  - When destination receives packet, reply to source with the shortest path
  - Repeat process if link lost

- **Ad-Hoc On-Demand Distance Vector Routing (AODV)**
  - Uses sequence numbers to find route
  - Source broadcasts request for connection
  - Once routes found, route through the least hop path
  - Recycle other routing tables from unneeded nodes
ANT ROUTING - OVERVIEW

- Based on food searching behavior of ants
- Ants randomly disperse until food found, leaving pheromone trail
- Ant with food return while leaving stronger trail
- Other ants use pheromone to search for food
- Unused path pheromone diffuses
ANTNET

- **Antnet Ant Routing Algorithm**
  - Originally by Lavina Jain
  - Implemented for ns-2.33
  - For routing packets in mobile ad-hoc network
  - Initialize routing table with uniform pheromone levels
  - Updates pheromone levels with time and passing packets
  - Does not use location awareness
GPS-ASSISTED ANTNET

- Modified version of original Antnet
  - Location awareness of neighbor & destination nodes
  - Use GPS information when Antnet pheromone information is inconclusive
  - Assume GPS information is given

- Some expected advantages
  - Lower delay during initial routing stage
  - Faster convergence to the optimum route
  - Scalar relationship between distance & delay
SIMULATION SETUP

- Same For Both Scenarios
- Node Number = 25
- Network Size = 50m x 50m
- Link Types = 512Mbps 5ms Drop-Tail
- Grid Topology
SIMULATION SCENARIO

- Interested in **Delay vs. Time** and **Delay vs. Distance**
  - 1. Original Antnet
    - Baseline
  - 2. GPS-Assisted Antnet
  - 2.5. GPS-Assisted Antnet, $V=0.01$
    - Modified routing decision algorithm
    - Rely more on GPS information compared to previous
  - 3. Full GPS Routing
    - Use **ONLY** GPS information and route toward destination
    - Best-case scenario
SIMULATION RESULTS – Antnet Only

Scenario 1 - Delay (ms)

Average Delay – 131.15 ms
SIMULATION RESULTS – Antnet with GPS

Average Delay – 117.80ms
SIMULATION RESULTS – Antnet with GPS, \( V = 0.01 \)

Average Delay – 53.06ms
SIMULATION RESULTS – GPS only

Scenario 3 - Delay (ms)

Average Delay – 34.06 ms
DISCUSSION OF RESULTS

- Results were as expected
- As V approaches 1, the routing solution converges to the ideal
- It is possible to use Antnet with GPS, reducing end-to-end delay by about 10%.
FUTURE WORK

- Different Topology
  - More nodes
  - A bottle-necked link
- Wireless links instead of Wired
  - Enable mobile nodes
- Mobile Nodes
  - Varying GPS coordinates
- Add GPS communication on packet
  - Current nodes know all GPS coordinates
REFERENCES


QUESTIONS?
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Simulation Scenarios

Simulation Result (vs. Distance)
  - Scenario 1
  - Scenario 2
  - Scenario 2.5
  - Scenario 3

Simulation Results (vs. Time)
  - Scenario 1
  - Scenario 2
  - Scenario 3
SIMULATION RESULTS – Scenario 2 Delay
SIMULATION RESULTS – Scenario 3 Delay