'A Communication Layer For Distributed Decision Making'





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Delft University of Technology





- Project goals.
- Crisis management project.
- Traffic simulation program.
- Simulation environment.
- Demonstration.
- Questions.

Project Goals

- *<i><i>`a communication layer for distributed decision making'*
- Develop a simulation environment that allows PDA's to communicate realistically.
- Develop a visualization application.
- Integrate traffic simulation data.

Crisis Management Overview



- Rescue service wireless communication.
- 3 layered model.
- Waypoint layer under development.





- Ant based control routing system.
- Routes vehicles using fastest route in time.
- Vehicle coordinate information.



Simulation Environment

'a communication layer for distributed decision making'

- Implemented in C#.
- Object oriented
- Extendable
- Multi-threaded.
- Distributed.
- Synchronized.
- Dataset based.



Ad Hoc Simulation



- Simulates wireless communication between PDA's.
- IEEE 802.11B (Wi-Fi).
- Ant-colony-based routing algorithm.
- Nearest neighbor detection.

PDA's currently in the container:	Simulation state
	Ticks read: Disconnected AHV State: Disconnected Current Simulation State: Stopped. PDA's active: 0

Ad Hoc Simulation

PDA Communication



- Protocol.
 - Route creation/maintenance using ARA.
 - Packet buffering.
 - Data fragmenting.
- Media access control layer.
 - IEEE 802.11B communication.
 - PDA to PDA('s) data transfer.
- Protocol and media access control layer function independently.



Ad Hoc Simulation IEEE 802.11B (Wi-Fi)

• Limited transmission ranges.

- Bourse HTB Date Destruction SFO CTS SFS DFS ACK Other NAW (4(T6) DFS / Customics Window NAV (4(T6) Defr Access Backet After Defer
- Transmits or listens not both.
- Carrier sense multiple access with collision avoidance media access control layer.
- Physical layer not implemented.



Ad Hoc Simulation Ant-Colony-Based Routing Algorithm



- Mimics ant food searching behaviour.
- Route creation using forward and backward ants.
- Pheromone values identify optimal routes.





Ad Hoc Simulation

Nearest neighbour detection

- Sector based solution implemented.
- Three step detection phase.
 - a) Transform PDA coordinates to sector coordinates.
 - b) Identify neighbouring sectors to search.
 - c) Calculate Euclidian distance between PDA's in the sector(s).

$$d_e = \sqrt{((x_a - x_b)^2 + (y_a - y_b)^2)}$$





Ad Hoc Visualization



- City street network visualization.
- Simulation statistics.
- Simulation options.
- PDA statistics.



Ad Hoc Visualization

Render Engine

- Memory buffered.
- Traffic map rendering.
- Coordinate transformation.
- Node rendering.
- Transmission range rendering.
- Connection rendering.





Ad Hoc Visualization Options



- Network connection.
- Dataset loading.
- MAC settings.
- Protocol parameters.
- Transmission ranges.

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Ad Hoc Visualization

PDA graphical user interface

- MAC statistics.
- Protocol statistics.
- Neighbours.
- Message transmission.
- File transmission.

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Demonstration



Ad hoc Simulation Ad hoc Visualization







Thanks!





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