



Graphic interactive user interface for monitoring rescue activities in emergency scenarios

Configuration tools of the Virtual Scenarios

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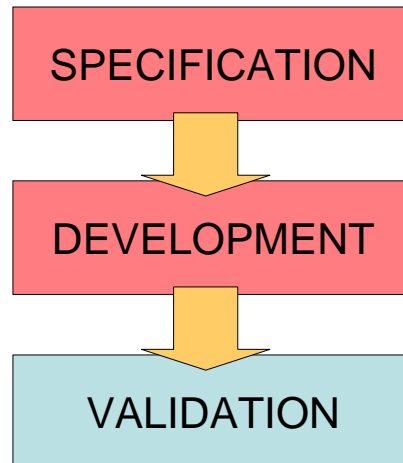
Aim of the research

- The research work aims at studying and developing software modules for:
 - modelling and configuring virtual cities, rescue agents and disasters;
 - visualizing and simulating rescue activities in case of disasters at real-time.
- To be used for:
 - Performing queries on urban area properties
 - Planning/monitoring rescue activities
 - Training on rescue activities

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Planned activities



System modules

- Modeling
- Visualization
- Simulation



Modeling

- **Modeling of urban area:**
 - Buildings
 - Building properties: type, mass, volume, material, texture, etc.
 - Roads
 - Infrastructure: waterworks, electric grids, drainage systems, telephone systems, etc.
 - Inhabitants
 - Number per building

(data imported by cadastral DB or inserted by users)
- **Modeling of rescue agents:**
 - Police, firefighters, medical aids, etc.



Visualization

- **Viewer of 3D scene:**
 - Setting of the level of details of buildings, roads infrastructure, etc.
 - Setting weather conditions, day/night, etc.
 - Navigation functionalities
 - Points of view (from agents, inside buildings, perspective, up view, etc.)
- **Queries on data:**
 - Building/road properties
 - Inhabitants in buildings
 - Data from sensors (images video, sounds, etc. from real environment)



Real-time simulation

- **Configuration of disaster:**
 - Damaged buildings (pictures from real environment)
 - Inhabitants
- **Configuration of operating rescue agents:**
 - Positioning data, kinematics data
- **Visualization:**
 - 3D environments from different povs
 - Simulation of events, situations (fire, water, etc.)
- **Planning/monitoring:**
 - Rescue operations
 - Way outs



First year activity

“T1A - Specification of the functional model of modeling and visualization tools”

“T1B – Configuration tools of the virtual scenario”



3D modeling of the Virtual City

1. Import of city cadastral data and/or manual data input

Aim of the activity was to define methods and procedures to represent a certain city according to the data model, taking advantage as much as possible of automated conversion procedures for the existing data, and defining the procedures to be followed for manual or semi-manual input in the database of the data that is missing or that cannot be treated automatically.

2. Reconstruction of the 3D model of the city

Implementation of an application for the conversion of the data described in the previous part to a format suitable for its visualization through standard graphic libraries. This includes, but is not limited to, the polygonal approximation of the geometrical information, mapping of pictures to be used as textures, etc.

3. Functions for city configuration (setting of date/time, meteo, etc.)

Management of "variable" information that affects the visualization but that can't be included in cadastral archives. Examples of such information are: daytime, which determines the intensity and the angle of sunlight (or moonlight) together with the geographical coordinates; the meteorological status (fog, snow, rain ...), the eventual light of lampposts or other street furniture, etc.



Virtual City: issues (1)

• 1. Buildings reconstruction

– Problem

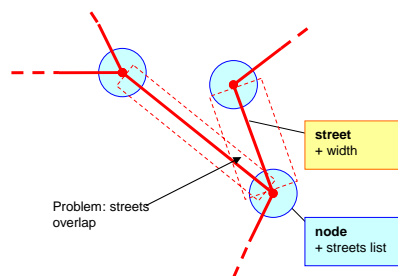
- The RoboCupRescue kernel provides:
 - 2D data describing buildings
 - Number of floors
 - List of coordinates defining the vertexes of polygons for each building

– Solution

- Development of an algorithm for tessellating polygons (not concave) used for representing buildings

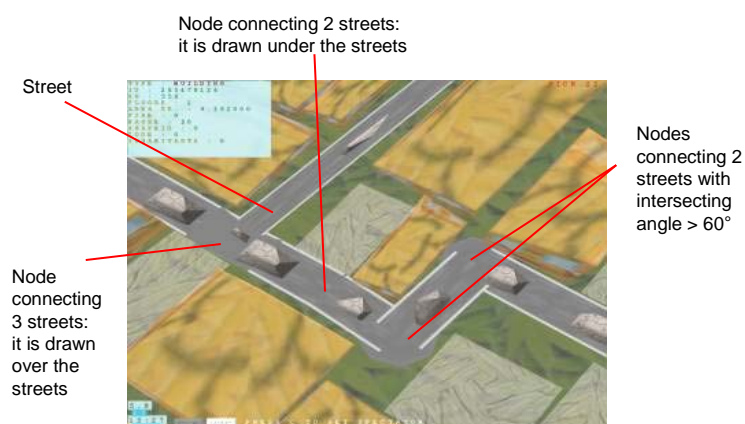
Virtual City: issues (2)

- 2. Representation and management of road graph
 - Problem solved using visual approximation in order to reduce visual defects



Virtual City: issues (3)

2. Representation and management of road graph



Virtual City: issues (4)

- 3. Illumination of the environment
 - Algorithm that on the basis of latitude, longitude, date and time of the location we intend to simulate, generates some values used for rendering the scene.

Virtual City: issues (5)

- 3. Illumination of the environment



Modeling of Agents

- Import of the agents' models (robots and rescue vehicles) and their positioning in the scene.
- The correct visualization of agents depends on the availability of positional information and, where applicable, kinematics.

Agents



Medical agents



Policeman



Fireman



Civilians



Agents: issues

- Positioning and movement of agents along the streets
 - Positioning of agents in the middle of the street, moving forward



Disaster configurations (1)

Setting of disaster configuration parameters, such as collapsed buildings, smoke clouds, fires, flooding, etc.

This information should be not only visualized, but also communicated to the kernel as it is relevant to the decisional process (e.g., a collapsed building can interrupt a road).



Knowledge
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Manufacturing
and
Related
Technologies

Disaster configurations (2)

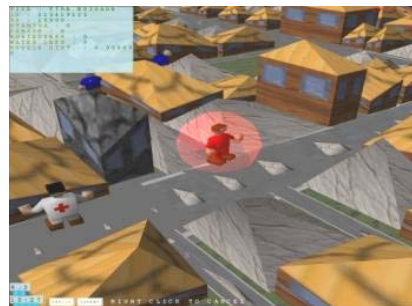
- Simulation of visual effects like fire and smoke
- Visualized on requests from simulation kernel



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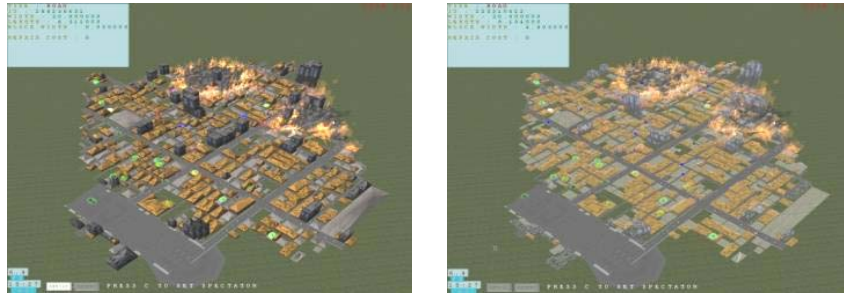
User Interface (1)

- Agent selection



User Interface (2)

- Aereal views



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User Interface (3)

- User's view

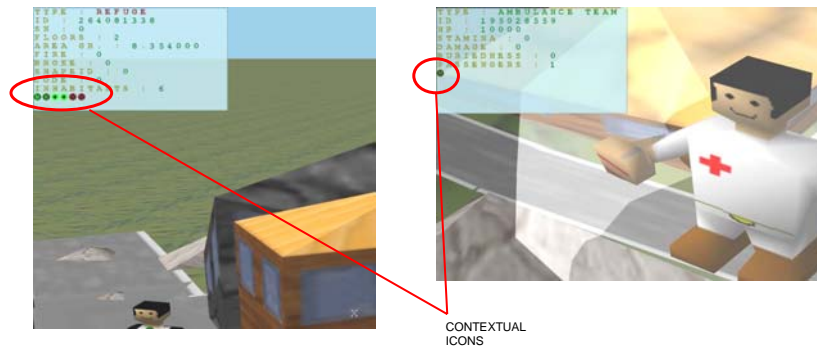


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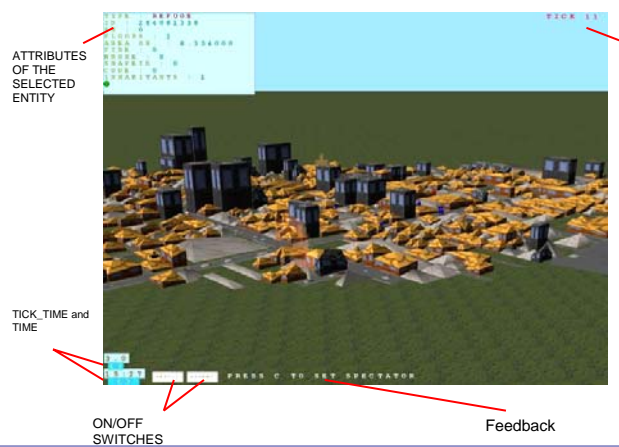
User Interface (4)

- Indicators of human presence



User Interface (5)

- GUI



Open issues

- Integration with RobocupRescue kernel
- Improvement of visual effects
- Improvement of GUI
- Modeling and simulation of indoor arena set-up and robotic agents