Ambulance simulator for paramedic training

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Project background

- Paramedics are responsible for assessing a patient's condition and providing essential treatment prior to hospital admission
- Different simulations are an integral part of paramedic training in Metropolia
  - Dummy patients
  - Actors as patients

Project background

- Paramedics must be able to provide treatment while the ambulance is moving
- A typical finnish emergency ambulance team consists of two paramedics
  - No ambulance technician → one of the paramedics must drive the ambulance
  - Driving training is not compulsory part of the training (a driving license is considered to be enough)

The simulator

- The simulator consists of an ambulance size base plate that has seating and stretchers installed in the positions of a typical ambulance
- Students can be trained in the simulator with the methods mentioned earlier

Training on the move

- The movement of an ambulance is simulated with a set of pneumatics muscles that installed in the front and back of the base plate
- The pneumatics muscles are controlled by an automation system

The control system

- The automation system that excites the pneumatic muscles is connected to a PC with Ethernet
- The PC run driving simulator software that simulates ambulance movement and provides the automation controller with information about the orientation of the ambulance
- The automation system calculated control values for the pneumatic muscles

Driving simulation

- Initially the motion information was produced by a racing game
  - The game had (and still has) a fairly high fun factor but the motion of the platform was bit too rough
  - Another game (truck simulator) was installed to address the rough motion problem but then problem was too sloppy motion (and no fun factor)
- A project for more realistic motion simulation was started

Accurate simulation

- To simulate ambulance movement accurately the physics of the ambulance need to modeled
  - A game physics simulator typically ’cuts corners’ and does not provide realistic motion information
  - A high precision physics simulation environment from Mevea Oy was chosen as the physics engine of the simulator

The ambulance model

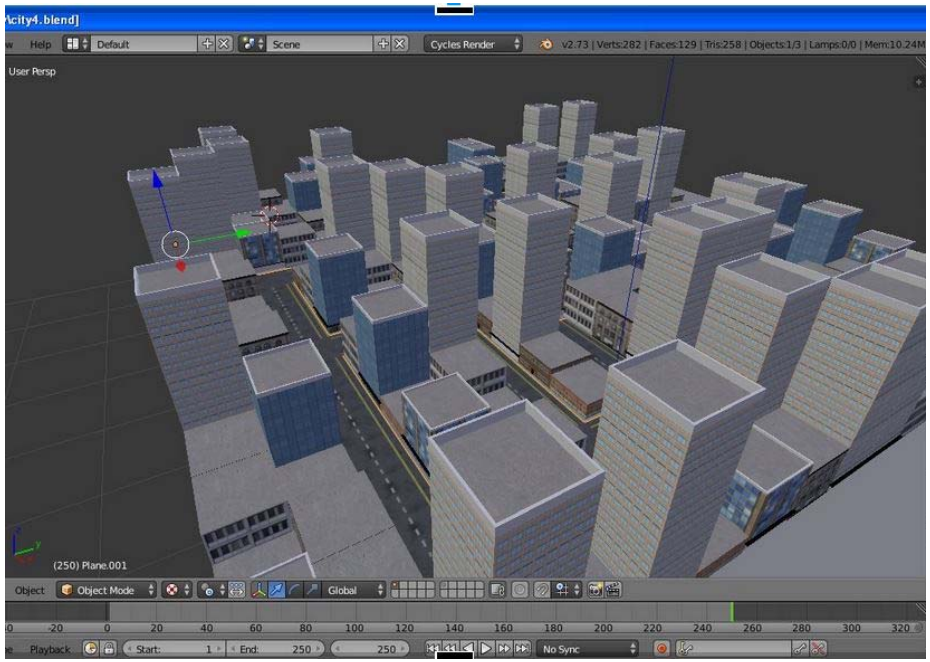
- Ambulance model consists of two parts: physics model and graphics
- Physics model is the key to accurate simulation
  - Model defines physical properties of the ambulance (masses, centers of gravity, inertial momentums, joints between bodies, power train and brake parameters etc.)
  - An accurate model yields realistic results
- Graphics is just ’eye candy’ that is hooked to the physics simulator

Motion platform

- The ambulance platform mentioned earlier is actively used in training so it must have a stable and documented software → development and testing must be done on a different platform
- 2 DOF motion platform is used for development and testing

A virtual city

- In addition to modeling the ambulance we also need to model the environment
- A 3D city model was created for testing purposes
  - Target of the project is to import maps of real cities to improve realism

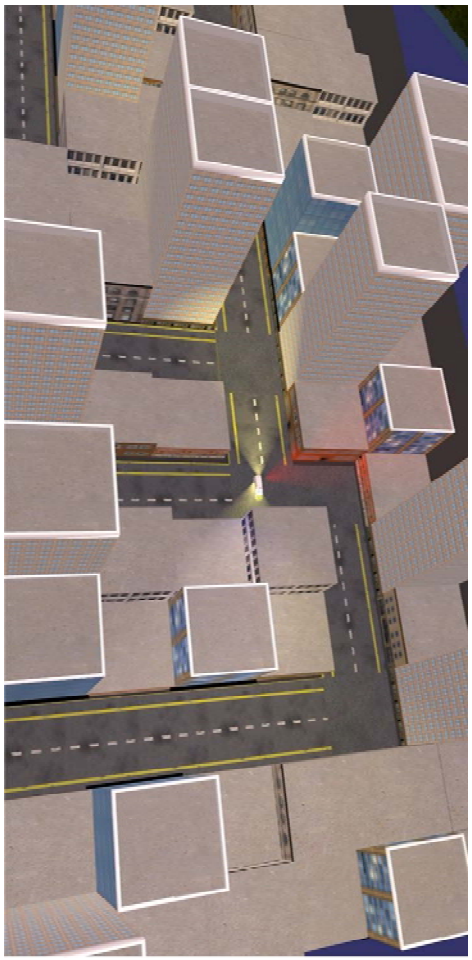


Driving around in my car

- The final model combines 3D city model with the ambulance physics model and ambulance graphics
- On the right you can see the drivers view
  - High quality graphics improves reality – note the brake lights in mirrors

A view from the top

- The simulation engine allows cameras to be placed anywhere in the virtual world
- The student performance in the simulator can monitored with multiple views
- To the right is a snapshot from bird's eye camera in the virtual city
  - Something is missing from the picture



Is there anybody out there?

- High number of equations needs to be solved to resolve the movement of the ambulance
- For smooth operation the equations need to be solved in real time
- When the number of cars is increased the number of equations to solve increases exponentially → with five cars it would take 40 seconds to solve the equations for 1 second of time

Back to the drawing board

- From the driver training and paramedic training perspective there is no need for accurate physics simulation of the other vehicles
- Realistic looking traffic simulation can be achieved without accurate physics simulation
  - You are excepted to avoid hitting other cars with the ambulance → no need to simulate collisions

Take the best of both worlds

- The next step is to simulate traffic with a game development engine (Unity)
  - Research is required to implement realistic traffic behaviour – microscale traffic models for example to model drivers reactions to approaching ambulance
- The ambulance physics can be simulated outside the game engine for realistic motion and game engine can take care of visualization