# **VDL Robot Sports**

2014-11-10 Evelien Snel

#### **Evelien Snel**

- Joined our team 4 months ago
- Previous experience in Philips Cyber Football Team
- Electrical Engineering (graduated in 1988 in Delft)
- 23 years of software development in many companies
- 4 years independent entrepreneur in Language & Technology

#### **Evelien Snel**

- Joined our team 4 months ago
- Previous experience in Philips Cyber Football Team
- Electrical Engineering (graduated in 1988 in Delft)
- 23 years of software development in many companies
- 4 years independent entrepreneur in Language & Technology
- Only team member with a private office...



#### There is nothing new...

Almost all MSL robots have a similar look these days: They look like...

#### There is nothing new...

Almost all MSL robots have a similar look these days: They look like



#### **DALEKS!**

### There is nothing new...

Almost all MSL robots have a similar look these days: They look like



#### **DALEKS!**

The Daleks were conceived by science-fiction writer Terry Nation and first appeared in the **1963** Doctor Who serial *The Daleks*, in shells designed by Raymond Cusick.

#### The best view of a Dalek...

Is the exploded view.

(Available as a handout; 1 per team.)



#### Peripherals

#### Suction Cup: Disallowed



Laser Gun: Disallowed



**Vision: Improved** 

All teams use Omnivision now. Or do they?

#### So this is our robot



#### Hardware: No problem

• "Any machine is as good as its power supply"



• Dilithium-powered?

#### Hardware: No problem

- Dilithium-powered
- LiFePO<sub>4</sub> powered
- This battery type is very difficult to obtain at the moment, because it is falsely accused of causing a fire in an airplane
- We have our own supplier, right here in Eindhoven
- Custom batteries have been ordered, which fit exactly in our frame
- Per-cell charge control guarantees optimal performance
- Fool-proof charging procedure

#### So... How will we win?

- It has to be in the software!
- KISS design approach
- Data management via shared memory
- Software is composed of small, dedicated tasks
- Round-robin, co-operative scheduling
- Stactics engine controls the sequence of events, by action- and decision-skills, forming an FSM
- Current development is focused on:
  - Path planner
  - Path smoother
- Team planner... in the near future!

## Path planner 1/2

- Long, long ago, we used a local potential field, not taking fieldpositions into account
- Later we used a cell decomposed planner
- But calculation time increased quadratically with field size
- And even then only very simplistic behavior was possible
- PLUS: 97% of the field is empty!
- Our new planner:
  - Only looks at interesting areas
  - Takes velocities into account
  - Produces a rough path
- The smoother then rounds off the sharp edges
- And the FSM executes the FollowPath skill

### Path planner 2/2

Robot-planner is inspired on a Visibility graph

- Visibility graph was first applied on Shakey the Robot, the first general purpose mobile robot able to reason about its own actions (1969)
- A visibility graph is a graph of intervisible locations, typically for a set of points and obstacles in the Euclidian plane.

Each node in the graph represents a point location, and each edge represents a visible connection between them.

That is, if the line segment connecting two locations does not pass through any obstacle, an edge is drawn between them in the graph.

#### **Euclidian plane?**

- We live in "Flatland"
- Co-ordinates are (x, y, Rz)
- No need for difficult quaternions;

atan2(y, x) avoids all singularities for us

Only the ball can leave the plane

 For the Daleks, this turned out to be an insurmountable problem

#### And the Daleks?



"Well, this certainly buggers our plan to conquer the Universe."

#### **Questions?**



#### Links

- www.robotsports.nl
- <u>http://fc03.deviantart.net/fs70/i/2010/238/5/0/Cubee\_\_\_D</u> <u>alek\_2010\_\_\_Ver5\_\_\_by\_CyberDrone.png</u>