



Using Rust for Playing Soccer With Robots at RoboCup



Hendrik Sieck
HULKs

zühlke
empowering ideas

RoboCup

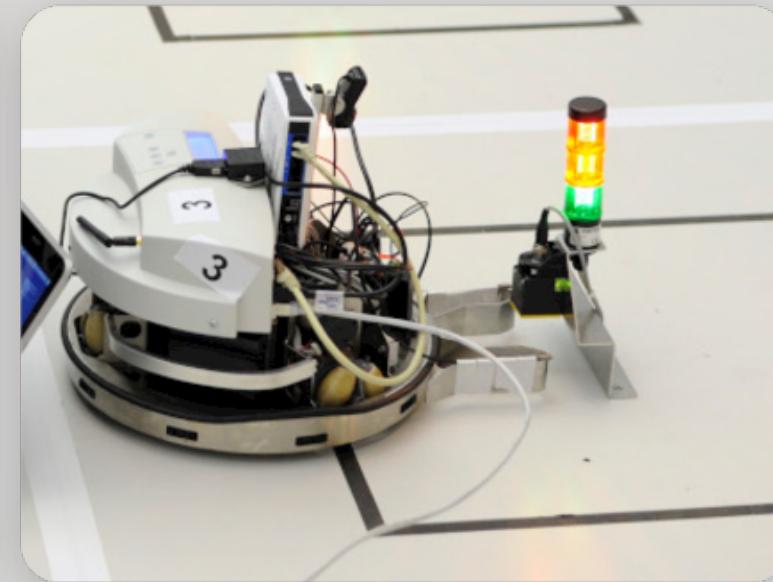
Rescue



At Home



At Work



Logistics



Soccer



Simulation



Small Size



Mid Size



Humanoid

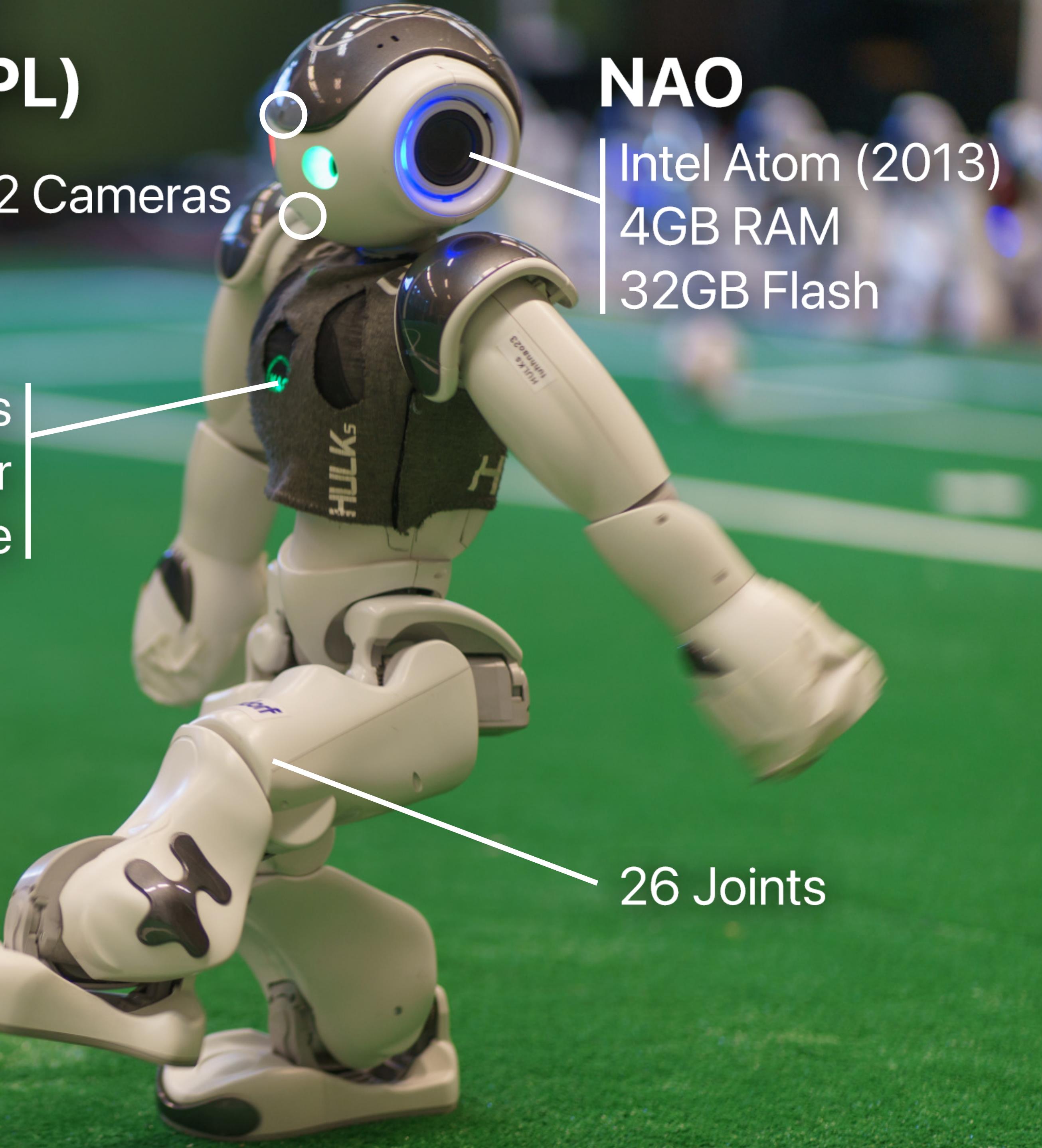


Standard Platform

Goal: Robots vs. Humans in 2050

Standard Platform League (SPL)

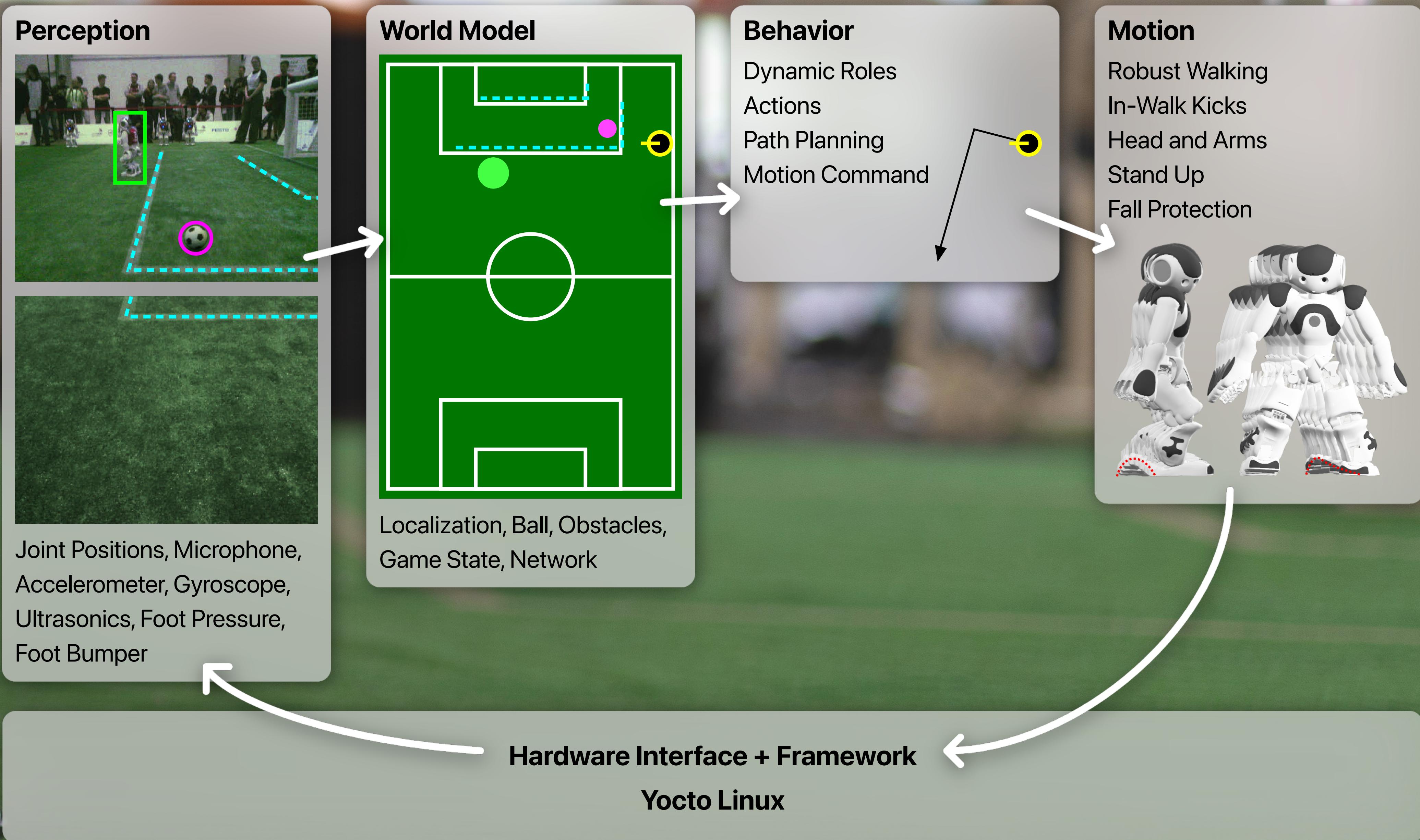
- Identical robots, only software differs
- Fully autonomous
- 7 vs. 7 or 5 vs. 5



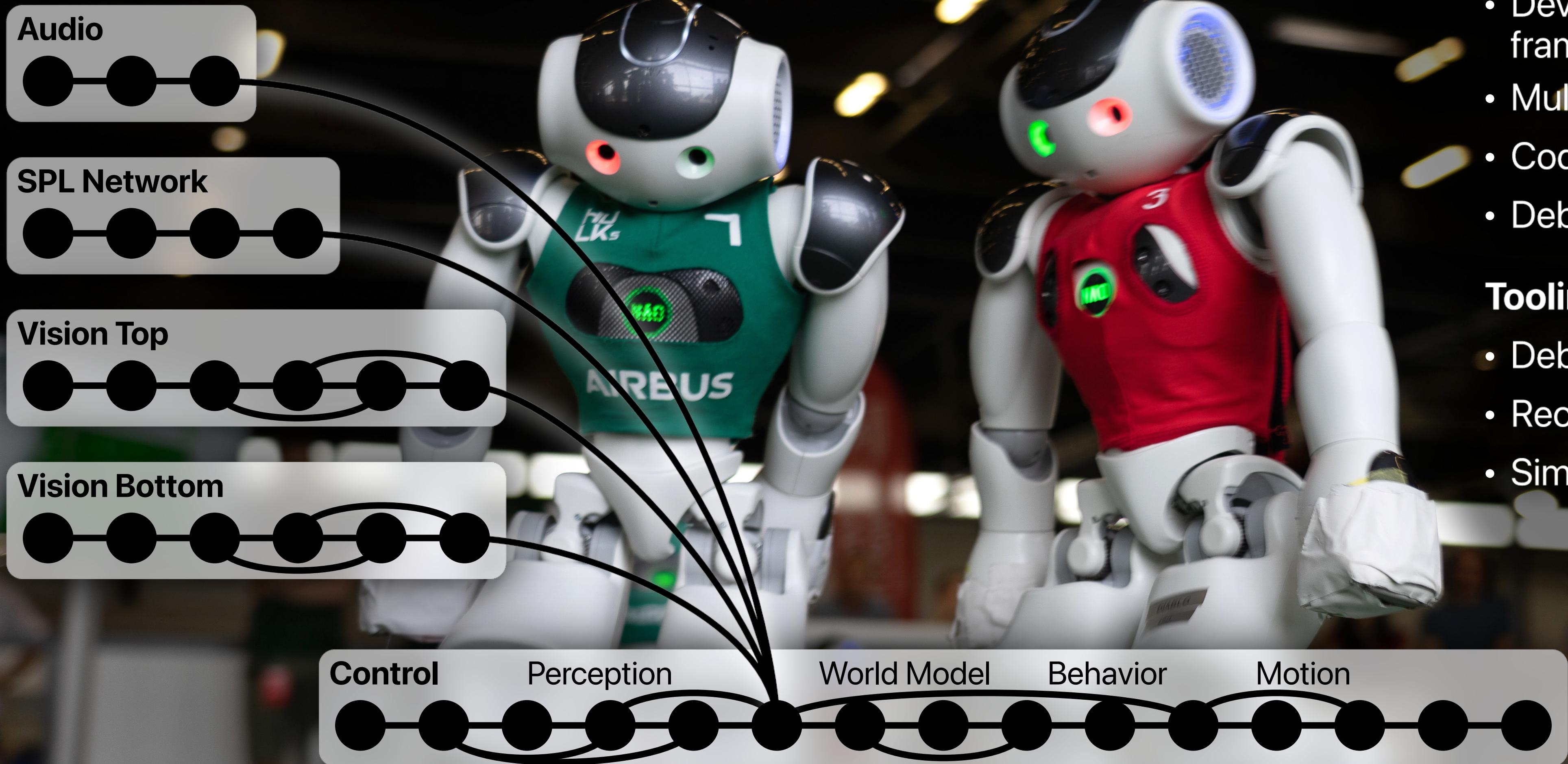
Team HULKs



Robot Control Software



Software Design



Framework

- Developer writes nodes, framework executes
- Multi-threading
- Code generation
- Debugging server

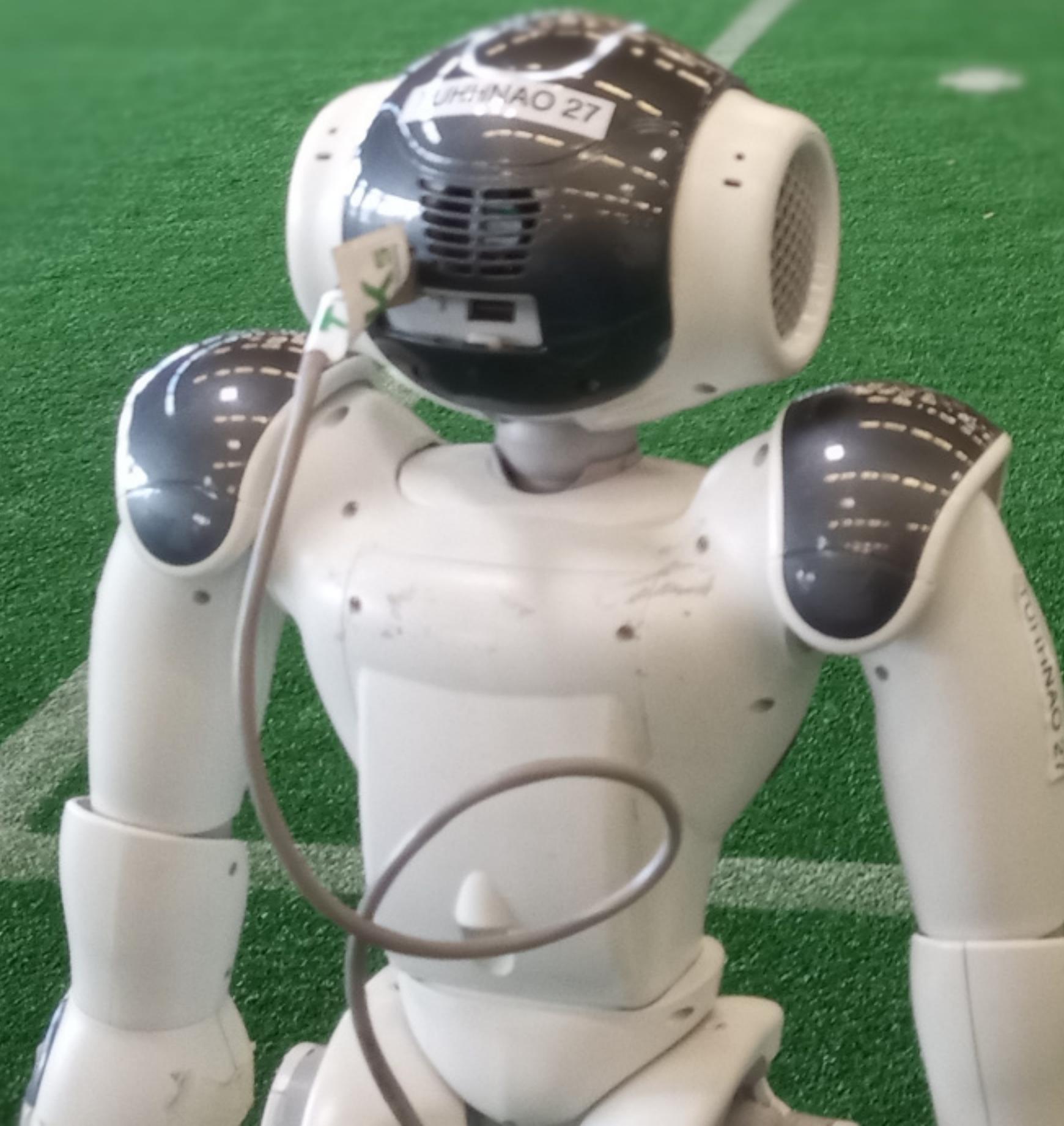
Tooling

- Debugging clients
- Recording & Replay
- Simulators

Transitioning from C++ to Rust

Why?

- Decrease technical debt, rethink main concepts
- Knowledge transfer, newbie motivation
- Learn a new language
- Fun ;)



Timeline

- November 2021: Start of concept and design
- After 2 months: Working framework prototype
- After 5 months: Technical demonstration at GORE
Scored 3 goals! 1 in opponent goal ;)
- After 8 months: Quarter finals reached at RoboCup
Scored 17 goals!
- Present: Further iterations of framework

Learnings

- Compiler + tooling → fearless change, velocity, risk taking
- Language and standard library has richer feature set
- Development feels longer, but then it just works
- No SEGFAULT infrastructure, high prototype quality
- Focus on domain and real problems, not optimization
- To infinity and beyond: GUI, Web, Embedded, ...



Current State & Tools

- Newbie Education** (Rust Introduction, Pairing)
- Monorepo + Workspace Dependencies** (cargo)
- Yocto Integration** (depp, cargo-bitbake)
- Additional Tooling** (clap, indicatif)
- CI Setup** (test, clippy, rustfmt)
- UI Tools** (egui, tungstenite + Web)
- Profiling** (VTune, pprof)
- Linear Algebra Libraries** (nalgebra)
- Coordinate Systems**
- Error Handling** (anyhow, eyre, color-eyre)
- Serialization** (serde)
- Machine Learning** (CompiledNN, OpenVINO)
- Interfacing to C++ and other stuff** (bindgen, mlua)



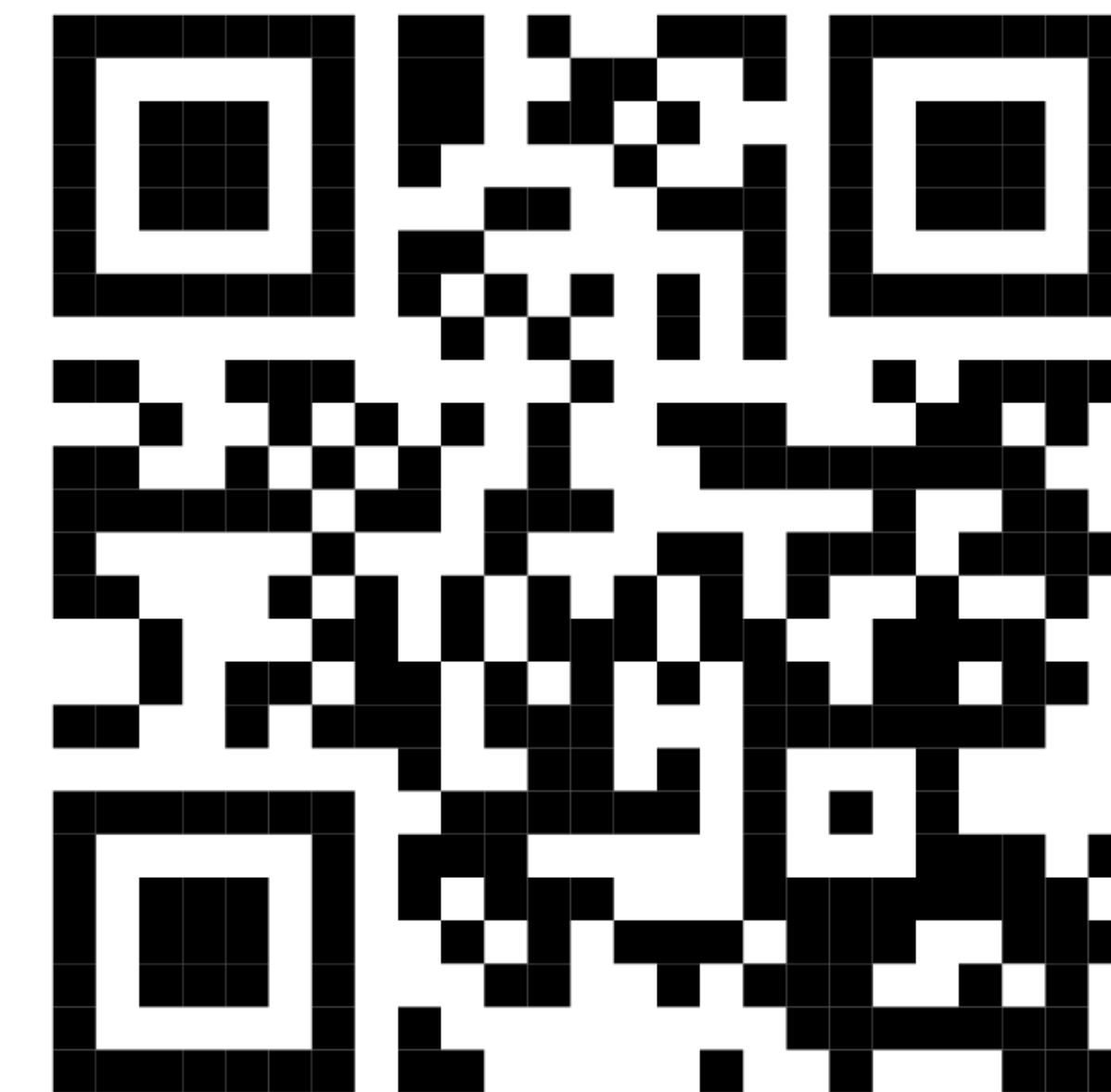
Live Demo

HULKs Code



<https://github.com/HULKs/hulk>

Slides and other Talks



<https://github.com/h3ndrk/talks>



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