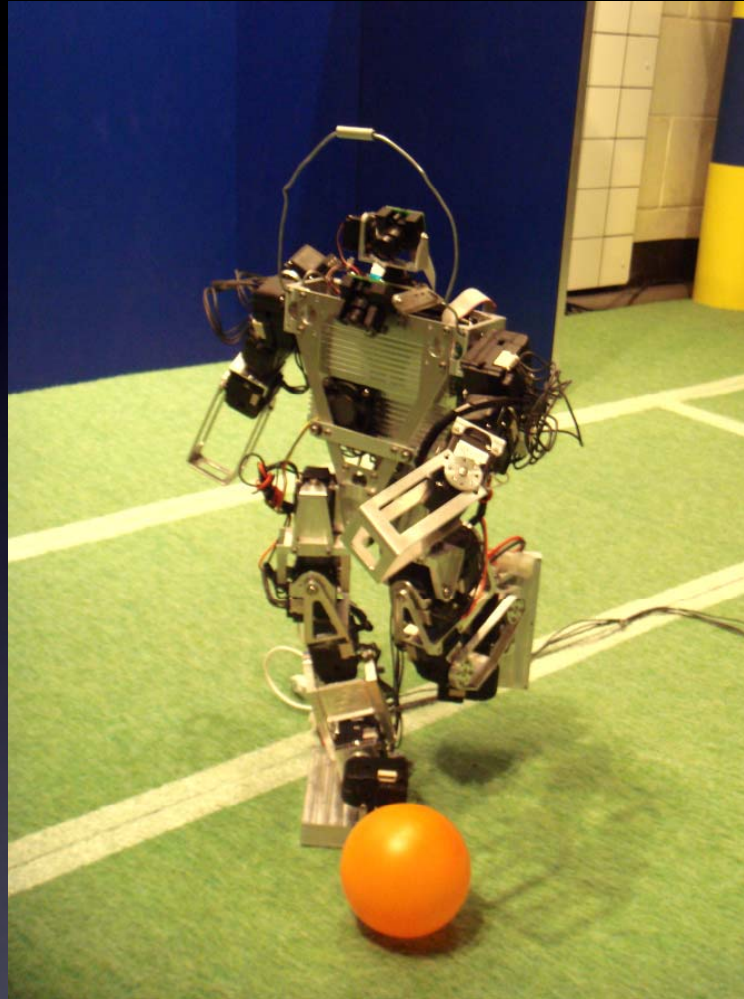
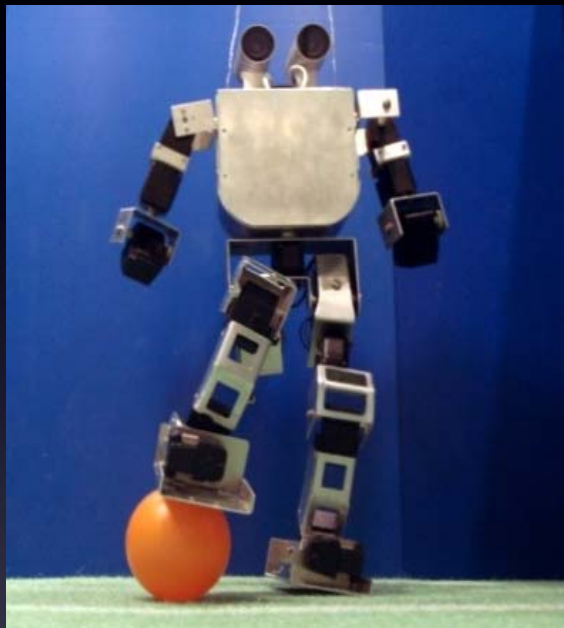


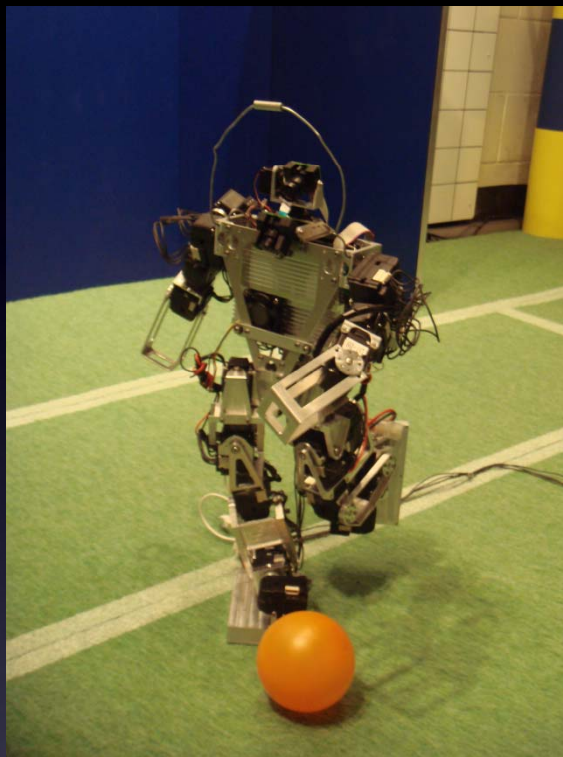
Development of an Open Humanoid Robot Platform for Research and Autonomous Soccer Playing



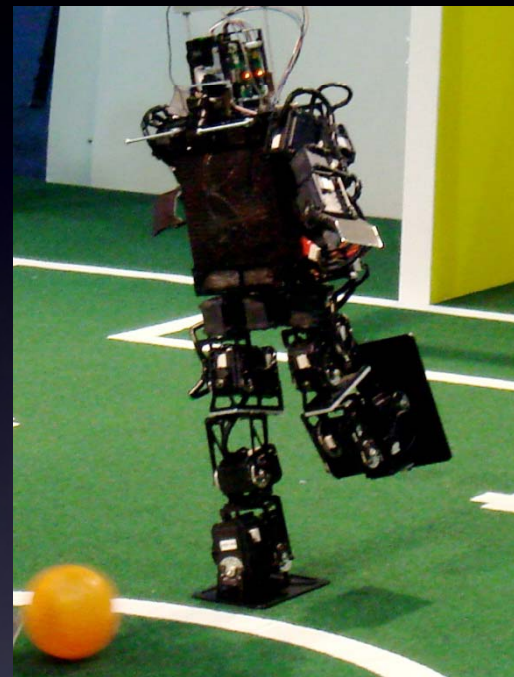
DARwIn Series



DARwIn I

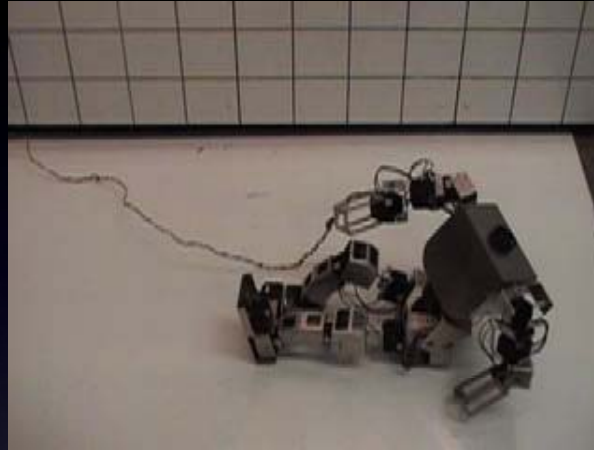


DARwIn IIa



DARwIn IIb

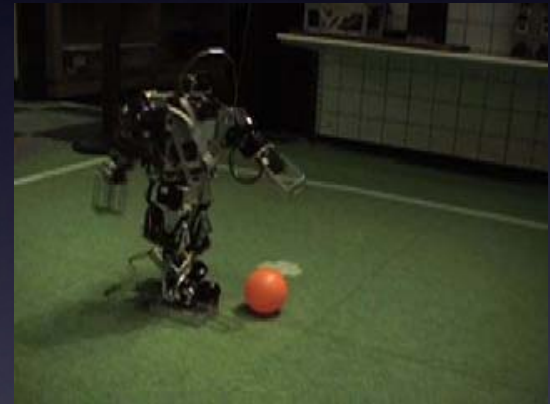
Evolution of DARwIn



DARwIn I



DARwIn 0



DARwIn IIa

RoboCup—a soccer competition between autonomous robots

Robocup's goal is,

“by 2050, to develop a team of fully autonomous humanoid robots that can win against the human worldcup champion team in soccer.”



- 2 v 2 soccer
- Penalty kicks
- Obstacle navigation
- Dribbling
- Passing



We were the *only* US team in *RoboCup* in the humanoid division

We have the most computing power among competitors

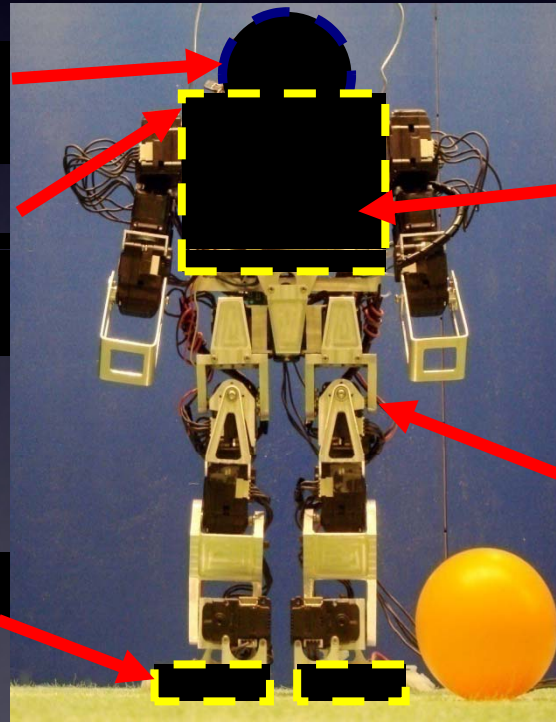
2 pan & tilt Firewire cameras

Onboard PC104+ computer

Lithium polymer batteries

Wireless network, serial ports, USB, compact flash, and an IMU

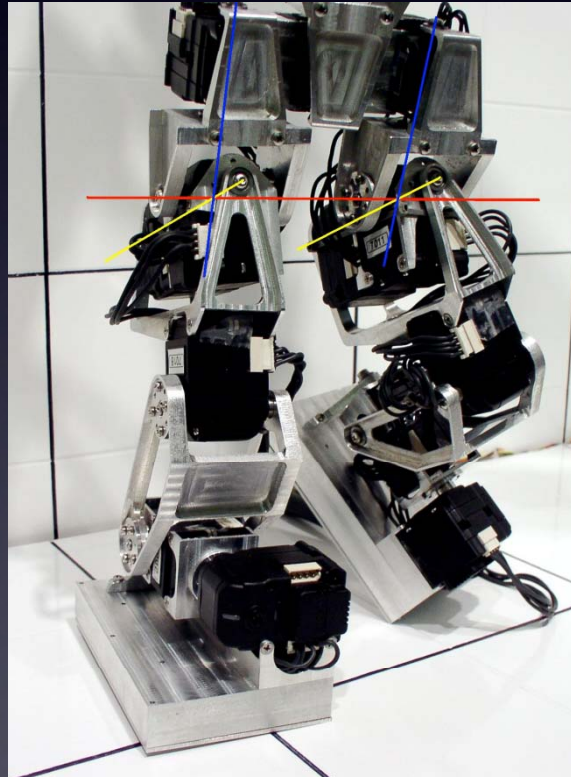
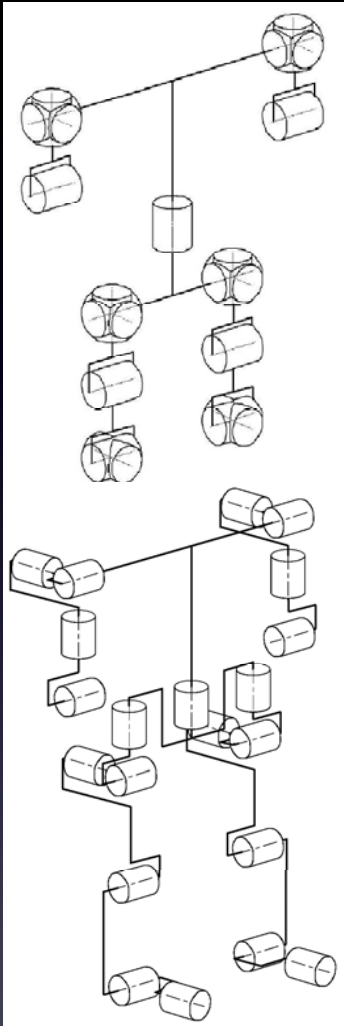
All parts fabricated in-house



Mechanical design

**Kinematically spherical
and universal joints**

**Maximum stiffness and
minimal weight in links**



Electrical Design

Shock mount

one
)

Ghz

ard

tribution
ion

Compact Flash Dr

2 USB Po

Power Supply



PC104+ Computer



Software design to include graphical user interface



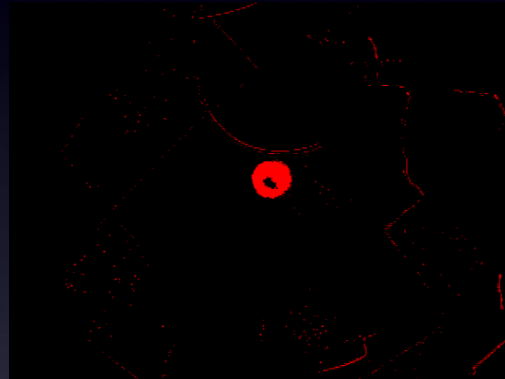
Basic vision implementation using LabVIEW

IEEE 1394 camera collects
uncompressed image



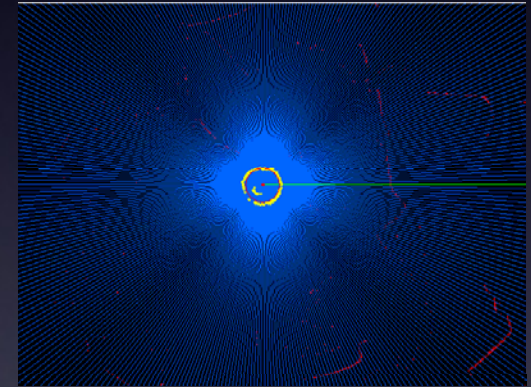
Original image

Software filters out
everything not "orange"



Threshold image

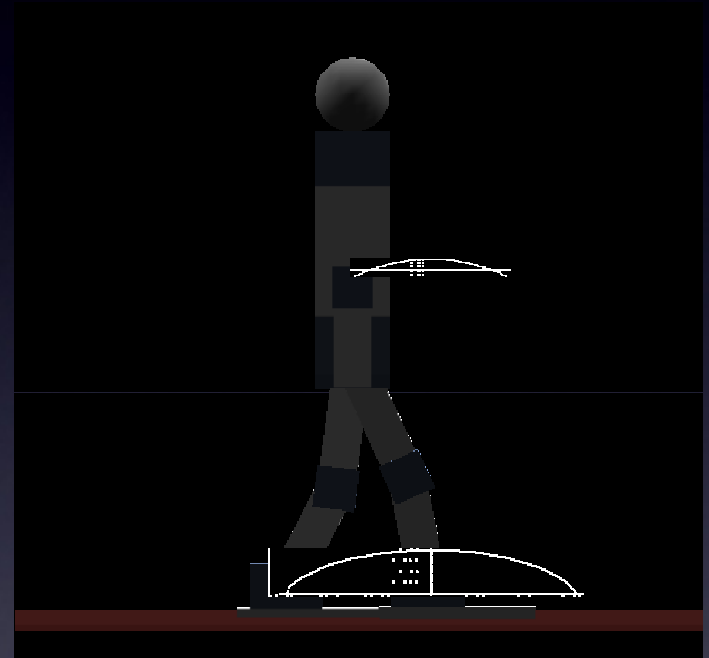
...finds a circle



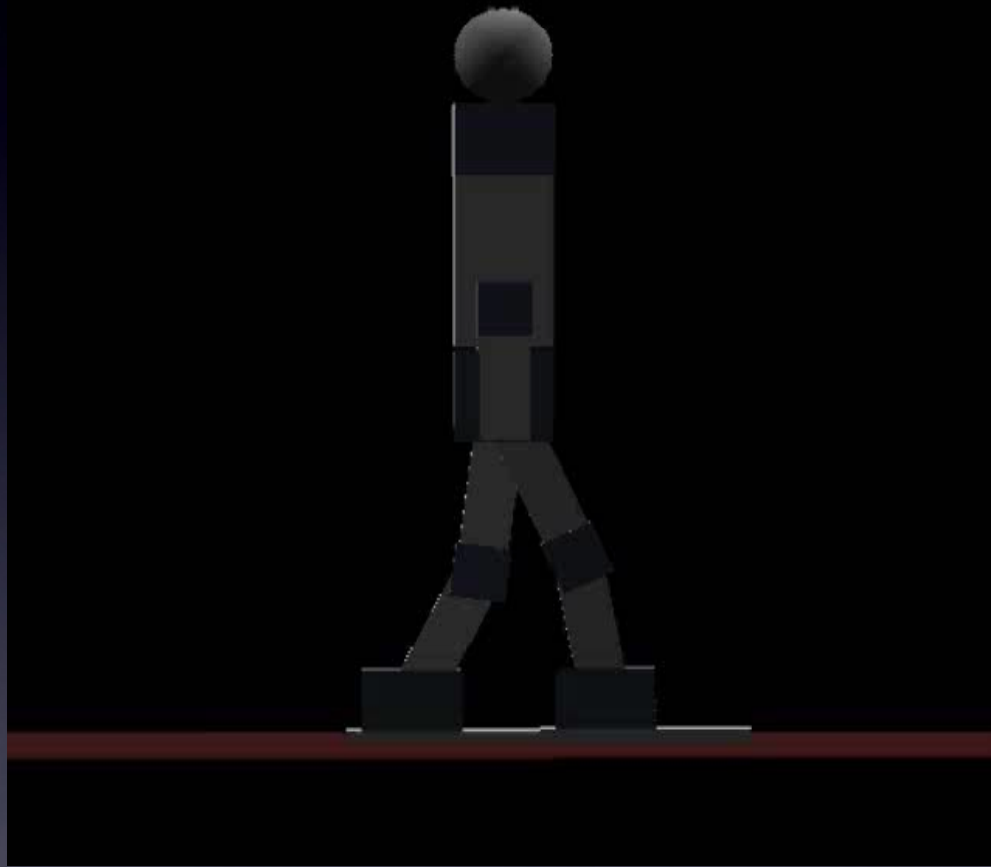
Ball recognition

Gait generation for DARwin

- Pelvis/hip uses a cycloid function
- Ankle uses a cycloid function for the x-position
- Ankle uses a cosine function for the z position
- Lateral motion is relatively simple
- ZMP control for stability

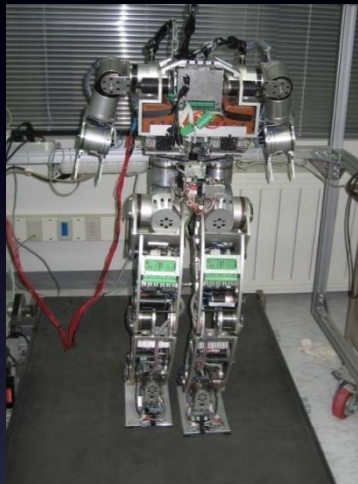


Joint angles and trajectories visualized in OpenGL transfer to the robot



Collaboration towards next evolution of DARwIn

Visit to Korea to see KAIST's humanoid robot, Hubo



Studied hardware and electronics



Got a picture of future technologies and ideas

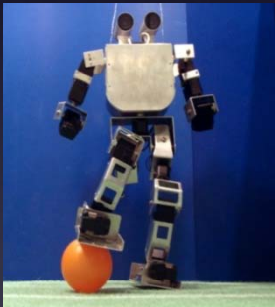


Foster collaboration with KAIST

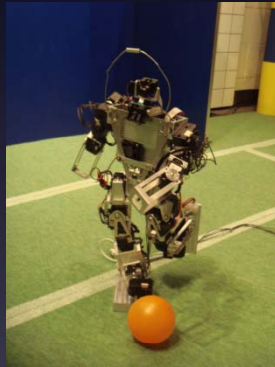
DARwIn III

The next evolution of DARwIn

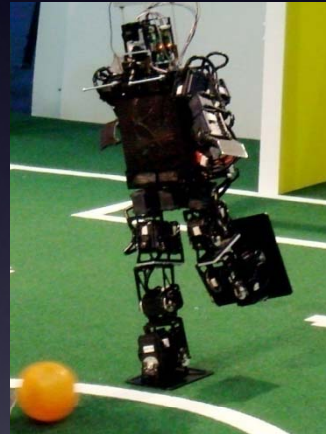
DARwIn III will be an open platform, available to the research community



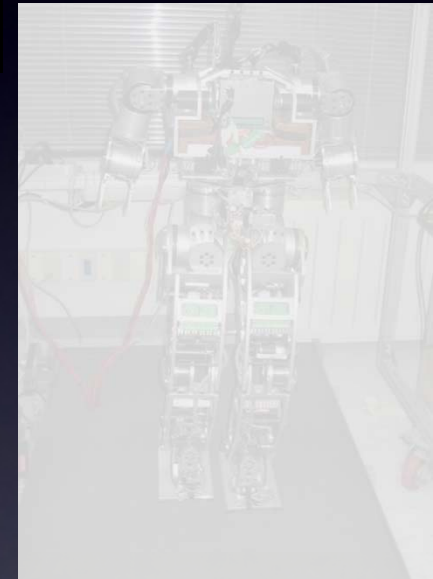
DARwIn I



DARwIn IIa



DARwIn IIb



DARwIn III

Outtakes



