e-puck workshop

EPFL 17 Mars 2010

GCtronic

CYBERBOTICS
professional mobile robot simulation

MINIATURE MOBILE ROBOTS GROUP (MOBOTS)

AUTOMATIC CONTROL LABORATORY

LIS

Disal

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Schedule

10:00 *** **Intro** ***

Groups/people presentations.

Overview production and market

10:20 *** **Hardware** ***

"Old" extensions: LIS set , MOBOTS

New extensions: SD Card ; gumstix

Maintenance: batteries , reparation

11:10 *** **Users** ***

Courses (MOBOTS, LIS, DISAL) , Research

Demonstrations/divulgation

11:30 *** **Embedded Software** ***

Libraries addition? Example X,Y,theta control

Bootloader problems

Communication: Mote, zigbee

12:00 *** **LUNCH** ***

13:00 SW continuation : Molole

13:10 *** **GUI** ***

Aseba ; Matlab e-pic ; Qt ; LabView

14:00 *** **Simulators** ***

Enki ; Webots ;

Rat's Life

14:30 *** **Documentation** ***

Web ; Wiki ; Manuals ; Tutorials

Papers

15:10 *** **Future** ***

Common or linked web/wiki

More active mailing list

Dynamic web/lib/doc

New Hardware extensions

New e-puck 2 ?

Association

16:00 *** **END** ***

Groups/people presentations

GCtronic: Gilles Caprari, Stefano Morgani

Cyberbotics: Olivier Michel, Fabien Rohrer

MOBOTS: Francesco Mondada, Michael Bonani, Stéphane Magnenat, Philippe Rétornaz

LIS: Adam Klaptocz, Steffen Wischmann, Michal Dobrzynski

DISAL: Amanda Prorok, Alexander Bahr, Florian Vaussard

Control Lab: Christophe Salzman

Overview production and Market

Production: EPFL ~500 ; GCtronic ~ 1200 ; AAI ~ 900

Distributors: Cyberbotics(450),

RoadNarrows (160),

K-Team (70)

Pitotech (34)

Robot returned: 4

Robot reprogrammed: 5

Hardware: "old" extensions

LIS:

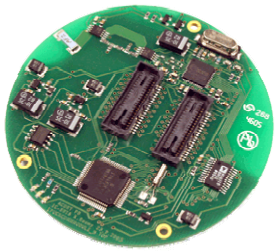
- Fly-Vision Turret: 3 linear cameras with near-omnidirectional vision
- Ground Sensors: 3 IR sensors toward the ground for line follow
- Colour LED Communication Turret: ring of 8 multi-colour LEDs
- Omnidirectional vision

DISAL:

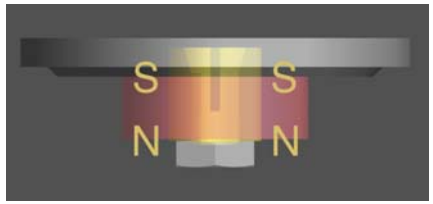
- ZigBee Comm Turret

MOBOTS:

- Magnetic wheels
- rotating range sensor
- gripper



Others: Range and bearing turret



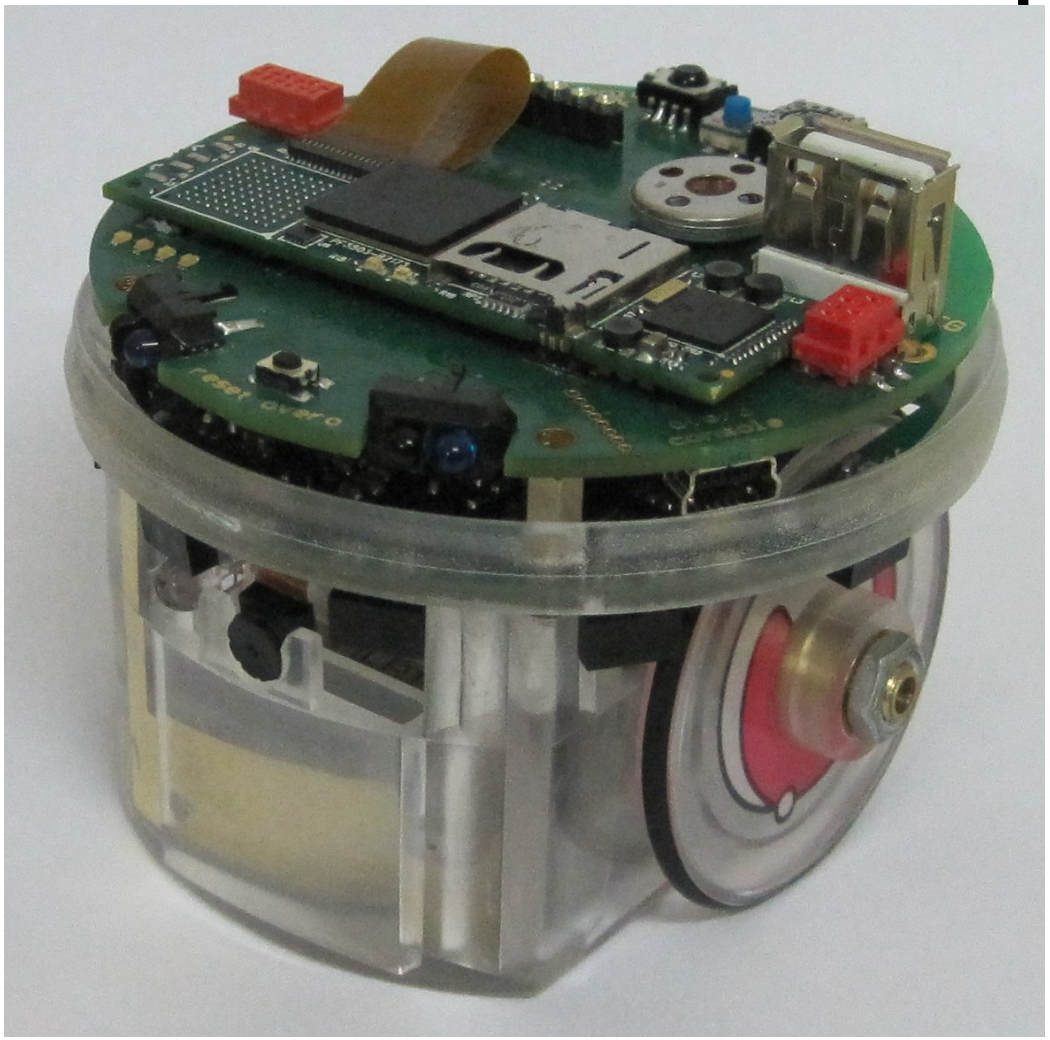
Hardware: new extensions

DISAL: SD card by Alexander

GCtronic: gumstix extension

OTHER ??

Gumstix overo extension: Linux@600MHz on e-puck



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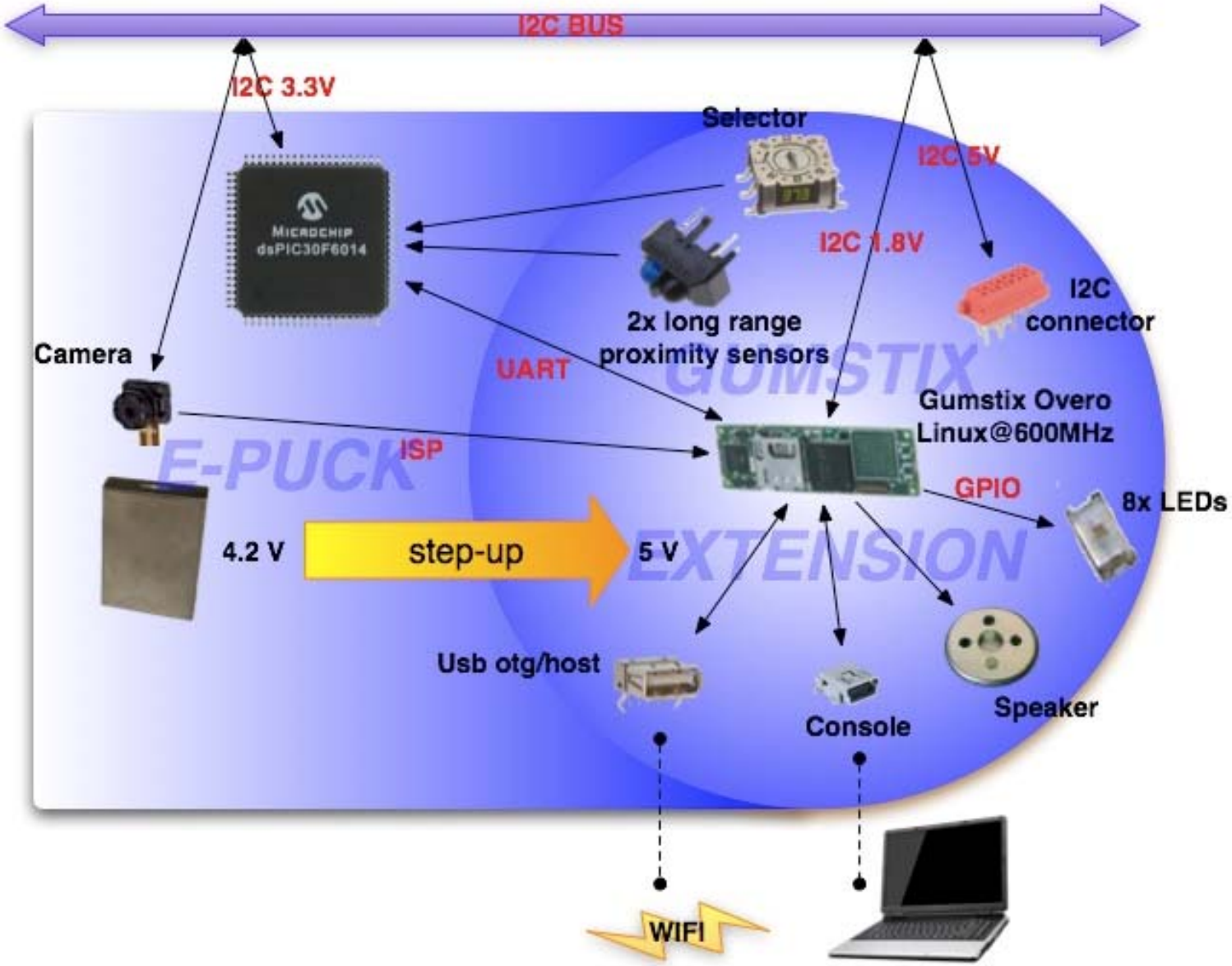
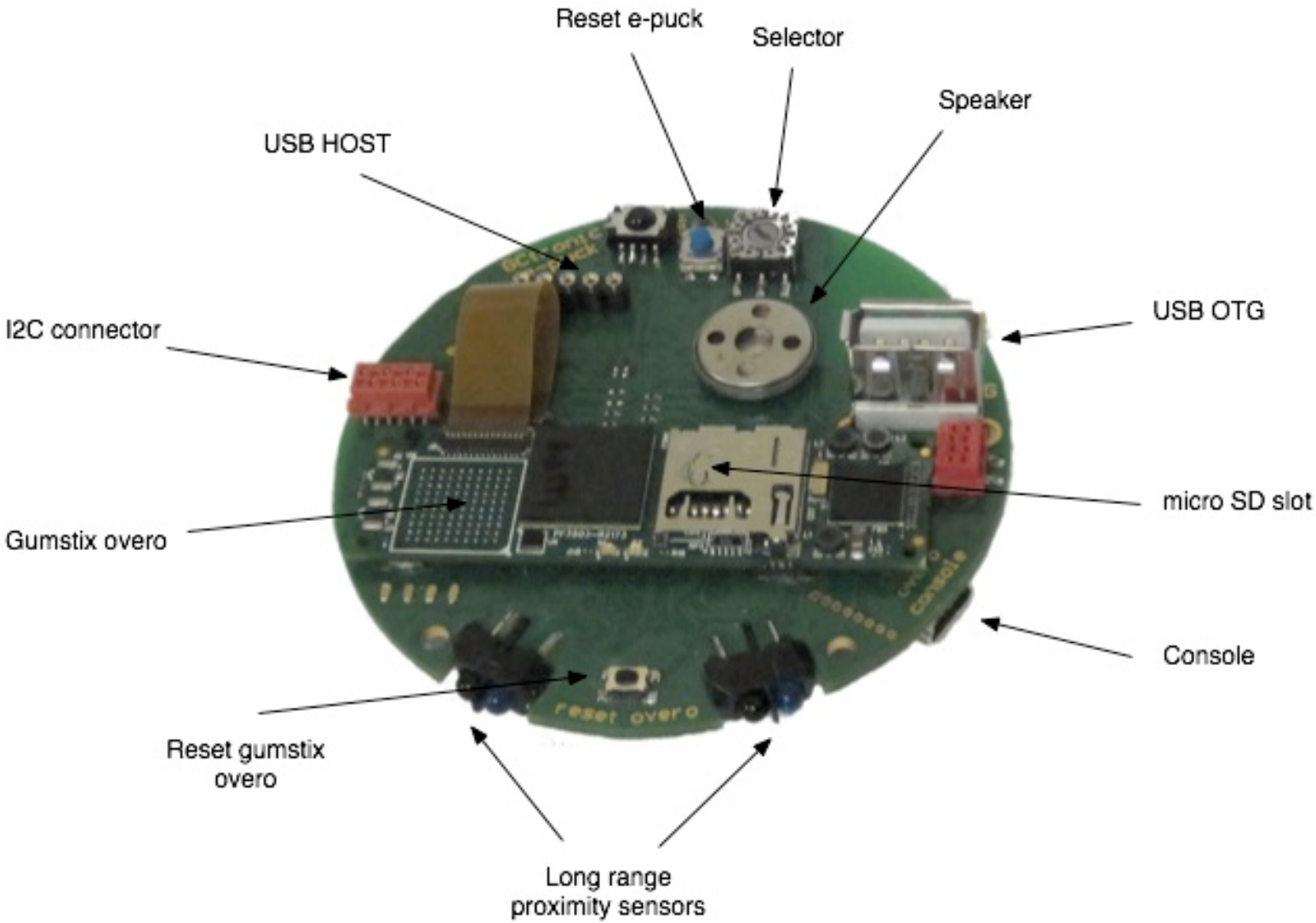
Global architecture



COLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE


Reset e-puck
Selector
Speaker
USB HOST
I2C connector
USB OTG
micro SD slot
Gumstix overo
Console
Reset gumstix
overo
Long range
proximity sensors

Gumstix overo extension (1)

- Linux-based system
  - Ångström distribution (Open Embedded)
  - Ubuntu
- Open Embedded + bitbake
  - Recipes (automatic packages download and compilation)
  - Linux kernels, file systems, packages
  - Not always the best approach (=> manual build)
- U-boot
  - System specific hardware configuration

Gumstix overo extension (2)

- System update:
  - microSD (fast and easy; more systems with different microSD; more capacity)
  - Flash (256 MB)
  - Opkg (package manager)
- Cross-compilation (arm processor):
  - OE toolchain; GNU toolchain for ARM processors (Code Sourcery)
  - examples: OpenCV, ViSP, player-stage, ROS

Gumstix overo extension (3)

New Linux driver (V4L2) for the e-puck camera

>> direct link camera - gumstix

- Basic initial driver
- ISP (schema...)
- up to 18 fps @640x480 color (given by e-puck clock)

- Optionally: USB camera (Targus): 25 fps

Consumption

- Robot + ext.: 300 mA
- WiFi: 180 mA

Duration test:

1) e-puck and gumstix active =>

(gumstix sends commands via serial to robot, robot runs asercom; movement every 3s during 1s at speed 300)

=> 3 h e 30

2) e-puck, gumstix and WiFi active =>

(same as above plus wifi active all the time with continuous ping)

=> 1 h e 25

Gumstix overo extension (4)

- Demo1: images acquisition, compression and WiFi transfer
  => frames per second: ~ 5
- Limiting factor:
  - Color space conversion
  - JPEG conversion (70% quality)
  - Can surely be improved
- Alternative: Raw transfer
  - 614'400 bytes per image (VGA color)
  - WiFi throughput: 20 Mb/s
  - ==> ~ 4 fps

Gumstix overo extension (5)

- Demo2: blobs tracking
- OpenCV => color histogram
- ~ 6 fps on the overo earth

Maintenance

Batteries measurements by Florian @DISAL

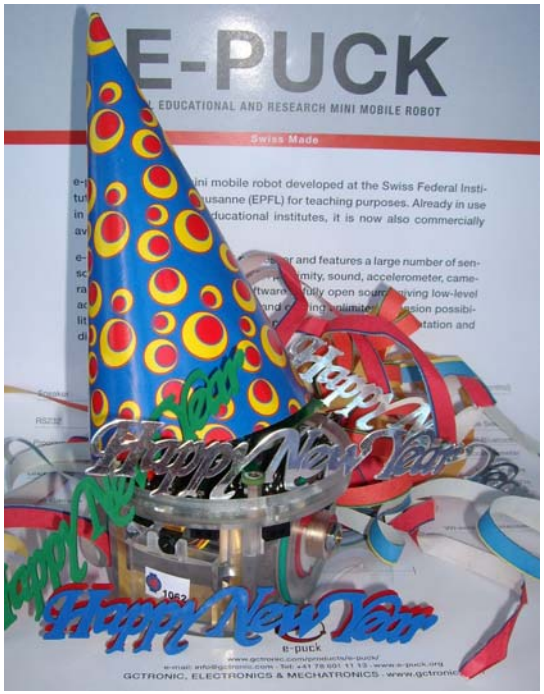
Reparation: in 2009 repaired for LIS 9 units

Users: courses

MOBOTS; LIS; DISAL; control lab

Biological and Artificial Intelligent Systems	Laboratory of Intelligent Systems
Microinformatique I (old)	Laboratoire de Systèmes Robotiques
Microinformatique II (old)	Laboratoire de Systèmes Robotiques
Microinformatique (new)	Laboratoire de Systèmes Robotiques
Robots Mobiles	Laboratory of Intelligent Systems
Swarm Intelligence	Swarm-Intelligent Systems Group
TP de robotique (filière RSA)	Laboratoire de Systèmes Robotiques / Learning Algorithms and Systems Laboratory / Laboratory of Intelligent Systems

Users: demo/public



Museum Lugano

Museum biology lausanne?

Embedded Software

Library addition? GNA used? New branches?

Example: XYtheta control by Alexander

Communication: Mote, ZigbBee by Amanda

Molole a dsPIC33 lib , porting to e-puck?

GUI

Aseba (mobots.epfl.ch/aseba.html)

Matlab e-pic (www.e-puck.org/index.php?option=com_content&task=view&id=55&Itemid=83)

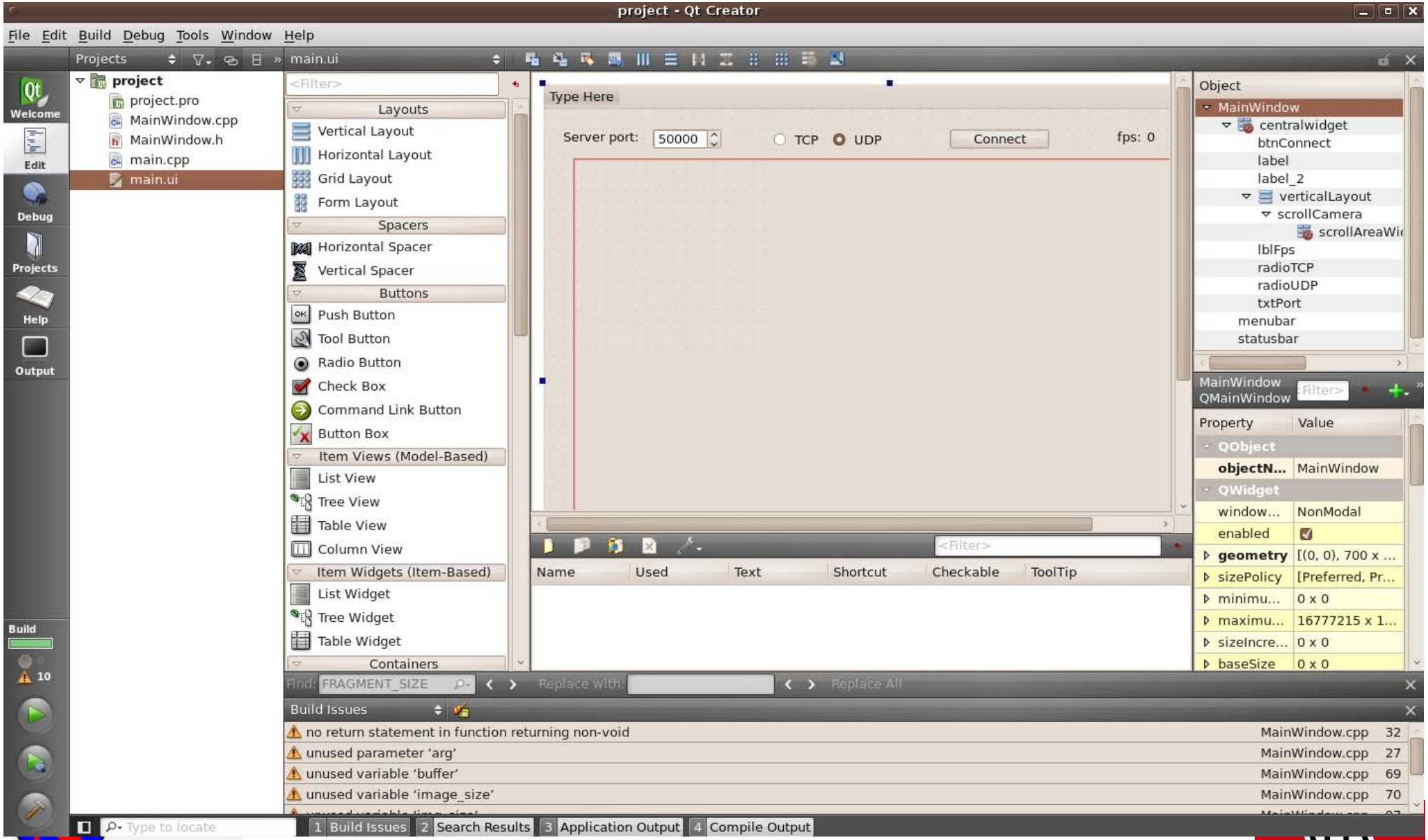
QT (www.gctronic.com/doc/index.php/E-Puck#PC_interface)

Labview

e-puck monitor

- Qt
  - Cross-platform
  - C++ class
  - Open source
  - Integrated development tools with cross-platform IDE (Qt Creator)
  - File IO, Multi-threading and concurrency, inter-object communications mechanism (signals and slots), …
- Dynamic vs Static compilation

Qt Creator



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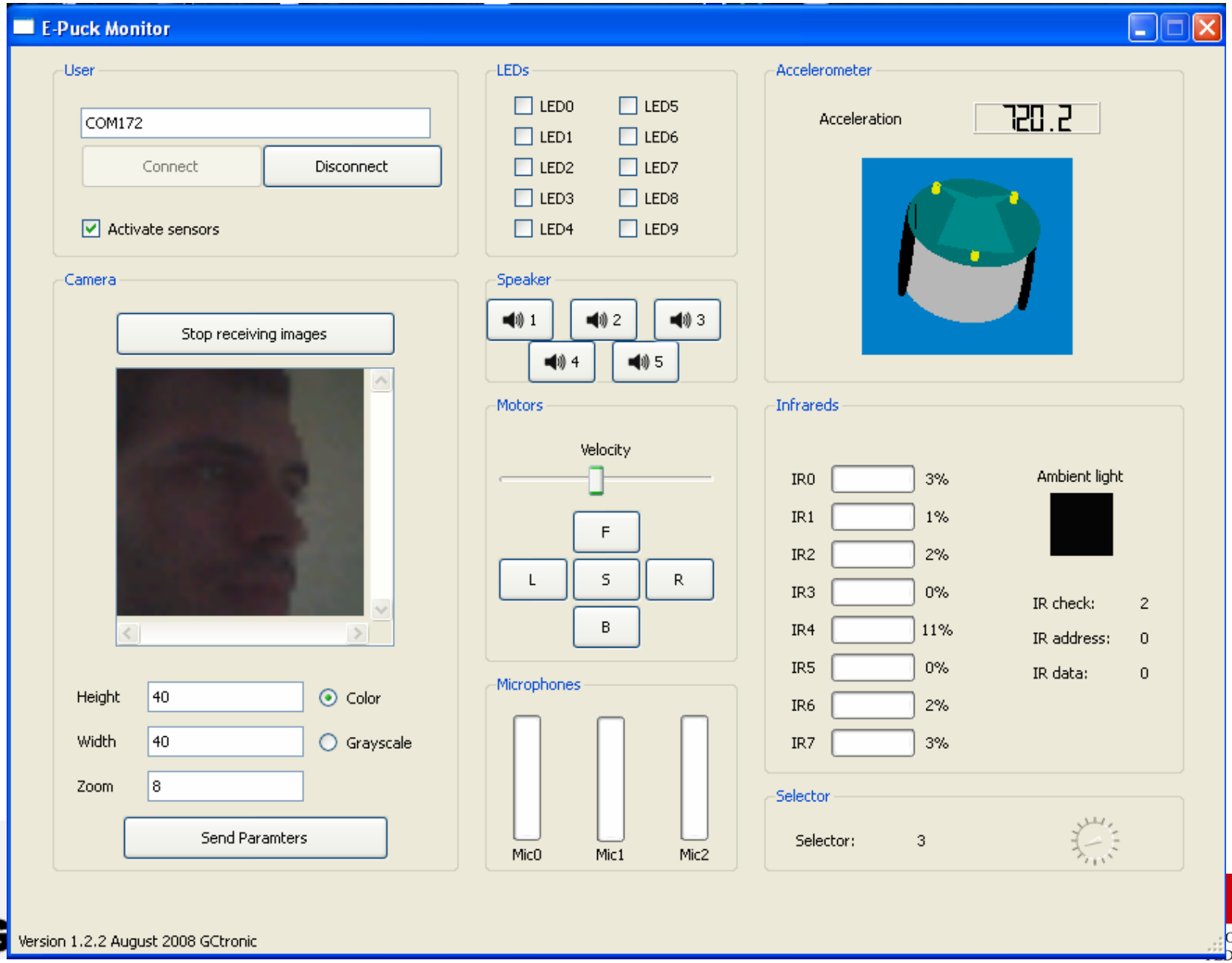
e-puck monitor

- Build and tested on Windows XP/Vista, Mac OS X, Linux
- OpenGL (included in Qt SDK)
  - GLX (Linux), WGL (Windows), CGL (Mac OS X)
- Future extension
  - Better 3D representation
  - Image, video saving

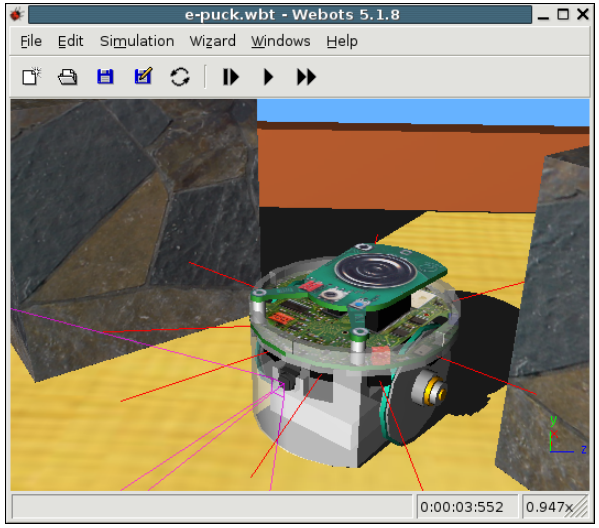
Windows XP


E-Puck Monitor
User
COM172
Connect
Disconnect
Activate sensors
LEDs
LED0
LED1
LED2
LED3
LED4
LED5
LED6
LED7
LED8
LED9
Accelerometer
Acceleration
720.2
Camera
Stop receiving images
Height
40
Width
40
Zoom
8
Color
Grayscale
Send Paramters
Speaker
1
2
3
4
5
Motors
Velocity
F
L
S
R
B
Microphones
Mic0
Mic1
Mic2
Infrareds
IR0
3%
IR1
1%
IR2
2%
IR3
0%
IR4
11%
IR5
0%
IR6
2%
IR7
3%
Ambient light
IR check:
2
IR address:
0
IR data:
0
Selector
Selector:
3
Version 1.2.2 August 2008 GCtronic

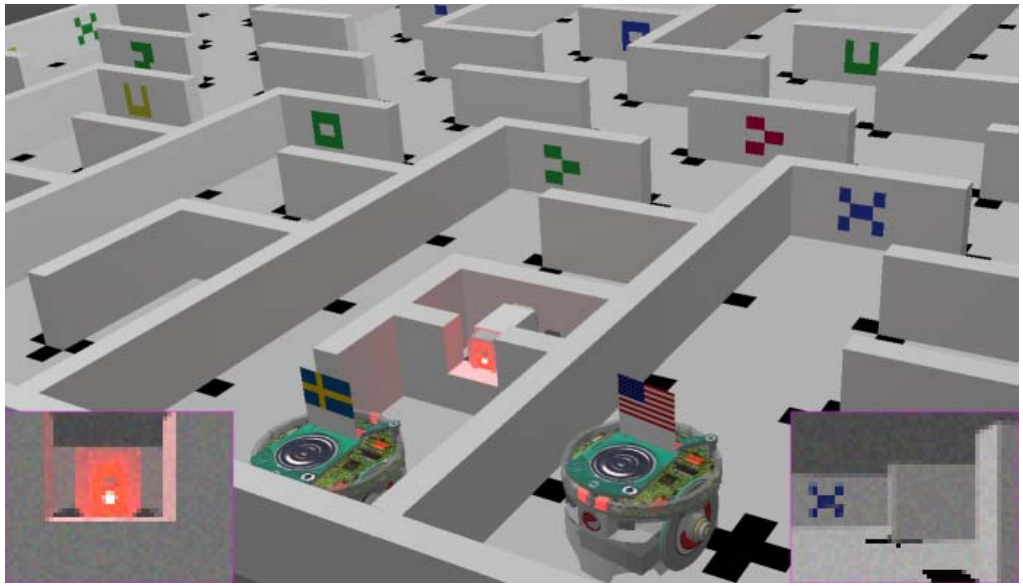
Simulators

Enki fast 2D

Webots, phisics 3D, integrated



Rat's Life



Documentation

Web:

www.e-puck.org;

www.cyberbotics.com/products/robots/e-puck.html

www.gctronic.com/e-puck.php

Wiki www.gctronic.com/doc/index.php/ : e-puck, extensions ; Guest users allowed

Manuals: AAI

Tutorial: en.wikibooks.org/wiki/Cyberbotics'_Robot_Curriculum

Papers:

The reference publication on the e-puck robot is:

Mondada, F., Bonani, M., Raemy, X., Pugh, J., Cianci, C., Klaptocz, A., Magnenat, S., Zufferey, J.-C., Floreano, D. and Martinoli, A. (2009) **The e-puck, a Robot Designed for Education in Engineering**. Proceedings of the 9th Conference on Autonomous Robot Systems and Competitions, 1(1) pp. 59-65

Future

Common or linked web/wiki/curriculum

More active mailinglist?

Dynamic web/lib/doc

New hardware extensions

New e-puck version 2 ?

Robotics association