Global cross platform robot soccer development

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The CIIPS Glory robot soccer team consists of five 15 cm tall robots running a specially developed operating system and control programs. The system is developed from Germany and Australia, using cross compilers running on Linux and Windows.

In this presentation, you will learn the following:

- What is Robot Soccer?
- Who are CIIPS Glory?
- What is the Eyebot and which OS is it running?
- How do we handle global cross platform development?
- How do robots play soccer?

Robot Soccer

- Since 1996
- MIROSOT ($7.5 \times 7.5 \times 7.5cm^3$)
- RoboCup (Leagues; simulation, small, middle, SONY legged and humanoid)
- Next RoboCup in Melbourne 2000-08-26
  - 73 simulation teams
  - 28 small size teams
  - 31 middle size teams
  - 5 SONY legged teams
  - 3 humanoid teams

CIIPS Glory

- Only robot soccer team in WA
- CIIPS/Electrical Engineering at UWA
- Small size league (2×10 minutes)
  - $274 \times 152.5cm^2$ field (ping-pong table)
  - Max 5 robots on each team
- Hopefully humanoid league
- Local vision (onboard camera) and global vision
- Eyebot soccer robots
- Previous experience
  - PRICAI'98 (Singapore November 1998)
  - Interact'99 (Melbourne August 1999)

Eyebot Hardware

- Motorola 68332 (25-40 MHz)
- 1 MB RAM and 512 KB Flash ROM
- Color camera (80x60 24bit)
- Radio (418 or 433 MHz)
- IR distance sensors
- Two wheels with encoders
- Servo (kicker and camera control)
- Microphone and speaker
- Acceleration sensors
- Digital compass

Robot OS (RoBIOS)

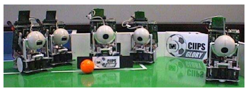
- M68 assembly and C using GNU C cross compiler (v2.95.2)
- Complete size $<$ 128 KB
- Features (in addition to HW drivers)
  - Multi-threading
  - OS upgrade using serial connection
  - Hardware description table
  - Up to three programs in ROM (optional autoloading)
  - Simulator
- GNU C library is available
- Developed in Germany and Australia (CVS)
- Bug tracking system (in development)


```
MotorHandle     leftmotor, leftmotor;
PSDHandle       psd_front, psd_left, psd_right;
VWHandle        vw;

int main(int argc, char *argv[])
{
  LCDMenu("","","","END");
  vw=VWInit(VW_DRIVE,1);

  /* this is because #5 has stuffed up PSD */
  psd_front = PSDInit(PSD_FRONT);
  psd_left = PSDInit(PSD_LEFT);
  psd_right = PSDInit(PSD_RIGHT);
  PSDStart(psd_front, TRUE);
  PSDStart(psd_left,TRUE);
  PSDStart(psd_right,TRUE);
  VWStartControl(vw, v_lin, t_lin , v_rot, t_rot);

  while (KEYRead() != KEY4)
    {
      if( (PSDGet(psd_front) > 100 && PSDGet(psd_left) > 100
         && PSDGet(psd_right)>100 ))
        VWDriveStraight(vw,0.01,0.2);
      else
        {
          LCDPutString("Backwards \n");
          VWDriveStraight(vw,-0.04,0.2);
          while (!VWDriveDone(vw))
            VWDriveWait(vw);

          if((rand()%2)==0)
            {
              VWDriveTurn(vw,1.57,0.6);
              LCDPutString("Turning Left \n");
            }
          else
            {
              VWDriveTurn(vw,-1.57,0.6);
              LCDPutString("Turning Right \n");
            }
          while(!VWDriveDone(vw))
            VWDriveWait(vw);
        }
    }/* end while loop */
}
```


Client/server CVS

- Concurrent Versions System
  - Keep track of what, who and why
  - Allow distributed development
- Server on Linux
- Clients on Linux and Win32
- Daily RoBIOS build
- Auto-generated ChangeLog
- More info on `http://www.sourcegear.com/CVS/`

How do robots play soccer



The goal is robot soccer without human interference.

- Sensor input processing
- Self localization, planning and decision making
- Action

Sensor input processing

- Vision
  - Overhead camera (video4linux)
  - Frame rate is everything
  - Local camera
  - CPU and bandwidth intensive
  - object recognition with light condition changes
- Distance sensors
- Compass
- Dead reckoning

Self localization, planning and decision making

- Obstacle avoidance
- Team coordination
- Prediction based on physics model
- Team play
  - Role change
  - Offensive or defensive

Action

- Communicate
- Drive
- Kick

Sponsoring

Would you like to get your firm exposed to high tech robotic research community in an event with international press coverage.

If so, we would like to hear from you.

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Thank you

`http://ciips.ee.uwa.edu.au/~pere/soccer/`