

# Bioloid based Humanoid Soccer Robot Design

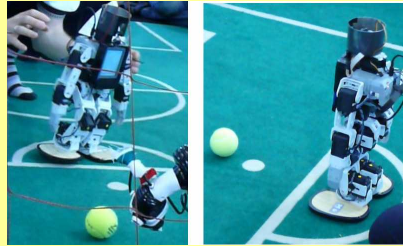


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## Low Cost Autonomous Humanoid

The University of Plymouth bipedal, humanoid soccer player Mk1 (Mark 1) is based on a Robotis Bioloid Comprehensive Kit, a HP iPAQ hx2490b PDA and a Spectec SD-Slot Camera. This platform enables a low cost introduction to research and competition in humanoid robotics.

## Robot in Action



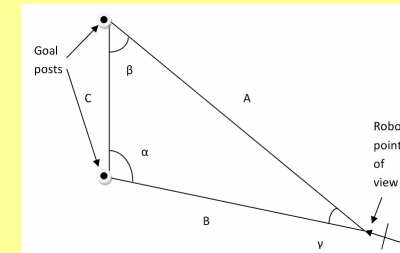
The robot gets ready to attempt a penalty. According to the FIRA HuroCup rules, the referee decides the position of the ball, which is not necessarily the penalty spot. Therefore a robot has first to identify the position of ball and goal before taking action.

## FIRA Rules for Humanoid Soccer:

Several challenges including Marathon, weight lifting, sprint and penalty shots are part of the FIRA HuroCup. Goals in FIRA HuroSot are marked by a 5 cm coloured bars.

### Self Localisation:

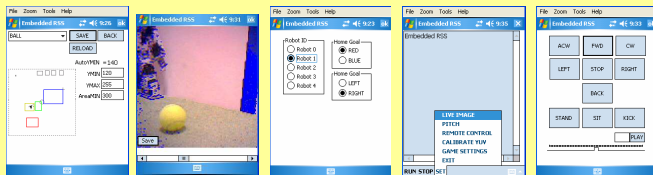
If the location of the two goal posts in the camera image is known, a distance to each goal post can be calculated (taking into account the height and pose of the robot). Using this distances triangulation can be used to determine the location of the robot on the pitch.



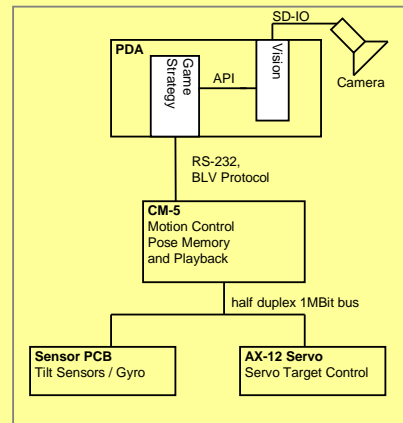
$$\sin\left(\frac{\alpha}{A}\right) = \sin\left(\frac{\beta}{B}\right) = \sin\left(\frac{\gamma}{C}\right)$$

## User Interface

The User interface for setting up a robot must be very fast and easy to use. A participant of the of the FIRA HuroCup only has seconds to get the robot ready. The user interface is embedded on the PDA since there is no communication with a host machine during a match. The Colour Configuration Menu is shown in the screenshot bottom-left. The dashed box represents the UV-colour-plane. The dots are a histogram of the region on the tennis ball, previously selected by the user from an image. In this menu, the user selects areas of the UV plane for calibrating the colour segmentation and region growing.



## Plymouth Humanoid Mk1 Control System



## Developer Software Available

- C Source Code for Motion playback based on motion pages designed by the Bioloid Motion Editor
- Vision system for Windows Mobile PDA and Spectec SD-Slot Camera

For software contact: joerg.wolf@plymouth.ac.uk