Software Survey 2025

Team Name

Bold Hearts

Is your software fully or partially OpenSource. If so, where can it be found:

Our code is partially open source. We open source code when it is entirely stable and tested in competitions. Software can be found: https://gitlab.com/boldhearts/

Do you have a kinematic or dynamic model of your robot(s)? If so, how did you create it (e.g. measure physical robot, export from CAD model)?

We measured our physical robot.

Are you using Inverse Kinematics? If so what solution (analytic, (pseudo)inverse jabcobian, etc...) are you using?

The IKWalk library is a C++ implementation of an open loop walk engine for small and mid-size humanoid robots. Motor target positions are generated online based on splines in Cartesian space and inverse kinematics. No ZMP is used but several parameters have to be manually tuned.

Are you simulating your robot? If so what are you using simulation for?

Yes, we have a model and libraries for the simulation in Webots.

What approach are you using to generate the robot walking motion?

We use the IKWalk library with a ROS2 wrapper

What approach are you using to generate motions for standing up?

We use manual key frame animations. But, we are looking at different ways for generating the motions more efficiently

What approach are you using to generate kicking motions?

We use key frame animations, but moving towards faster and more efficient solutions, as for the standing up motions

Do you use any other motions than the previously mentioned? If so, what approaches are you using to generate them?

Similar approach is used for all the motions.

Which datasets are you using in your research? If you are using your own datasets, are they public?

We use a combination of data collected during RC competition (currently not released), and dataset created by the Hamburg Bit-Bots and built by the RC community

What approaches are you using in your robot's visual perception?

We wrap the Darknet framework as a ROS2 node and use the xYOLO network developed by the Electric Sheep team. Additionally, we have improved their image pre-processing and network detection accuracy for a greater number of object detections. Electric Sheep xYOLO : https://doi.org/10.48550/arXiv.1910.03159

Are you planning with objects in Cartesian or image space? If you are using Cartesian space, how do you transform between the image space and cartesian space?

We currently use image space, but will move towards Cartesian space with the addition of localisation.

How is your robot localizing?

We develop an approach to calculate camera pose estimation independent of IMU and inverse kinematics estimations. Previously we search for (X, Y, Θ) for a given camera pose (Z, R, P, Y) by converting from camera frame, to agent frame, to world frame. We develop an approach to course search for (X, Y, Z, Θ, R, P, Y) candidates in the camera frame, followed by a refined search, allowing us to integrate data directly into the world frame. This approach is less accurate, but removes errors introduced by latency and inconsistencies in the hardware.

Is your robot planning a path for navigation? Is it avoiding obstacles? How is the plan executed by the robot (e.g. dynamic window approach)?

It is not currently. However, we are investigating possible techniques, such as image-based dynamic window approaches to obstacle avoidance

How is the behavior of your robot's structured (e.g. Behavior Trees)? What additional approaches are you using?

We currently use a fall-through behaviour tree to perform actions and perform state transitions.

Do you have some form of active vision (i.e. moving the robots camera based on information known about the world)?

Not currently.

Do you apply some form of filtering on the detected objects (e. g. Kalman filter for ball position)?

Not currently.

Is your team performing team communication? Are you using the standard RoboCup Humanoid League protocol? If not, why (e.g. it is missing something you need)?

Since we are using ROS 2 to develop our software, we decided to make full use of the functionalities provided by this framework. In particular, ROS 2 supports the quality of service (QoS) policy that allows us to tune the communication between nodes. For the team communication, we use the ROS 2 efficient non-blocking "best-effort", "UDP-like" and "TCP-like" policy. But, we are working on implementing the standard RoboCup Humanoid League protocol.

Please list contributions your team has made to RoboCup

We ran a Robotics module at the University of Hertfordshire for Bachelors students. Our team members are also part of the RC-HL organisation committees. Since the last three years, we started an annual RC hackathon event for students in both Schools of Engineering and Computer Science for robot design and software solutions. Team members are participating at demos, presentations for students and general public, and providing interview and promoting research related to RoboCup.Team members have also been invited to provide keynote presentations to local RC junior qualifications. Since two years, team members are involved in the development of a bridging event to

allow new teams and teams coming from the junior league to join HL.

Please list the scientific publications your team has made since the last application to RoboCup (or if not applicable in the last 2 years).

The team also is actively involved in editing and contributing to the unique journal project, titled "The human in the loop: perspectives and challenges for robots' behaviours in RoboCup 2050".

Please list the approaches, hardware designs, or code your team is using which were developed by other teams.

We are currently using IKWalk Engine from Rhoban team, and our vision is a modified version of the one developed from former team Electric Sheep.

What operating system is running on your robot and which middleware are you using (for example Ubuntu 22.04 and ROS2 Galactic)?

We run Ubuntu 24.04 and ROS 2 jazzy

Is there anything else you would like to share that did not fit to the previous questions?

N/A

If you have additional materials you would like to show, please link to them here.

N/A