Software Survey 2026

Team name

Bahia RT

Which division(s) are you applying for? If your used software differs between divisions, please fill out the survey once per division.

Large Size (height < 190 cm, weight < 80 kg)

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

It is partially open-source. The open-source modules can be found at:
https://github.com/BoosterRobotics/robocup_demo

Are you using any software developed by other teams? If so, list every component that you are reusing and the team that originally developed it.

We use the Booster T1 Robocup official demo V2 available at
https://github.com/BoosterRobotics/robocup_demo.
It consists of three modules:
1) vision: The Robocup vision recognition program, based on Yolo-v8, detects objects such as robots, soccer balls, and the field, and calculates their positions in the robot's coordinate system using geometric relationships.
2) brain: The Robocup decision-making program reads visual data and GameController game control data, integrates all available information, makes judgments, and controls the robot to perform corresponding actions, completing the match process.
3) game controller: Reads the game control data packets broadcast by the referee machine on the local area network, converts them into ROS2 topic messages, and makes them available for the brain to use.
We used a modified version, provided by the RoboFEI team, with adjustments to the goalkeeper's positioning in the brain module.

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

No, at this time we are not using datasets

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

1. SALES, RAONI ; FONTES MAGALHÃES MASCARENHAS, ANA PATRÍCIA ; Simões, Marco A. C. ; RODRIGUES DE SOUZA, JOSEMAR . Towards Automatic Code Generation for Robotic Soccer Behavior Simulation. JOURNAL OF INTELLIGENT & ROBOTIC SYSTEMS, v. 110, p. 18, 2024
2. BUCHE, C. (Org.) ; ROSSI, A. (Org.) ; Marco A. C. Simões (Org.) ; VISSER, U. (Org.) . RoboCup 2023: Robot World Cup XXVI. 1. ed. Springer Cham, 2024. v. 1. 443p .
3. SANTOS, CAROLINE S ; MASCARENHAS, ANA PATRICIA F. M. ; de Souza, Josemar Rodrigues ; Simões, Marco A. C. . Load and Selection Policies for Setplays in the RoboCup 3D Soccer Simulation League. In: 2025 Brazilian Conference on Robotics (CROS), 2025, Belo Horizonte. 2025 Brazilian Conference on Robotics (CROS), 2025. p. 1-6.
4. RODOWANSKI, IVANOÉ JOÃO ; MASCARENHAS, ANA PATRICIA FONTES MAGALHAES ; Simões, Marco A. C. ; CAMPOS, JORGE ALBERTO PRADO DE ; SILVA FILHO, JOSÉ GRIMALDO DA ; SOUZA, JOSEMAR RODRIGUES DE . A New Architecture to BILL Service Robot. In: V Brazilian Humanoid Robot Workshop and VI Brazilian Workshop on Service Robotics, 2024, Curitiba. Proceedings of the V Brazilian Humanoid Robot Workshop (BRAHUR) and VI Brazilian Workshop on Service Robotics (BRASERO), 2024.
4. DE BRITO, ARON CAIUÁ V. ; MASCARENHAS, ANA PATRÍCIA F. M. ; SIMÕES, MARCO A.C. ; RODOWANSKI, IVANOÉ J. ; DE CAMPOS, JORGE ALBERTO P. ; de Souza, Josemar Rodrigues ; DA SILVA FILHO, JOSE GRIMALDO . RoboSign: Improving Interaction Between Service-Robot and Hearing Impairments People. In: 2024 Brazilian Symposium on Robotics (SBR), and 2024 Workshop on Robotics in Education (WRE), 2024, Goiania. 2024 Brazilian Symposium on Robotics (SBR), and 2024 Workshop on Robotics in Education (WRE). Porto Alegre: SBC, 2024. p. 19.
5. SILVA, LÁZARO Q. ; MASCARENHAS, ANA PATRICIA F. M. ; Simões, Marco A. C. ; RODOWANSKI, IVANOÉ J. ; DE CAMPOS, JORGE ALBERTO P. ; de Souza, Josemar Rodrigues ; DA SILVA FILHO, JOSE GRIMALDO . LLM Text Generation for Service Robot Context. In: 2024 Brazilian Symposium on Robotics (SBR), and 2024 Workshop on Robotics in Education (WRE), 2024, Goiania. 2024 Brazilian Symposium on Robotics (SBR), and 2024 Workshop on Robotics in Education (WRE). Porto Alegre: SBC, 2024. p. 25.
6. GOMES, VANESSA M. ; MASCARENHAS, ANA PATRÍCIA F. M. ; RODOWANSKI, IVANOÉ J. ; DE CAMPOS, JORGE ALBERTO P. ; de Souza, Josemar Rodrigues ; FILHO, JOSE GRIMALDO DA SILVA ; Simões, Marco A. C. . Using Speech and Text in Emotions Recognition. In: 2024 Brazilian

Symposium on Robotics (SBR), and 2024 Workshop on Robotics in Education (WRE), 2024, Goiania. 2024 Brazilian Symposium on Robotics (SBR), and 2024 Workshop on Robotics in Education (WRE). Porto Alegre: SBC, 2024. p. 31.
7. SILVA, WESLEY S. ; SOUZA, JOSEMAR RODRIGUES DE ; RODOWANSKI, IVANOÉ J. ; Simões, Marco A. C. . Um Modelo para Otimização de Caminhada em Robôs Bípedes usando Pêndulo Invertido e Aprendizado por Reforço. In: Escola Regional de Computação Bahia, Alagoas e Sergipe, 2024, Brasil. Anais da XXIV Escola Regional de Computação Bahia, Alagoas e Sergipe (ERBASE 2024), 2024. p. 195.

Are there any other contributions you would like to share with the RoboCup community?

Our team leader served as the general chair of RoboCup 2025 in Salvador. Since 2015, several team members have participated as Execs, TCs, or OCs in the RoboCup Soccer Simulation 3D league. At this moment, one of our team members is OC in the SSIM3D league, and three team members are actively developing the new MuJoCo-based soccer simulator, which will be used in the RoboCup 2026 as the main simulator for the SSIM3D league. The roadmap is to present this simulator as a candidate for the official humanoid soccer simulator for the HSL in the near future.

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

We employ an end-to-end Deep Reinforcement Learning (DRL) approach using the PPO algorithm within a Gymnasium-based environment. Our policy is trained to output joint targets based on high-level velocity commands and IMU feedback. Crucially, we implement Domain Randomization during training to bridge the 'Sim-to-Real' gap, ensuring the walking gait remains stable and robust against hardware noise and physical irregularities in the real world.

Which approach are you using to generate other motions of the robot (e.g. kicking, standing up)?

We extend our DRL framework to handle complex, episodic maneuvers such as dynamic kicking and stand-up recovery. Unlike traditional keyframe-based approaches, using PPO allows the robot to learn versatile recovery strategies from various falling orientations and optimize kick impact. The training emphasizes handling complex contact dynamics, allowing the robot to execute these motions fluidly without rigid pre-scripted sequences.

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

Yes. We utilize the official URDF model provided by the manufacturer (Booster Robotics) at https://github.com/BoosterRobotics/booster_assets

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

We use Yolo-v8 from the vision module of the Booster T1 RoboCup Official demo v2

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 plan in Cartesian space. We transform from Image Space to Cartesian Space using a Pinhole Camera Model with Brown-Conrady distortion correction. Our vision system projects 2D pixels to 3D coordinates relative to the camera, which are then transformed to the robot and field frames.

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

Yes. Currently, our system utilizes a tracking algorithm to keep the ball centered and a scanning pattern for recovery. For RoboCup 2026, we are upgrading to a state-based gaze control architecture adapted from the 3D Simulation league. This includes a Kalman Filter for predictive tracking and latency compensation, as well as a search mode driven by the object's last known position.

What approach are you using to localize your robot?

We use a Particle Filter (Monte Carlo Localization). The system initializes a set of particles (hypotheses) representing possible robot poses (x,y,θ). These particles are updated based on visual landmarks (L-corners, T-corners, Penalty spots) observed on the field, minimizing the residual distance between projected observations and known map landmarks.

Is your team performing team communication? Which communication protocol are you using?

Yes, our team uses a hybrid architecture based on the User Datagram Protocol (UDP) for

communication. We utilize a Custom Binary Protocol, consisting of fixed-size C++ structures serialized directly over network packets. The system employs UDP Broadcast for dynamic peer discovery and keep-alive signals. Once teammates are identified, communication switches to UDP Unicast to exchange high-frequency game state data. Additionally, we utilize the SPL Standard Message protocol to communicate with the GameController.

What approach are you using for navigation? Are you avoiding obstacles?

At this time, the robots go to their planned target (eg, ball or strategic position), but there is no obstacle avoidance. We are migrating our former obstacle avoidance system used by the Simspark RoboCup Soccer Simulation team to the HSL team. It is based on potential fields and the A* algorithm, and we got good results in simulation. We plan to use this solution in the RoboCup 2026 in HSL.

How is the behavior of your robots structured? (e.g. Behaviour Trees)

Leveraging our background in the 3D Simulation league, we employ Behavior Trees to orchestrate robot decision-making. This structure allows us to reuse high-level logic validated in simulation while adapting low-level action nodes (leaves) for the physical constraints of the real robots. The architecture supports modular development, making it easy to integrate new skills into complex game strategies.

Are you simulating your robot? If so, which simulator are you using and for what purpose do you use simulations?

Yes. We use a MuJoCo-based simulator. This is the same simulator used in the RoboCup Soccer Simulation Leaague. It simulates the Booste T1 robot and we use it for:
1. Training or optimizing motions like walking and kicking
2. Gameplay: as we participate in the RoboCup Soccer Simulation League we simulate the complete gameplay, considering game strategies, navigation, setplays, etc

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

Ubuntu 22.04 and ROS2 Humble

Is there anything else you would like to share that did not fit any previous question?

Based on our experience with the RoboCup Soccer Simulation 3D League, we are adapting strategy and setplay solutions for the HSL and will incorporate this into the new version of Brain that we are developing. Part of this development will already be visible in RoboCup 2026.