

The NUbots Team Extended Abstract 2022

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1 History and Overview

NUbots are the RoboCup team at the University of Newcastle, Australia. In 2022 they will participate in the Kid Size Humanoid League, with their NUGus design based on the iGus platform[4]. NUbots have previously participated in the Standard Platform League (2002-2011), the Kid Size Humanoid League (2012-2017, 2021), and the Teen Size Humanoid league (2018-2019).

In the last physical RoboCup competition, which was held in 2019, NUbots faced issues with locomotion, hardware and sensors.

2 Developments

Robotic Simulation: NUbots have developed Webots [9] communication capabilities in NUClear [6] and have created a robot model for use in Webots. Webots has been used to optimise simple walk motions using genetic algorithms, with the team now working on more complex motion optimisations. Webots has also been used to create quasi-static and dynamic walk routines, however these have not been transferred to the real robot hardware yet. Visual odometry has also been explored, and is described below.

Vision and Localisation: The NUbots team have rewritten their particle filter localisation system. They have implemented visual odometry in Webots and are in the process of integrating this on the real robot. Work has begun on detection of field features from Visual Mesh [5] field line detections to then be used in the localisation particle filter.

Vision Data Collection: NUbots are currently working on a range of automatic vision data collection tools. A CycleGAN method has been investigated

and trained, and the team is now preparing to train a Multimodal CycleGAN for creation of synthetic vision data. The team is in the design phase of creating a tool that uses tracking devices to automatically segment real images.

Walk Engine: The team has moved to using Bit-Bots’ Quintic Walk [3], based off Rhoban’s Quintic Walk and IK Walk [8] since the 2019 competition. The team plans to further improve the walk before the 2022 competition. An ongoing project currently in the testing and debugging phase involves creation of a modular walk engine with dynamic motion controllers based on vector fields.

Hardware: The NUGus platform contains undesirable flex around the hip joint. A set of metal legs have been created to combat this issue. The team are considering further design improvements.

Protobuf Communication Protocol: A standard communication protocol [2], based on Protobuf messages, was proposed by NUbots to the Technical Committee. A prototype tool, based on the NUsight [1] debugging utility, for monitoring network communications and displaying robot communications in a meaningful manner is being developed, with part of the user interface completed.

High Level System Documentation: A new comprehensive documentation resource has been developed in the form of a public website [7], providing detailed information about the hardware and software systems along with guides. It is hoped that this resource will be useful not only for the NUbots team, but also the broader RoboCup community.

References

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