

RCF Support for Projects for League Developments 2018

RoboCupJunior Simulation League Development

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Project Overview

RoboCupJunior has demonstrated the ability to engage students in robotics and offers a unique learning opportunity for robotics education and engagement [1][2]. One key challenge to RoboCupJunior is the linking of Junior to the Major leagues to enable a progression from Junior level to the Major leagues and university-based research. Additionally, there is a significant cost barrier to many of the Junior teams because developing robots could be expensive for many, therefore developing a league requiring minimal costs has a potential to significantly widen the uptake. To meet these challenges, this project proposes the development of a RoboCupJunior Simulation Rescue sub-league. This involves the development of an Open Source Rescue simulation platform, which opens robotics to many more students around the world and develop a pathway to the Major competition. The Open Source platform will be developed alongside the Major Rescue Simulation platform with a collaboration with the Major Rescue Simulation league exec members, to provide a complimentary solution.

There are currently limited opportunities for Junior teams to engage in a simulation based challenges. Within RoboCupJunior, there is Rescue CoSpace competition which offers some limited simulation experience. However, this has no connection to the Major leagues. All other Junior leagues require physical hardware, with the leagues demanding increasingly complex and expensive components year on year, which is a considerable barrier to entry for new teams to Junior competitions. The development of a simulation-based league encourages an engagement with Major leagues and provides a low cost and low complexity entry-level to Major Rescue Simulation league, whilst also providing a potential expansion to be used as a significant research platform.

Although simulation does not provide ‘hands on’ experience, it allows a focus on algorithm development and software development. However, due to the physics engine inclusion, there is some provision to understand many of the challenges of using robots in the ‘real world’. Significantly, simulation is low cost, open to all and is efficient in terms of the space, resources and the initial knowledge of the instructors required, all of which are key advantages for a schools based robotics challenge [3].

Engagement of young roboticists and scientists is crucial to solving many of the problems facing society. Through the development of a Junior Simulation Rescue sub-league, we hope to increase young students’ engagement in engineering and technology helping to develop future roboticists who will help towards achieving the overall RoboCup goal.

Benefits for RoboCup

This project will lead to the development of an open-source platform for RoboCupJunior which opens up RoboCupJunior to many more teams worldwide due to the low entry cost and no requirement of a physical component. This provides a link between Junior and the Major leagues, aiming to help bridge the significant gap in technical skills and knowledge between the two. This link can help retention between Junior and Major leagues and provides a way to engaging advanced Junior members into the Major competitions. Additionally, the simulation allows for virtual participations, such that it is possible for many more teams to compete at the international level without the significant financial burden.

In terms of complexity, the simulation platform developed will allow solutions of varying complexity to be produced. This will allow entry level teams to develop simple rescue strategies, learn the basics of the software development aspects of the challenge and the algorithms required. However, the simulation will also allow highly complex solutions to be developed for more experienced teams such that high level, research driven solutions can be developed and tested.

Proposed League Development

The Rescue Simulation developed must be open source and based on a physics engine and platform providing an easy transition from Junior simulation to Major simulation. Therefore, the significant bulk of this project is focusing on the development on an open source simulation platform which aligns with the Major competitions; however, allows Junior level teams to interact with it successfully. Where possible we will base the new simulation engine to the one used for the Major Rescue simulation league [4]. However, it will focus on developing an interface which allows Junior team members to interact with the simulation in a meaningful way.

A single agent rescue simulation will be developed as this provides a reasonable level of challenge, with teams able to focus on developing simple searching strategies and interpretation of sensor results. Additionally, this provides significant scope for teams to investigate highly complex search strategies and resource management. This range of levels at which teams can interact with the simulation is key to the success of the proposed league. The simulation environment will allow the simulation of vision systems, Lidar and other systems, which would be challenging practically for Junior teams in a real-world robot scenario. This allows Junior teams to work on topics such as vision, depth perception and some learning, segmentation or image classification to be investigated; the areas that would not otherwise be easily accessible to Junior teams.

For widescale adoption, the software platform developed must have a low complexity entry barrier, such that installation is achievable within a school environment. Additionally, the creation and use of introductory materials are critical as this will provide the underlying skills set upon which teams can develop their solutions. Alongside teaching materials, a forum system must be created to assist with technical questions, installation queries etc. This can be supported by the RoboCup community. Developing this supporting materials and infrastructure is key to the success of this project.

Although the initial league development is focusing on Rescue simulation, there is potential to extend this development into other simulation scenarios, such as soccer and/or @Home.

Implementation and Budget

The proposed project can be broken into a number of stages, culminant in testing of a demonstration league in RoboCup 2018 with a small number of teams, and a virtual competition. The work packages and the required budget for these is summarised below.

We will be working with both the RoboCup Rescue Major Simulation execs and TC and the RoboCupJunior Rescue TC to develop a platform that interfaces well with both of these existing leagues.

Work Package	Tasks	Budget
WP1: Develop software requirements	- Fully identify the exact simulation scenario to be developed - Develop a list of requirements and expectations for the software	
WP2: Software Development	- Working with the RoboCup community, and external software developers produce the open-source software platform - Fully test the software and iteratively fix the bugs as required	\$3000 for software development support
WP3: Development of tutorials/introductory materials	- Produce and test introductory getting started guides for using the simulation - Produce rules and guidelines for the competition - Develop forum and online presence for the simulation	
WP4: Engage teams to trial the league	- Find a range of experience and age of simulation teams to take part in a demo league. - Support teams through the online forum	
WP5: Demo League	- Run the simulation league as a Demo league - Make a presentation about the league to other competitors	\$3000 Travel support for teams
WP6: Feedback and future development assessment	- Assess the success of the demo league using feedback from teams - Establish how the league can progress going forwards and the support and changes which are required to the software/rules	
Total Budget		\$6,000

We will be looking to engage relevant members of the RoboCup community in the development of this league, and use the demo league as an opportunity to promote the league to teams for the future involvement. This has a potential for significant further expansion, providing an opportunity for the more close collaboration of RoboCupJunior with the Major leagues.

References

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