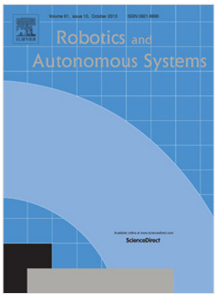
Accepted Manuscript



A directional antenna based leader-follower relay system for end-to-end robot communications

Byung-Cheol Min, Ramviyas Parasuraman, Sangjun Lee, Jin-Woo Jung, Eric T. Matson

PII: S0921-8890(17)30414-1
DOI: https://doi.org/10.1016/j.robot.2017.11.013
Reference: ROBOT 2956

To appear in: *Robotics and Autonomous Systems*

Received date : 16 June 2017
Revised date : 9 October 2017
Accepted date : 24 November 2017

Please cite this article as: B. Min, R. Parasuraman, S. Lee, J. Jung, E.T. Matson, A directional antenna based leader-follower relay system for end-to-end robot communications, *Robotics and Autonomous Systems* (2017), https://doi.org/10.1016/j.robot.2017.11.013

A Directional Antenna based Leader-Follower Relay System for End-to-End Robot Communications

Byung-Cheol Min[a], Ramviyas Parasuraman[a], Sangjun Lee[a], Jin-Woo Jung[b,*], Eric T. Matson[a,c]

[a] *Department of Computer and Information Technology, Purdue University, West Lafayette, IN 47907, USA*
[b] *Department of Computer Science and Engineering, Dongguk University, Seoul, 04620, Republic of Korea*
[c] *Department of Electrical Engineering, Kyung Hee University, Yongin, 17104, Republic of Korea*

Abstract

In this paper, we present a directional antenna-based leader-follower robotic relay system capable of building end-to-end communication in complicated and dynamically changing environments. The proposed system consists of multiple networked robots - one is a mobile end node and the others are leaders or followers acting as radio relays. Every follower uses directional antennas to relay a communication radio and to estimate the location of the leader robot as a sensory device. For bearing estimation, we employ a weight centroid algorithm (WCA) and present a theoretical analysis of the use of WCA for this work. Using a robotic convoy method, we develop online, distributed control strategies that satisfy the scalability requirements of robotic network systems and enable cooperating robots to work independently. The performance of the proposed system is evaluated by conducting extensive real-world experiments that successfully build actual communication between two end nodes.

Keywords: Multi-Robot System, Relay Robots, Robotic Convoy System, Wireless Communications, Directional Antennas, Weighted Centroid

*Corresponding author; This paper was presented in part at the International Conference on Robot Intelligence Technology and Applications, Denver, USA, Dec, 2013 [1] and in part at the IEEE Sensors Applications Symposium, Queenstown, New Zealand, April, 2014 [2].

Email addresses: minb@purdue.edu (Byung-Cheol Min), ramviyas@purdue.edu (Ramviyas Parasuraman), lee1424@purdue.edu (Sangjun Lee), jwjung@dongguk.edu (Jin-Woo Jung), ematson@purdue.edu (Eric T. Matson)