International Journal of Innovative Computing, Information and Control
Volume **4**, Number **1**, January **2008**

 ISSN 1349-4198
pp. 165–173

LOCALIZATION OF A MOVING SENSOR BY PARTICLE FILTERS

Minoru Ito

Department of Control Engineering
Maizuru National College of Technology
234 Aza Shiroya, Maizuru, Kyoto 625-8511, Japan
mito@maizuru-ct.ac.jp

Masahiro Tanaka

Department of Information Science and Systems Engineering
Konan University
8-9-1 Okamoto, Higashinada-ku, Kobe 658-8501, Japan
m_tanaka@konan-u.ac.jp

Received February 2007; revised July 2007

Abstract. *Recently, interest in localization and map building with laser range sensor have been increasing in the robotics community. One of the reasons for this is that the algorithms with laser range sensor have lower computational cost and are more robust than using vision sensors. Another reason is the robustness against environmental changes (e.g. lighting condition, etc.). We are developing a walking aid system for physically handicapped persons. As the first step in this project, we consider the localization of a moving cart with laser range sensor and building environment map. We estimate the moving cart position and orientation by maximizing the number of matched point pairs between current scan data and reference scan data. Our matching algorithm is based on point-to-point matching algorithms. In this paper, we show some preliminary results using raw data and discuss the availability of our matching algorithm for future applications. We also show the way to apply particle filters for this problem and examine this localization algorithm.*

Keywords: Laser range sensor, Localization and map building, Scan matching, Particle filter

1. **Introduction.** We are developing a walking aid system, where a handicapped person or an old person uses a pushcart or a wheelchair with a laser sensor. The necessary function of the sensor is to give the person various safety signals or alarms in using it. In addition to that, it would be of great support if the locational information of the person is given to the person, or reported to a remote watching person by using wireless communication.

In this project, localization of the sensor position is a very important problem. In fact, also in robotics research, localization and map building is an essential component, and has been studied extensively in the community. In localization and map building, dead reckoning approaches with internal sensors (e.g. encoder, gyro, etc.) information are most common approaches. However, a drawback of the dead reckoning approach is error accumulation (e.g. wheel slip, etc.). For this reason, we also need to correct dead reckoning error using external sensors (e.g. laser range sensor, vision sensor, etc.) that acquire information from the environment to help the localization and map building more accurately [1,2,6,8,12,14].

Localization and map building with external sensors have been studied extensively for the past few years. The most common studies are using ultrasonic sensors, vision