FOR A SIX-DEGREE-OF-FREEDOM MANIPULATOR TO AVOID UNPREDICTABLE OBSTACLES

By Iman, H (Iman, Hafiz) [1] ; Khan, MR (Khan, Md Raisuddin) [1]

View Web of Science ResearcherID and ORCID (provided by Clarivate)

Source IIUM ENGINEERING JOURNAL

Volume: 24 Issue: 1 Page: 319-332

DOI: 10.31436/iiumej.v24i1.2642

Published JAN 2023

Indexed 2023-02-17

Document Type Article

Abstract This paper presents the use of a sampling-based planner as a reactive planning scheme to avoid obstacles between a robotic arm and a moving obstacle. Based on a planner benchmark on an obstacle-ridden environment, a rapidly-exploring random tree (RRT) planner has been used to populate the trajectories of the task space and map them into a configuration space using a Newton-Raphson-based inverse kinematic solver. Two robot poses are defined in a cycle of back-and-forth motion; the initial and the goal poses. The robot repeatedly moves from the starting pose to the end pose via the midpoint pose. Each set of trajectories is unique. We define this unique solution within the context of the configuration space as a cycle space. We impose a periodically occurring synthetic obstacle that moves in and out of the robot arm workspace define

in a simulated environment. Within the robot's workspace, the obstacle moves and cuts through the cycle space to emulate a dynamic environment. We also ran a benchmark on the available sampling planner in the OMPL library for static obstacle avoidance. Our benchmark shows that the RRT has the lowest time planning time at 0.031 s compared with other sampling -based planners available in the OMPL library, RRT implicitly avoids singularities within the cycle space, and reactively attempts to avoid synthetic moving objects near the robot hardware. This research intends to further investigate on the use of RGB-D sensor and LiDAR to track moving obstacles while abiding by the task spacc commands described by the initial and goal poses.

Keywords **Author Keywords:** mechatronics; mhot manipulator; planner; motion planning; dynamic environment

Author Information

Corresponding Address: Iman, Hafiz (corresponding author)

Int Islamic Univ Malaysia, Dept Mechatron Engn, Kulliyyah Engn, Jalan Gombak, Kuala Lumpur 53100, Malaysia

Addresses :

1 Int Islamic Univ Malaysia, Dept Mechatron Engn, Kulliyyah Engn, Jalan Gombak, Kuala Lumpur 53100, Malaysia

E-mail Addresses : hafiz.ghazman@gmail.com

Categories/ Classification

Research Areas: Engineering

Citation Topics: 4 Electrical Engineering, Electronics & Computer Science › 4.29 Automation & Control Systems › 4.29.435 Multi Agent Systems

Sustainable Development Goals: 11 Sustainable Cities and Communities

Web of Science Categories

Engineering, Multidisciplinary

+ See more data fields

New

Journal information

IIUM ENGINEERING JOURNAL

ISSN 1511-788X

eISSN 2289-7860

Current Publisher KULLIYYAH ENGINEERING, INT ISLAMIC UNIV MALAYSIA, JALAN GOMBAK 53100, MALAYSIA

0.5
Journal Impact Factor ™ (2022)

0.17
Journal Citation Indicator ™ (2022)

29

Journal Impact Factor	Journal Citation Reports ™
Research Areas	Engineering
Web of Science Categories	Engineering, Multidisciplinary

Citation Network

In Web of Science Core Collection

0 Citations

Create citation alert

10 Cited References

View Related Records →

Use in Web of Science

0 Last 180 Days

0 Since 2013

Learn more →

This record is from:

Web of Science Core Collection

- Emerging Sources Citation Index (ESCI)

Suggest a correction

If you would like to improve the quality of the data in this record, please Suggest a correction

10 Cited References

→ View as set of results

Showing 10 of 10 *(from Web of Science Core Collection)*

29