

Chapter 13

Control Architecture Model in Mobile Robots for the Development of Navigation Routes in Structured Environments

Alejandro Hossian

Universidad Tecnológica Nacional, Argentina

Gustavo Monte

Universidad Tecnológica Nacional, Argentina

Verónica Olivera

Universidad Tecnológica Nacional, Argentina

ABSTRACT

Robotic navigation applies to multiple disciplines and industrial environments. Coupled with the application of Artificial Intelligence (AI) with intelligent technologies, it has become significant in the field of cognitive robotics. The capacity of reaction of a robot in unexpected situations is one of the main qualities needed to function effectively in the environment where it should operate, indicating its degree of autonomy. This leads to improved performance in structured environments with obstacles identified by evaluating the performance of the reactive paradigm under the application of the technology of neural networks with supervised learning. The methodology implemented a simulation environment to train different robot trajectories and analyze its behavior in navigation and performance in the operation phase, highlighting the characteristics of the trajectories of training used and its operating environment, the scope and limitations of paradigm applied, and future research.

DOI: 10.4018/978-1-5225-8060-7.ch013

INTRODUCTION

Early research in the field of robotics were made based on development environments working with cells fixed in their positions for the robot to develop its work, as in the case of the welding robot in an assembly plant.

The significant technological advances in various industrial environments were one of the main reasons to provide adequate capacity to move the robot systems beyond its work cells. This discipline has been called, in due course, “Robotics Mobile” and is one of the greatest challenges addressed by the scientific community that works within the extensive and rich field of robotics.

In this context, it should be noted that successive investigations have worked to provide a level of autonomy to these mobile systems with the aim of robots that can navigate its operating environment and react to situations that have not been considered in scheduling its control. To make navigating the robot to meet the requirements that were specified, the robot must have a cognitive architecture on which to establish links between its sensory system and its system of performance in the operating environment, and therefore, the robot is able to achieve objectives.

Through the navigation, it is possible to guide the course of a mobile robot through an environment with the presence of obstacles. Different schemes are known to carry out this task, but all have the common goal of directing the vehicle to your destination in the most secure and efficient manner possible. The capacity of reaction that may possess the robot when faced with unexpected situations should be its most distinctive quality to function effectively in the environment where it should operate, which indicates the degree of autonomy that it has.

CONTROL ARCHITECTURE

In the context of the design of robot systems, a control architecture is some description of a system established on the basis of components of a structural nature and how it is assembled together to be able to shape a coherent and consistent set with respect to its “structure and function.” In the context of mobile robotics, which is the branch of Robotics that concerns us in the present work, include the following sentence belonging to Javier De Lope Asiaín (De Lope, 2001):

Mobile robot control architecture is a software system that provides the actions or movements that should make the robot from the acquisition and processing of sensory information and of the objective or objectives that have been identified.

Given this reasoning, in which case it is intended to design and build a mobile robot, one of the key issues to solve this problem must be related the following to obtain a satisfactory design:

- Appropriate sensors to perceive the robot system operating environment.
- Engines, to facilitate the mobility of the robot to act on its environment.
- CPU (Central Processing Unit) to exercise control over this mechanism of relationship between sensors and motors.
- Command of tasks. The commands are ordered tasks the robot can complete.

17 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:
www.igi-global.com/chapter/control-architecture-model-in-mobile-robots-for-the-development-of-navigation-routes-in-structured-environments/222434

Related Content

Interactive Games with Robotic and Augmented Reality Technology in Cognitive and Motor Rehabilitation

Ana Belén Naranjo-Saucedo, Cristina Suárez-Mejías, Carlos L. Parra-Calderón, Ester González-Aguado, Frida Böckel-Martínez, Antoni Yuste-Marco, Pablo Bustos, Luis Manso, Pilar Bachiller, Sergi Plana, Jose M. Diaz, Ricardo Bonicheand Adriá Marco (2014). *Robotics: Concepts, Methodologies, Tools, and Applications* (pp. 1233-1254).

www.irma-international.org/chapter/interactive-games-with-robotic-and-augmented-reality-technology-in-cognitive-and-motor-rehabilitation/84947

Sentiment Predictions Using Deep Belief Networks Model for Odd-Even Policy in Delhi

Sudhir Kumar Sharma, Ximi Hoqueand Pravin Chandra (2016). *International Journal of Synthetic Emotions* (pp. 1-22).

www.irma-international.org/article/sentiment-predictions-using-deep-belief-networks-model-for-odd-even-policy-in-delhi/178518

The Transformative Role of Cryptocurrencies in Modern Finance: Opportunities, Risks, and Future Directions

Ilimsan Feyzullah (2025). *FinTech and Robotics Advancements for Green Finance and Investment* (pp. 129-172).

www.irma-international.org/chapter/the-transformative-role-of-cryptocurrencies-in-modern-finance/379523

Automatic Operating Process for Zebrafish Embryo Injection

Wang Yiliao, Sun Mingzhu, Feng Xizeng, Wang Ya Nan, Zhao Baoquanand Zhao Xin (2013). *International Journal of Intelligent Mechatronics and Robotics* (pp. 1-15).

www.irma-international.org/article/automatic-operating-process-for-zebrafish-embryo-injection/87477

Next-Generation Bioinformatics: Sustainable Wireless Solutions for Personalized Surgery

Tanusha Gorak, P. R. Anisha, C. Kishor Kumar Reddy, Rimsha Sadafand Jothi Paranthaman (2026). *Next-Generation Insights on Autonomous Surgical Robotics* (pp. 25-54).

www.irma-international.org/chapter/next-generation-bioinformatics/412845