Chapter 13
Control Architecture Model in Mobile Robots for the Development of Navigation Routes in Structured Environments

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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.

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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.