Chapter 27
Architecture and Framework for Interfacing Cloud-Enabled Robots

B. Srinivas
Kakatiya Institute of Technology and Science, India

Lakshmana Phaneendra Maguluri
Koneru Lakshmaiah Education Foundation, India

K. Venkatagurunatham Naidu
Guntur Engineering College, India

L. Chandra Sekhar Reddy
CMR College of Engineering and Technology, India

M. Deivakani
PSNA College of Engineering and Technology, India

Sampath Boopathi
Muthayammal Engineering College, India

ABSTRACT

The integration of robot activities with cloud computing and the internet of things is essential to Industry 4.0 implementation. In the chapter, the fundamental principles of cloud computing and integrated robotics are explained. Emergence, characteristics, service delivery models, and computing models of robot-cloud computing principles have been discussed. Classical principles of service-oriented architecture, service models, web services, gSOAP, robotic operating systems, and challenges of robot cloud computing fields were illustrated. The main objective of this chapter is to illustrate cloud computing architecture frameworks. The architecture, platform, setup, and implementation principles of fixed and variable-length strings for cloud robotic frameworks have been briefly illustrated.

DOI: 10.4018/978-1-6684-8145-5.ch027

INTRODUCTION

Although there are more applications and uses for mobile robots, their variety of services is constrained by low-power batteries, a lack of software upgrades, and a lack of enough processing and storage. Sharing information and expertise among robots is difficult because they are designed differently. By using the internet to connect a robot to the cloud infrastructure for data processing and storage, a robot's capabilities can be increased. However, because to deployment strategies, architectural design, and other factors, the robot-cloud communication protocol is susceptible to attacks. Additionally, cloud application responses with high latency and low connection speeds may render the robot brainless. A standard command for robots, such as a proxy-based master robot with higher bandwidth, can be used to construct a universal light weight knowledge interchange format, which can be used to address the low speed of robots. This might lessen the redundant data or knowledge produced by diverse robots using various hardware and software. To exchange knowledge data and utilise the computational capacity of the cloud, this suggested study blends robotics with cloud computing technologies. It seeks to provide a generally recognised interface between diverse robots and the cloud while reducing unnecessary code and data for them. Library Assistant as a test bed has been prepared to illustrate the concepts. A test bed for fixed length string communication has been built to test the architecture of mobile robots, and a variable length string is used for testing the architecture. Standard API has been utilised to harness the database and processing capabilities of the cloud. A path or map on a cloud-based architecture has been proposed using KIF, a knowledge interchange protocol. The idea of a variable string has been expanded in order to produce a standard representation for the paths that a robot would use to navigate utilising geographical features. Test bed 3 serves as an illustration of the system architecture of the Cloud Enabled Robotic Framework employing Landmark and Variable Length String.

Enterprises may now invest less in capital expenditures and utilise that money on things like robots thanks to the revolution that cloud computing has brought about in computing and infrastructure management. It offers robust processing, storage, and means to communicate and work together with other robotic systems. Cloud technology can be used by robots to communicate and work together. It is challenging to create software for robots and share data with the cloud due to the diversity of their hardware and operational platforms (Boopathi et al., 2023; Kumara et al., 2023; Vanitha et al., 2023). This is because there isn't a single platform that works with all kinds of hardware, which makes it challenging to reuse code. An open source framework called ROS was developed to make it easier to create strong, complicated robot software behaviour across several platforms. Various communities have contributed to it; however, the robotics communities are opposed to its application. Collections are inscribed and collective, but fail to keep them free of faults, rendering them useless after a predetermined amount of time. Reusing programme code between platforms is challenging, and lack of standard interfaces for robot hardware components is a key challenge (Paraforos & Griepentrog, 2021).

By combining and mapping data from many sources, an ontology can be used to create a new generation of information systems that are accessible to end users as a repository. This idea can be applied to cloud robotics to allow machines to share and reuse information. A networked robotics architecture known as cloud robotics comprises of an infrastructure cloud and an ad-hoc cloud created via machine-to-machine (M2M) interactions. In order to allow task offloading and information sharing, it uses a resilient computing approach to dynamically assign resources from a common pool. To accommodate various applications, many communication protocols and elastic computing models have been proposed. The potential advantages of cloud robotics in many applications have been highlighted through discussions