Chapter 32
Kinova Modular Robot Arms for Service Robotics Applications

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ABSTRACT

This article presents Kinova's modular robotic systems, including the robots JACO2 and MICO2, actuators and grippers. Kinova designs and manufactures robotics platforms and components that are simple, sexy and safe under two business units: Assistive Robotics empowers people living with disabilities to push beyond their current boundaries and limitations while Service Robotics empowers people in industry to interact with their environment more efficiently and safely. Kinova is based in Boisbriand, Québec, Canada. Its technologies are exploited in over 25 countries and are used in many applications, including as service robotics, physical assistance, medical applications, mobile manipulation, rehabilitation, teleoperation and in research in different areas such as computer vision, artificial intelligence, grasping, planning and control interfaces. The article describes Kinova's hardware platforms, their different control modes (position, velocity and torque), control features and possible control interfaces. Integration to other systems and application examples are also presented.

INTRODUCTION

Robots are well implemented in industry for manufacturing and are used in a large array of applications. Their speed, precision, stamina and strength allow them to perform many tasks better and faster than humans. They also allow humans to avoid many tasks that would be too dangerous or repetitive. These industrial robots typically have a limited number of sensors and decision capabilities preventing them

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from safely operating near humans. However, in many applications, humans would benefit from a direct interaction with robots. For instance, we could interact with the robot by taking advantage of our own capabilities (capacity of decision) along with the robot's capabilities (strength, endurance, stamina) thus creating a synergy allowing to accomplish tasks that were not possible for one or the other alone. In order for this new collaboration to be possible, robots must be safe, intuitive and have a better understanding of their environment (De Santis et al, 2008; Haddadin and Croft, 2016). In order to achieve this, sensor information and advanced algorithms are very important.

This new era of human assistance is emerging in many applications. In manufacturing, robots work closely with operators in the same workspace. For example, this includes collaborative devices and new commercial robots from companies such as Kuka, Rethink Robotics, Universal Robots, ABB, Kawada Industries and MABI.

Kinova's History

Kinova was founded in 2006 as a company for development of innovative solutions for compensating the loss of mobility of upper limbs. The inspiration came from Kinova's CEO and co-founder's uncle, who suffered from muscular dystrophy, as did two of his brothers. He was challenged by the idea of developing an arm which could be controlled by his only active finger and allow him to become more independent and able to grasp and manipulate objects in his surroundings without external assistance. Kinova then designed the robot JACO (as shown in Figure 1) to assist people with physical disabilities

Figure 1. JACO mounted on a powered wheelchair. Figure courtesy of Kinova.