Current market demands require an increasingly agile production environment throughout many manufacturing branches. Traditional automation systems and industrial robots, on the other hand, are often too inflexible to provide an economically viable business case for companies with rapidly changing products. The introduction of cognitive abilities into robotic and automation systems is, therefore, a necessary step toward lean changeover and seamless human–robot collaboration. In this article, we introduce the European Union (EU)-funded research project SMErobotics, which focuses on facilitating the use of robot systems in small and medium-sized enterprises (SMEs). We analyze open challenges for this target audience and develop multiple efficient technologies to address related issues. Real-world demonstrators of several end users and from multiple application domains show the impact these smart robots can have on SMEs. This article intends to give a broad overview of the research conducted in SMErobotics. Specific details of individual topics are provided through references to our previous.