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Robots for City Life: Design Guidelines and Strategy Recommendations for Introducing Robots in Cities

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Abstract : The aim of this paper is to articulate design strategies and recommendations for introducing robots into the city life of people based on experiments conducted with robots and semi-autonomous systems in three cities in the Netherlands. This research was carried out by the Spot robotics team of Impact Lab housed within YES!Delft, a start-up accelerator located in Delft, The Netherlands. The premise of this research is to inform the development of the 'region of the future' by the Municipality of Rotterdam-Den Haag (MRDH). The paper starts by reporting the desktop research carried out to find and develop multiple use cases for robots to support humans in various activities. Further, the paper reports the user research carried out by crowdsourcing responses collected in public spaces of Rotterdam-Den Haag region and on the internet. Furthermore, based on the knowledge gathered in the initial research, practical experiments were carried out using robots and semi-autonomous systems in order to test and validate our initial research. These experiments were conducted in three cities in the Netherlands which were Rotterdam, The Hague, and Delft. Custom sensor box, Drone, and Boston Dynamics' Spot robot were used to conduct these experiments. Out of thirty use cases, five were tested with experiments which were skyscraper emergency evacuation, human transportation and security, bike lane delivery, mobility tracking, and robot drama. The learnings from these experiments provided us with insights into human-robot interaction and symbiosis in cities which can be used to introduce robots in cities to support human activities, ultimately enabling the transitioning from a human only city life towards a blended one where robots can play a role. Based on these understandings, we formulated design guidelines and strategy recommendations for incorporating robots in the Rotterdam-Den Haag's region of the future. Lastly, we discuss how our insights in the Rotterdam-Den Haag region can inspire and inform the incorporation of robots in different cities of the world.

Keywords : city life, design guidelines, human-robot Interaction, robot use cases, robotic experiments, strategy recommendations, user research
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