

**Mini Review***Copyright © All rights are reserved by Ayodeji Seriki*

Robotics and Automation for Smart Cities: Enhancing Urban Living

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This project explores the role of robotics and automation in enhancing the quality of life in smart cities. With the rise of urban populations, efficient and sustainable city management is critical. Robotics and automation technologies offer transformative capabilities in transportation, waste management, public safety and healthcare. This study discusses various applications, benefits, challenges, and future directions of robotics in smart city development.

Keywords: Robotics; Automation technologies; Smart City; Urban populations; Public Safety; Healthcare

Introduction

The 21st century is witnessing a rapid transformation of cities into smart urban ecosystems through the integration of information and communication technology (ICT). Smart cities use digital technologies to improve public services, reduce environmental impact, and increase citizen engagement. Robotics and automation are central to this transformation, enabling autonomous operations in complex urban environments (Batty et al., 2012).

With global urbanization projected to increase-by 2050, nearly 68% of the world's population is expected to live in cities (UN DESA, 2018)-the demand for intelligent systems that can manage infrastructure, transportation, waste, and public services is more urgent than ever.

Robotics in smart cities**Smart Transportation**

Autonomous vehicles (AVs) are reshaping urban mobility by

reducing traffic congestion, accidents, and emissions. Companies like Waymo and Tesla are already piloting autonomous cars that rely on robotics, AI, and sensor fusion (Litman, 2020). Drones, too, are being tested for traffic monitoring and medical supply delivery (Kellermann et al., 2020).

Waste Management

Smart waste collection robots and automated bins equipped with IoT sensors optimize collection routes and reduce fuel consumption (Longhi et al., 2012). For instance, Finland's Enevo system uses sensors in dumpsters to notify when they need emptying, enhancing efficiency.

Public Safety and Surveillance

Robots and automated surveillance systems enhance urban safety. Surveillance drones can patrol large areas with thermal cameras and facial recognition software, aiding law enforcement

(Hayes, 2017). In Dubai, robotic police units interact with citizens and monitor city events in real time (Khaleej Times, 2017).

Infrastructure Maintenance

Robots are used to inspect and repair infrastructure such as bridges, water pipes, and power lines. These systems can navigate hazardous environments, reducing human risk and costs. For example, the UK has invested in “self-repairing cities” using autonomous robots to fix potholes and streetlights (Royal Academy of Engineering, 2015).

Automation in urban services

Healthcare and Social Services

Telepresence robots and automated kiosks provide remote consultations and monitor patient vitals, particularly useful in pandemics (Yang et al., 2020). In Japan, robots assist elderly citizens with daily tasks, reducing the burden on caregivers (Broadbent et al., 2009).

Energy Management

Smart grids powered by AI and automation systems help regulate electricity use and integrate renewable energy sources (Gungor et al., 2011). Automated lighting and HVAC systems in smart buildings reduce energy consumption.

Education and Public Engagement

Educational robots in public libraries and schools engage children in STEM learning. Furthermore, urban robots at service centers provide information and directions, enhancing citizen satisfaction (Tanaka et al., 2015).

Challenges and considerations

Despite the benefits, there are significant challenges:

- **Privacy and Security:** Surveillance robots raise ethical and legal questions regarding data privacy (Calo, 2012).
- **Cost and Infrastructure:** The implementation of robotic systems requires substantial investment in infrastructure.
- **Job Displacement:** Automation may lead to unemployment in certain sectors, necessitating workforce reskilling.

Governments must ensure policies that balance innovation with equity, privacy and sustainability.

Future Directions

The future of robotics in smart cities lies in increased autonomy, collaboration with humans (cobots), and integration with AI and big data. Emerging technologies like 5G and edge computing will

enhance real-time robotic performance. Moreover, urban planning will increasingly consider robotic systems in its blueprints, emphasizing “robot-friendly” cities.

Conclusion

Robotics and automation are vital pillars of smart city development, enhancing urban living through efficient services, improved safety, and sustainability. While there are challenges to address, the integration of these technologies presents a promising path toward resilient, livable and future-ready cities.

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Conflict of interest

No conflict of interest.

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