


Chapter 5

Cyber–Physical Systems and the Future of Urban Living: Decision–Making Challenges and Opportunities

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ABSTRACT

Cyber-physical systems, where software and physical infrastructure are intertwined are promising technologies for re-imagining urban life. As CPS apply tightly coupled networks of sensors and actuators, supported by advanced data analytics, the field has great potential for addressing many aspects of city life and improving the quality of life of city inhabitants. Global urban development and itself increasing complication of the processes involved have produced considerable demand for

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fresh approaches to various local problems, extending from transport management to energy consumption, disease prevention, and preservation of natural resources. Moreover, CPS can be helpful in conservative consumption of resources: energy, water supply, and others in cities. Addressing these challenges via adaptive policies and frameworks, ethical imperatives, as well as special attention to the principles of smart design, will be vital for the successful translation of the potentials of CPS for improved efficiency, sustainability, and equity in urban settings.

1. INTRODUCTION TO CYBER-PHYSICAL SYSTEMS (CPS) AND URBAN LIVING TRANSFORMATION

Urbanization has advanced over the years and so has the increase in complexity of these emerging today's urban world problems including traffic jams, high energy consumption and pollution. Cyber-physical systems have become revolutionary in managing the City's technical networks and human environment through converged computational applications, communication, and physical support systems, thus improving the life of the City's residents. Cyber-physical systems are intelligent systems and are defined as systems that integrate computational algorithms and communication technologies with physical processes.

1.1 Overview of Cyber-Physical Systems (CPS)

Cyber-physical systems are made of a set of physical entities which interact with each other, for instance, sensors, and actuators, but also comprise computational and communicational qualities. These systems use data analysis and machine learning alongside real-time decision making over actual physiologic processes toward the formulation of improved physical systems alongside the general system robustness (Alshammari et al., 2021). CPS interconnectivity of cyber and physical elements allows coordinating information sharing and employing the control strategies to reconsider the existing urban issues concerning traffic circulation, energy consumption, and environmental impacts. The potential that can be seen from cyber-physical systems in defining and redesigning the way people live in cities is possible is unprecedented. Through integration of CPS, cities can find new and better approaches to management of infrastructure, provision of services and growth of quality of life for citizens Ali et al., 2020.

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