iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** IV **Month of publication:** April 2025

DOI: https://doi.org/10.22214/ijraset.2025.69883

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue IV Apr 2025- Available at www.ijraset.com

Smart City Simulation and Design using AI

Gupta Ramkalesh Raghav Prasad[1], Faizal Hussain[2], Gopal Ji[3], Harsh Anand[4], Dr. Saumya Chaturvedi[5], Mr. Harendra Malik[6]

[1, 2, 3, 4]*Department of Computer Applications, Greater Noida Institute of Technology (Engg. Institute), Greater Noida, India*
[5]*Head of Department, Department of computer Applications, Greater Noida Institute of Technology (Engg. Institute), Greater Noida, India*
[6]*Assistant Professor, Department of Computer Applications, Greater Noida Institute of Technology (Engg. Institute), Greater Noida, India*

Abstract: ***The idea of smart cities is a viable answer to the problems that urbanization is posing to cities worldwide, and artificial intelligence (AI) is a key component of this change. With an emphasis on its six primary domains—smart mobility, smart environment, smart governance, smart living, smart economics, and smart people—this study reviews the literature on AI solutions used in smart cities. The Scoop-available publications from 2021 to 2024 are included in the analysis. This study looks at how AI is being used in each field and notes its challenges, developments, and potential paths forward. The analysis's objectives were as follows: (1) to find applications and solutions that use AI in smart cities; (2) to find the obstacles that prevent AI from being implemented in smart cities; and (3) to investigate potential future directions for AI use in smart cities.***
Keyword: smart cities, artificial intelligence (AI), technology.

I. INTRODUCTION

Smart city development presents a viable answer to emerging problems as communities worldwide continue to grapple with the intricacies of urbanization. Artificial intelligence (AI), which has the potential to completely reshape many facets of urban life, is at the center of this change. AI is crucial to realizing the full promise of smart cities, from managing natural resources to improving governance, boosting economic growth, empowering residents, and optimizing transportation systems. Smart cities make use of cutting-edge technology data analytic, and digital infrastructure to improve inhabitants' quality of life, sustainability, and efficiency [1]. To address urban difficulties and enhance general well-being, these cities incorporate a variety of smart solutions from a variety of sectors, such as energy, transportation, health-care, government, education, and more. The usage of Internet of Things (IOT) devices for data collection and networked digital platforms for smooth stakeholder collaboration and communication are two essential features of smart cities [2]. Industry 4.0 and the increasingly common term Society 5.0 [3], which depicts a highly developed society in which technology acts as a catalyst for constructive social and economic change, are closely related to smart cities.

The goal of humanity has always been to advancement by creating ever-more technologically sophisticated cities that are home to an increasing number of clever, environmentally conscious individuals. It should be highlighted, although, that artificial intelligence is another idea that makes significant strides, particularly in smart cities. AI has a significant influence on people's behavior and way of life in addition to bringing forth significant technological advancements. Nearly every aspect of human life can benefit from the application of artificial intelligence.

II. LITERATURE REVIEW

Over recent years, a growing body of research has examined the integration of AI in smart city infrastructures, reflecting its increasing role in solving complex urban challenges. According to Feher (2021), citizen participation and the cultivation of a “smart mentality” are essential for the effective implementation of AI technologies in urban governance [4]. Meanwhile, Obracht-Prondzyńska et al. (2022) emphasized the environmental dimension by presenting AI-powered tools like Greencoin, designed to increase climate awareness and promote sustainable living practices [5].

The security dimension of AI integration has also received considerable attention. Bokhari and Myeong (2023) analyzed the intersection of AI, cybersecurity, and e-governance, identifying how digital solutions can foster secure and transparent governance in smart cities [6]. Similarly, Jhanjhi et al. (2023) introduced AI-based models for cyberattack detection in IoT-driven systems, which are pivotal to the sustainable functioning of smart city environments [7].

©IJRASET: All Rights are Reserved

In the domain of urban energy and the environment, Stecuła, Wolniak, and Grebski (2023) reviewed the transformative role of AI from individual energy usage to societal patterns, while Kapoor et al. (2024) showcased nature-inspired AI techniques for air quality modeling in Indian cities [9][11]. These efforts are crucial for managing real-time data and mitigating urban air pollution—one of the major concerns in densely populated regions. Additional studies, like those by Bainomugisha et al. (2023) and Al-Eidi et al. (2023), have proposed low-cost, AI-supported air quality sensing systems and regression-based predictions to help manage environmental conditions in resource-limited urban areas [12][13].

AI has also played an increasing role in social management systems. Al-Marghilani (2022) proposed AI-based safeguards for online social networks to mitigate cyberbullying in digital urban environments, emphasizing ethical design and user safety [8].

These studies illustrate the diversity of AI applications across the six domains of smart cities: environment, economy, people, governance, mobility, and living. However, the literature also reveals shared concerns such as data governance, algorithmic bias, integration complexity, and ethical oversight. This review seeks to synthesize findings across these domains and provide a clearer understanding of AI's real-world impact and future potential in urban innovation.

III. METHODOLOGY

The research methodology used in this study is a literature review. The authors analyzed papers that were included in the Scoop index. They discovered through a search engine that this database has over 442,000 documents with the phrase "artificial intelligence" and over 30,000 papers indexed with the keyword "smart city" (data from the day of 29 January 2024). The search results are shown in Table 1, and the authors restricted the study to the years 2021–2024. The last three years, from 2021 to 2023, including January 2024 (data from January 29), are the time frame that the writers have chosen. This time frame was selected to guarantee that this review article concentrates on the most current advancements in the nexus between smart city efforts and artificial intelligence. Regarding the quantity of articles that are simultaneously described by the keywords "artificial intelligence" and "smart city," the search revealed that 773 papers have been published since 2021.

Table1.Search results for papers with the given keyword son Scopes.

Keywords	Number of Papers Scopus	Number of Paperssince 2021- Scopus
smart city	**31,785**	**11,327**
Artificial intelligence	**442,077**	**116,373**
smart city artificial intelligence	**1623**	773

A. Smart Environment

The Key Elements of AI Implementation in Smart Environments One of the key components of a smart environment in this context is energy conservation and efficient urban energy use. Numerous research on the effectiveness of energy utilization based on artificial intelligence have been published in the literature.

The study by Li e Al. [105] addresses the problems with energy efficiency in smart cities and suggests a solution utilizing AI and Io T-based smart metering. The suggested Using information from energy efficiency statistics and recurrent neural networks for load forecasting, the system seeks to estimate energy usage in smart cities. To increase overall efficiency, the smart grid's scheduling and energy management must be optimized. However, energy theft is a genuine issue that requires attention.

IV. FUTURE WORK

Although the use of artificial intelligence (AI) in smart city simulation and design is a promising field, there are still a number of uncharted areas that need further research and development. Future research in this area ought to focus on the following areas:

* Simulations with Multiple Scales and Agents
* AI-Powered Urban Planning and Enhancement
* Co-Simulation of AI and Digital Twins
* Designing AI with Ethics and Policy in Mind
* Modeling Human Behavior

No conflicts of interest have been disclosed by the writers. The funder were not involved in the study's design, data collection, analysis, or interpretation, manuscript writing, or the choice to publish the findings.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

V. CONCLUSION

The swift development of artificial intelligence offers smart cities enormous potential to solve urban problems and enhance citizens' quality of life. This study has determined the key uses, implementation challenges, and future paths of AI solutions in the six primary domains of smart cities—smart mobility, smart environment, smart governance, smart living, smart economy, and smart people—by analyzing the literature from 2021 to January 2024.

This study's reliance on peer-reviewed sources and possible linguistic bias favoring English publications are among its research weaknesses. Furthermore, the methodology of this study, which centers on a literature review approach, can restrict the breadth of analysis and the applicability of the results to all smart cities worldwide. The selection of keywords is also linked to a research constraint. Only the fundamental terms "artificial intelligence" and "smart city" have been selected. It is possible to use more specific keywords, for

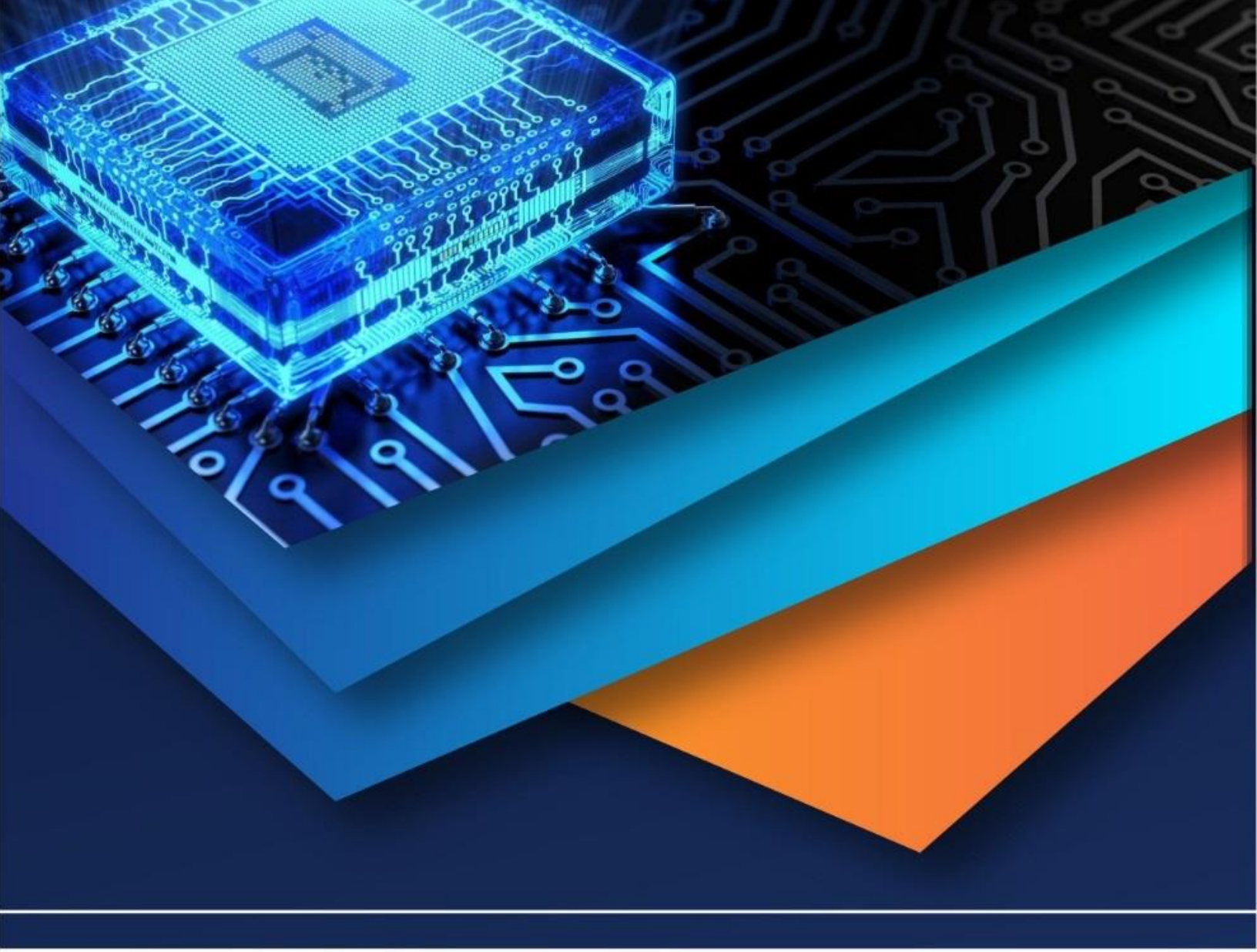
example, “urban AI”, “smart governance AI”, “public safety AI”, etc., in future, more

detailed research.

REFERENCES

[1] The McKinsey International Institute. In 2018, the McKinsey Company published Smart Cities: Digital Solutions for a More Livable Future in New York, USA.
[2] Incentives for the Internet of Things: A survey by Maddikunta, P.K.R., Pham, Q.-V., Nguyen, D.C., Huynh-The, T., Aouedi, O., Yenduri, G., Bhattacharya, S., and Gadekallu, T.R. 206, 103464; J. Netw. Comput. Appl. 2022. [Reference]
[3] Making a Smart City Legible (Pilling, F.; Akmal, H.A.; Lindley, J.; Coulton, P.); Wiley: Hoboken, NJ, USA, 2022
[4] Feher, K. Expectation of smart mentality and citizen participation in technology-driven cities. Smart Struct. Syst. Int. J. 2021, 27, 435–445.
[5] Obracht-Prondzy´ nska, H.; Duda, E.; Anacka, H.; Kowal, J. Greencoin as an AI-Based Solution Shaping Climate Awareness. Int. J. Environ. Res. Public Health 2022, 19, 11183. [CrossRef] [PubMed]
[6] Bokhari, S.A.A.; Myeong, S. Artificial Intelligence's Impact on Cybersecurity and E-Government in Smart Cities: A Stakeholder's Viewpoint. 69783–69797 in IEEE Access 2023, 11. [Reference]
[7] Jhanjhi, N.Z.; Masud, M.; Alqhatani, A.; Prabakar, D.; Sundarrajan, M.; Manikandan, R. IoT-Powered Cyberattack Detection Using Energy Analysis and Artificial Intelligence in a Sustainable Smart City. Sustainability 15, 6031 (2023). [Reference]
[8] Al-Marghilani, A. Cyberbullying-Free Online Social Networks in Smart Cities using Artificial Intelligence. Comput. Intell. Syst. Int. J. 2022, 15, 9. [Reference]
[9] Stecuła, K.; Wolniak, R.; Grebski, W.W. AI-Driven Urban Energy Solutions—From Individuals to Society: A Review.
[10] Subramanian, M. Leveraging Digitalization for Improving Energy Efficiency; Springer: Singapore, 2023. 2023, Energies 16, 7988. [Reference]
Elsevier: Amsterdam, The Netherlands, 2024.
[11] Kapoor, N.R.; Kumar, A.; Kumar, A.; Arora, H.C. Air Quality Modeling for Smart Cities of India by Nature Inspired AI—A Sustainable Approach.
[12] Bainomugisha, E.; Ssematimba, J.; Okure, D. A Distributed Low-Cost Air Quality Sensing System for Urban Environments with Limited Resources: Design Considerations. Atmosphere 14, 354 (2023). [Reference]
[13] Comparative Analysis Study for Air Quality Prediction in Smart Cities Using Regression Techniques, Al-Eidi, S.; Amsaad, F.; Darwish, O.; Tashtoush, Y.; Alqahtani, A.; Niveshitha, N. In 2023, IEEE Access 11, 115140–115149. [Reference]

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)