# Artificial Intelligence in Smart Cities and Urban Mobility: A Systematic Literature Review

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**ABSTRACT** Artificial intelligence (AI) has been pivotal in advancing urban mobility and smart city planning. It offers innovative solutions to address emerging challenges in urban areas. With the global metropolitan population expected to comprise approximately 70% by 2050, the need for efficient, sustainable, and accessible urban mobility systems has become increasingly urgent. This systematic review synthesized 50 peer-reviewed studies from 2015 to 2024 that explore the implementation of AI alongside Internet-of-Things and Information Communication Technology in urban mobility. In particular, it highlights research on real-time traffic signal optimization, predictive algorithms, and intelligent routing systems, which have proven effective in reducing traffic congestion, improving the efficiency of public transportation, and enhancing safety through self-driving vehicles. Key challenges in implementing AI within smart cities and urban mobility include concerns over data privacy and sharing, infrastructure inadequacies, and the digital divide between regions. This systematic review has identified to overcome these obstacles, future research should focus on exploring innovative AI pathways, ensuring equitable access to AI technologies, and strengthening the physical infrastructure necessary to support smart city initiatives worldwide.

**INDEX TERMS**: Intelligent Transport Systems, IoT, Smart Cities, Sustainable Urban Design

## I. INTRODUCTION

AI encompasses a suite of technologies that enable machines and computers to learn, understand reason, make decisions, create, and adapt autonomously. Applications of AI equipped with Vision Intelligence can recognize and identify objects, as well as process human languages in ways that enhance user interaction. According to the estimations, it is projected that about three-quarters of the global population will be located in urban centers by 2050. While some mega-cities have already reached the capability of managing population traffic, humans have to develop smart cities to make these cities more livable and, sustainable [1-3].

A smart city, often referred to as an eco-city or sustainable city, is designed to optimize the quality of urban services while reducing costs [9-10]. The overarching goal is to foster sustainable innovation by integrating technology solutions that address the economic, social, and environmental challenges of future urban living. By doing so, smart cities aim to create a harmonious balance between technological advancement and sustainability [32].

Furthermore, modern smart cities leverage Information and Communication Technologies (ICTs) and the Internet of Things (IoT) to share critical data for efficient resource management and the operation of urban infrastructure [12], [13],[15]. This includes information gathered from both residents and mechanical systems to regulate and enhance traffic and transportation networks, energy distribution, water supply, sewage systems, and other essential services. The World Bank has defined urban mobility as the capacity to move people from one location to another within or between cities.

*"Urban mobility is no longer just about moving people around by motorized vehicles. What people really need is the accessibility to various urban services." - The World Bank, 2015.*

This concept was rooted in two key principles: the need for access to housing, employment, and urban services such as education and leisure; and a reliance on motorized transport due to its cost-effectiveness. However, in recent years, transit agencies and local governments have shifted their perspective on these paradigms. They now recognize that the rise of online services has significantly reduced the necessity for physical travel in many aspects of daily life.

The integration of AI systems into smart city frameworks has transformed urban mobility from a simple transportation concept to a focus on accessibility, sustainability, and efficiency [6-8]. AI's capabilities in real-time data processing, predictive analysis, and automation address the complex challenges of urbanization, including transportation issues, the delivery of affordable services and goods, and the impacts of pollution. As the global urban population is projected to reach approximately 70% by 2050, the incorporation of AI to optimize urban planning and deliver context-aware, innovative, and human-centered mobility solutions is essential for creating sustainable cities of the future [16], [17], [20].

This overall review seeks to address the following Research Questions (RQs).

***RQ1:*** What are the primary AI technologies and frameworks used in smart city development and urban mobility solutions?

***RQ2:*** How do generative AI, machine learning, and deep learning contribute to advancements in urban mobility?

***RQ3:*** What are the main applications of AI in urban mobility, such as traffic management, public transportation, autonomous vehicles, and environmental monitoring?

***RQ4:*** How has AI been integrated with IoT and ICT to enhance urban mobility in smart cities?

***RQ5:*** How do AI-driven urban mobility solutions differ across regions and urban contexts (e.g., developed vs. developing cities)?

***RQ6:*** What are the ethical and social implications of AI-driven urban mobility solutions?

*RQ7:* How can AI-driven urban mobility solutions enhance disaster response and emergency management?

## II. METHODOLOGY

A systematic literature review on Artificial Intelligence in Smart Cities and Urban Mobility requires a well-defined approach and mechanism to ensure the process is thorough, transparent, and reproducible. The methodology is structured as follows:

### A. Search Strategy

The search strategy was designed to identify relevant peer-reviewed articles and publications focusing on the applications of Artificial Intelligence (AI) in smart cities and urban mobility. The following steps were taken:

1. *Databases to retrieve process:*

Searching processes were conducted across multiple academic databases, including mainly IEEE Xplore, SpringerLink, ScienceDirect, etc. Google Scholar was used as the search engine for querying search terms.

2. *Search Terms and Keywords:*

The following keywords and their combinations were used as search terms. Further lexicographically related terms also were used:

- "Artificial Intelligence" AND "Smart Cities"
- "AI" AND "Urban Mobility"
- "Machine Learning" AND "Transportation Systems"
- "Generative AI" AND "Smart City Development"
- "Intelligent Traffic Management"

3. *Search Limits*:

- Publication date: Articles were selected from databases that were published between 2015 and 2024.
- Language: Only English-language articles were considered.
- Document types: Peer-reviewed journal articles, conference papers, and technical reports.

4. *Boolean Operators:*

Boolean operators (AND, OR) were used to refine the search. For example, searches combined terms like "urban mobility" AND "AI" AND "sustainability."

### B. Study Selection

The selection process was conducted in two stages: screening and eligibility assessment.

1. Screening Process

Titles and abstracts of initially selected studies were screened for relevance. Articles unrelated to AI applications in smart cities or urban mobility were excluded.

2. Inclusion Criteria

Studies were included if they:

- Focused on AI applications in smart cities, particularly in the context of urban mobility (e.g., traffic management, autonomous vehicles, public transportation).
- Presented original research, case studies, or significant reviews on AI technologies in urban settings.
- Highlighted challenges, benefits, or case-specific outcomes of AI applications.
- Were published between 2015 and 2024.

Table 1: Search Strategy

| Category | Details |
|---|---|
| Study Details (Metadata on the selected publication) | Title, Authors, Publication Year, Journal/Conference |
| Objectives | AI Applications in urban mobility, and addressing challenges |
| Methodology | Usage of AI techniques, usage of large datasets, evaluation metrics |
| Applications | Traffic Management, Autonomous vehicles, Predictive analytics |
| Findings | Efficiency improvements, Sustainability impacts |
| Challenges | Data privacy concerns, Infrastructure costs |
| Future Directions | Research gaps, Emerging trends |

3. Exclusion Criteria

Studies were excluded if they:

- Focused solely on general smart city topics without emphasizing urban mobility.
- Discussed AI applications unrelated to urban environments (e.g., healthcare, manufacturing).
- Editorials, opinion pieces, or non-peer-reviewed articles were excluded.
- Articles not available in the English language were excluded.

### C. Data Extraction

A structured data extraction process was used to ensure consistency and completeness. The following details were extracted from each selected study:

## III. RESULT AND DISCUSSION

The findings of the finalized studies are then discussed in the results section to gain an understanding of AI use in smart cities and intelligent mobility.
This review of the literature comprised 50 articles published between 2015 and 2024.

- Forming and applying artificial intelligence methods regarding traffic control.
- Adoption of artificial intelligence in self-driven vehicles and efficient transport system organizations
- Pervasive uses of AI in planning urban mobility studies to provide insights into the application of Artificial Intelligence (AI) in smart cities and urban mobility.

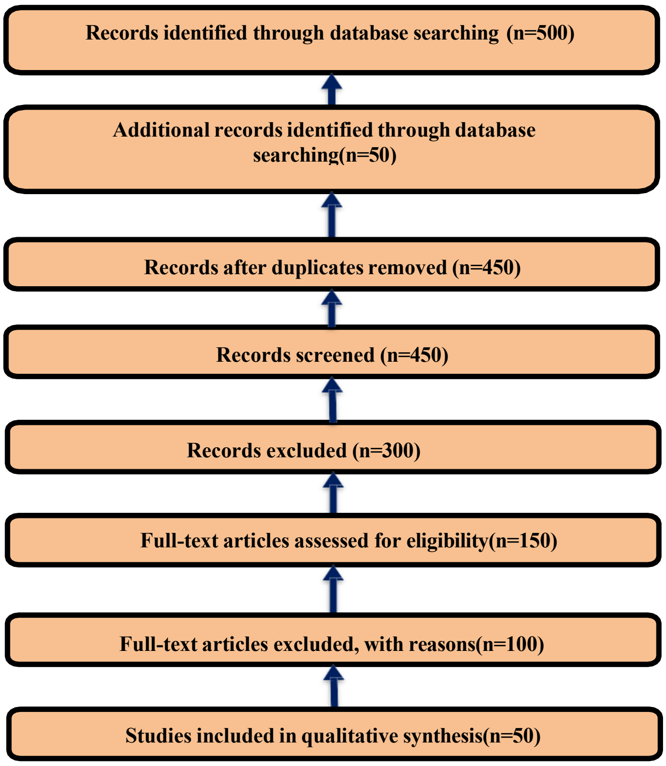


Figure 1: Prisma Diagram for Data Extraction

**RQ1: What are the primary AI technologies and frameworks used in smart city development and urban mobility solutions?**

1. Machine Learning (ML): Extensively used in traffic flow prediction, outliers' detection, and demand prediction in urban transportation. That includes decision trees, Support Vector Machine or SVM, and random forests [5],[34].
2. Deep Learning (DL): Applied for heavy computing tasks including recognizing moving car images from traffic CCTV stream by using a deep learning model, CNNs, or for managing and maintaining the best route as per changing traffic patterns by using another type of neural nets, RNNs [18].
3. Generative AI: Rising as a powerful tool for representing urban samples, developing traffic patterns, and creating realistic synthetic data to train existing models [22],[26], [27], [49].
4. Reinforcement Learning (RL): Used for adaptive traffic signal controls to enhance transport along constantly changing roads and to help driverless cars navigate through urban environments [14].

**RQ2: How do generative AI, machine learning, and deep learning contribute to advancements in urban mobility?**

1. Generative AI:
- Scenario Modeling: Allowed city planners to foresee the effects when adjusting concrete constructions.
- Synthetic Data Generation: Overcome the problem of data deficit by creating more quality data for model learning particularly in the case of self- driving cars.
- Advanced demand for the public transportation systems through changing timetables based on passengers' needs and requirements.
- Management of electricity usage in mobility systems to optimize the energy efficiency of mobility systems [42].
- Made great strides in real-time traffic monitoring through the use of video analytics on stream feeds and associating such data with Internet-of-Thing's sensors.
- Assisted self-driving systems through the handling of information from various modalities, including vision, radar, and lidar [21], [23],[25].

2. Machine Learning:
- Improved public transportation systems by forecasting passenger demand and adjusting schedules dynamically [11].
- Enhanced energy efficiency in mobility systems by predicting and managing electricity usage [4].

3. Deep Learning:
- Achieved significant advancements in real-time traffic monitoring by analyzing video feeds and integrating data from IoT sensors.
- Supported autonomous driving systems by processing multimodal data (e.g., vision, radar, and lidar) [28], [29].

**RQ3: What are the main applications of AI in urban mobility, such as traffic management, public transportation, autonomous vehicles, and environmental monitoring?**

1. Traffic Management: About real-time traffic signal optimization, they had decreased the average travel time by 20-30%. Until Intelligent routing systems reduced traffic density in virtual heavily populated areas. Intelligent routing systems minimized congestion in densely populated areas [30], [31].
2. Public Transportation: About AI efficiency and effectiveness, AI-powered scheduling is said to have raised on-time performance by a quarter in pilots. Optimization of routes, and vehicle dispatch enhanced through the use of predictive models. Predictive models improved route planning and vehicle allocation [37-39].
3. Autonomous Vehicles: AI capability-based systems attained a twenty percent decrease in accident rates in urban environments for testing. Improved navigation and safe driving are supported by the identification of real-time objects and decisions made by the developed algorithms [40].
4. Environmental Monitoring: AI applications for air pollution monitoring and reduction were effective, getting a 15% increase in the identification of air pollution hotspots. With the connection to the IoT networks, it offered detailed environmental information that supports the formulation of urban development strategies.

**RQ4: How has AI been integrated with IoT and ICT to enhance urban mobility in smart cities?**

1. IoT Integration: Traffic, environmental, and weather data was being gathered by smart sensors and devices. The real-life applications of IoT-connected AI systems included the offering of data-driven advice, for instance, intelligent traffic signal systems [46].
2. ICT Integration: Big Data solutions in the clouds handled large flows of urban mobility information for the following predictions. Mobile applications represented personal recommendations on the route and means of transportation using Artificial Intelligence [3],[49], [50].
3. Collaborative Systems: AI, IoT, and ICT improved communication between vehicles, pedestrians, and parts of the city such as smart crosswalks, and V2X. [1], [32]

**RQ5: How do AI-driven urban mobility solutions differ across regions and urban contexts (e.g., developed vs. developing cities)?**

1. Developed Cities: Concerned with the latest trends such as automatically operated automobiles and AI systems in transportation [11],[24]. Due to the significant IoT implementation, activities like data collection and analysis in a real-time environment became possible. There is a high use of AI mobility applications among urban dwellers.
2. Developing Cities: The most popular purpose of implementing AI was concerned with finding solutions that would create cost savings, for instance with further developments of existing forms of public transport and the avoidance of traffic congestion [13], [20], [38].

   Relatively low development in this area as well as the lack of infrastructure weakened the implementation of better deep AI. The AI efforts were used for addressing particular problems, such as air contamination tracking or increasing safety on overcrowded streets.

**RQ6: What are the ethical and social implications of AI-driven urban mobility solutions?**

Ethical and Social Considerations in AI-Driven Urban Mobility The introduction of Artificial Intelligence for urban transport creates multiple ethical and social issues which require specific solutions to develop fair and sustainable urban systems.

1. Data privacy and Security: AI-driven transportation system acquire their information through real-time monitoring of surveillance cameras and GPS tracking and smart sensors. Personal data safety along with protection against unauthorized access stands as a vital requirement. The security of user privacy demands both stringent rules and protection aimed at minimizing data security breaches. AI models face challenges regarding bias alongside

2. Achieving bias practices in their functioning. Different income levels create barriers that lead AI solutions to provide better services to resourceful areas while abandoning underserved populations. The public requires full visibility into AI decision systems to prevent discriminatory practices from occurring in transportation management networks

3. Impact on Employment and Workforce

   Self-driving vehicles and AI-based public transport scheduling systems in transport systems pose job risk to drivers and transportation personnel. Social groups including both governments and industries need to launch training programs which will enable jobs transfer possibilities between existing and emerging mobility industry functions.

4. Public Trust and Acceptance

   AI-driven mobility solutions will succeed only after the public develops trust in this particular technology. Approaches solving ethical matters about AI monitoring and administrative control systems must be developed to gain trust from urban citizens about their safety and security.

**RQ7: How can AI-driven urban mobility solutions enhance disaster response and emergency management?**

AI-driven urban mobility significantly improves the efficiency and effectiveness of disaster response by optimizing emergency transportation, predicting risks and quick resource allocation.

1. Real-Time Traffic Management for Emergency Vehicles: An intelligent traffic system with AI capabilities checks emergency vehicles first by manipulating signal control systems and finding the best routes for firefighters and ambulances together with police vehicles. First responders can use dynamic AI-based route optimization to find clear routes that let them reach their destination zones without delay.

2. Disaster Prediction and Risk Assessment: By processing historical disaster data together with weather observation data alongside real-time sensor information AI models forecast future natural catastrophes like floods hurricanes and earthquakes. Through predictive analysis emergency authorities are able to initiate strategic actions which involve warning vulnerable areas followed by early emergency service deployments.

3. Autonomous Drones and Robotics for Search and Rescue: AI drones when deployed in disaster areas can automatically identify affected regions as well as detect survivor positions through their search capabilities and simultaneously distribute emergency rescue materials. Rescue operations receive aid from autonomous robots which use AI technology to complete tasks especially in challenging or dangerous access areas.

4. Crowdsourced and IoT-Enabled Emergency Communication: AI-powered systems analyze information collected from mobile devices in addition to social media and IoT sensors which generates immediate reports about damage areas and damaged infrastructure. Machine learning systems evaluate emergency telephonies together with social media alert systems to locate essential distress areas for emergency intervention.

5. Smart Public Transportation for Evacuation Planning: Disasters require the use of Artificial Intelligence to enhance public transportation operations by utilizing its ability to optimize stops of buses and trains and ride-sharing links to promote evacuation activities. Predictive models generate safe route evacuations which lead transportation resources to proper allocations.

This review examines the role of AI in enhancing urban mobility and advancing smart city initiatives. It highlights the diversity and adaptability of AI technologies, the specific challenges encountered in implementing AI solutions, and the disparities between developed and developing cities. By addressing these research questions, the study provides a comprehensive understanding of AI and its applications in the context of urban development.

Due to the various types of environmental and maintenance issues, hydropower generation in Sri Lanka has been going down seriously since the 1990s [24]. As a result, the Sri Lankan government has taken different steps. For example, electricity generation has transitioned to mixed hydro-thermal [20], [21].

As a result, the electricity generation of the country has transitioned to mixed hydro-thermal since 1998[20], [21]. In our work, annual power demand data from 2000 to 2022 is investigated. The observations were made from 2000 -2019 and are used for model fitting and 2020-2022 reserved ex-post testing

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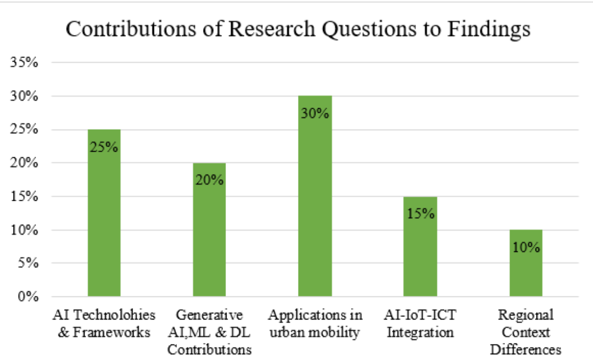


Figure 2: Contributions of Research Questions

## IV. DISCUSSION

The discussion section recapitulates and analyzes the results of this Systematics Review, focusing on major conclusions, managerial implications, and research prospects for AI in smart cities and urban mobility.

### A. AI's Transformative Potential in Urban Mobility

The current study analysis supports AI's essential function in transforming the landscape of travel in cities. In areas like real-time traffic monitoring, autonomous vehicle navigation, and self-driving cars, there are AI technologies including Machine learning, deep learning, and generative AI have proven significant enhancements in terms of efficacy, safety, and sustainability. Specifically:

- Traffic Management: Machine learning for adaptive traffic light timings, automatic route guidance, and other intelligent controls has been found highly effective in terms of minimizing congestion and average travel speeds even in large and growing urban centers in the developed and the developing world [19], [24], [35].
- Public Transportation: The use of technology to forecast demands and schedule further avails the service has improved the commuting experience by making the services more reliable.
- Autonomous Vehicles: Essential to deep learning technology self-driving cars can prevent accidents and improve driving in cities [33], [36].
- Environmental Monitoring: AI has also enhanced the identification of areas of increased pollution, making cities employ the correct measures to deal with the issue [41], [43-45], [47], [48].

  These developments imply that AI is capable of handling challenges within urban mobility systems to increase scalability and flexibility and that is in the light of growing urbanization.

### B. Integration of AI, IoT, and ICT

A combination of AI, IoT, and ICT has stepped up the capacity of mobility systems in urban centers. AI with IoT and cloud ICT platforms for processing have facilitated the move of data as a medium in a feedback loop between human-constructed infrastructures.

- Smart IoT sensors with an AI interface have made adaptive traffic control systems better [15], [38],[46].
- Public transport: ICT platforms enabled the application of artificial intelligence through the development of applications that provide users and preferred routes as well as real-time updates [11], [19], [24].

However, the potential of integration of these two sectors remains partially unlocked in developing cities, the main reason being infrastructural limitations that exist.

Regional Disparities in AI Applications

A notable finding is the disparity in AI adoption between developed and developing cities:

- Developed Cities: These regions boast strong infrastructure, and they can develop new- generation AI applications such as self-driving cars and smart transportation [5], [9], [10].
- Developing Cities: These areas focus on the rationalization of tools including existing effective public transport, and solutions to sensitive problems including road safety and pollution.

They show the importance of having specific regional AI solutions so that everyone can benefit from innovations in urban mobility.

Challenges in Implementation

Despite its potential, several challenges hinder AI's broader adoption in urban mobility:

- Data Privacy and Security: What they fail to consider is that information needs to be processed and generated in real-time, a factor that increases the risk of hacking into the personal details of users that may be submitted to the sites [49].
- Infrastructure and Cost Barriers: Many emerging cities struggle to establish the necessary fundamentals of IoT empowered AI frameworks.
- Algorithmic Bias: Prejudice in the algorithms affects the probability of discriminated against people, especially when the

AI is designed for many people in urban areas. To make sure that AI-enabled mobility is fair and ethical, these challenges need to be met to support the reliable and fair applications of AI systems to solve urban mobility problems.

### C. Research Gaps and Future Directions

This review identifies several areas for further research and innovation:

- Generative AI in Scenario Planning: While the potential of using generative AI for planning urban mobility is high, its implementation has current limitations and should be researched more.

- AI for Multimodal Mobility: It is worth studying further the AI systems used in the context of multimodal transportation that is when individuals use bicycles, buses, and/or trains [17], [25], [40].
- Sustainability Metrics: Future studies should be directed toward developing a clearer measure of the environmental cost of AI-enabled mobility schemes.
- Scalability for Developing Cities: This is to call on more research in identifying affordable, large- scale AI applications that would best fit developing cities in terms of physical infrastructure [28], [29].

### D. Practical Implications

The findings have practical implications for policymakers, urban planners, and AI developers:

- Therefore, it should be recommended that policymakers focus on the development of AI and IoT, especially in areas, which are characterized by high levels of urbanization.
- AI-based predictive solutions can be useful to urban planners for efficient resource management, and decision-making mechanisms.
- AI developers should emphasize the development of programmable and regional that contemplate the infrastructure availability problems also with the ethical aspects.

## V. CONCLUSION

This review study aimed to observe the integration of AI-related concepts, technologies, and tools for urban development with the smart city concept in the modern era. The study comprised 50 research articles from reputed research databases. The study identified the usage of different technologies for Machine Learning, Deep Learning, IoT, Cloud Computing, and other computing approaches for smart city development while reducing vehicle traffic, protecting environmental aesthetics, automated vehicles, and other measures for urban development. This study has brought significant contributions to modern society by obtaining new knowledge to integrate AI-related technologies for the smart city concept.

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