# A Study On Artificial Intelligence In Smart Cities For On-Demand Vehicle Automation Systems

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**Abstract**

Urban planning is becoming much easier and more familiar because to ai. Those who reside in cities are more likely to be prepared for future problems and to stay up with the newest innovations in problem-solving strategies compared to those who live in rural areas. Experts anticipate that by the year 2050, metropolitan areas will be home to the vast majority of the global population. Ensuring that public transport systems in metropolitan areas are not only reliable but also safe and easy to use is crucial. Fifty research publications on urban mobility considering ai, the iot, and communication and information technologies make up this review. In these pieces, we zero in on how these three disciplines meet. The articles were published in a variety of journals between 2015 and 2024. Two of the most crucial considerations in selecting the papers were the presentation's clarity and the presenter's energy. Intelligent routing systems, prediction algorithms, and real-time traffic signal optimisation are the main focusses of this group's research. The widespread use of autonomous vehicles has the potential to improve public transportation, lessen traffic congestion, and raise road safety standards. Not only that, but this is demonstrated by a plethora of additional criteria that are not limited to those already mentioned. In order to address many problems, it is crucial to apply ai to smart cities and urban transportation. Issues such as the digital divide across nations are examples of what this topic encompasses.

***Keywords:*** artificial intelligence, smart cities, intelligent transportation systems, autonomous vehicles, smart infrastructure.

## 1. Introduction

The term "artificial intelligence" (ai) refers to abilities that enable robots to do tasks such as learning, reasoning, making decisions, creating things, and improving their performance. In its abbreviated form, "artificial intelligence" is abbreviated as "ai." together, artificial intelligence and virtual intelligence collaborate to comprehend human languages, which significantly improves communication, as well as to locate and organise things in the environment (le et al., 2024). The majority of the world's population is expected to reside in urban areas by the year 2050, according to the predictions of scientists. In spite of the fact that certain megacities have already discovered solutions to the problem of heavy traffic, the construction of smart cities is essential if these cities are going to become more liveable and sustainable in the future. Megacities contribute to the longevity of their cities by taking this course of action. The transportation industry has evolved as a result of the ability of artificial intelligence to improve the performance of several systems. New innovations in the transport sector have made things far more efficient. Additionally, the researchers have achieved advancements in areas such as self-driving cars, predictive modelling, data processing and analysis, customised routes, and traffic optimisation and simulation. By utilising this technology, traffic management systems can identify patterns, forecast future traffic, and exercise control over traffic in the most effective manner possible. It's possible that the data that machine learning algorithms examine comes from a wide variety of sources and encompasses a tremendous deal of territory. Over the course of the past several years, there has been a significant amount of change in the field of artificial intelligence. The result makes it possible for self-driving automobiles to instantly perceive their surroundings, determine what is going on, and respond appropriately. With the use of artificial intelligence, the researchers are now able to create traffic simulation models

that are very similar to the way traffic actually moves. There is a possibility that this cutting-edge technology will make it simpler to test and develop systems that monitor and control traffic. Ai is playing a significant role in the rapid expansion of the transportation industry, which is seeing rapid growth. There are several challenges that intelligent transportation systems (its) must overcome, including the fact that they are overly complicated, that they are not widely used, and that they must evaluate data in real time. There are several factors that contribute to these issues, including real-time processing, data security, privacy concerns, expensive computer expenses, and potential security hazards. Consideration of this matter is required of the researcher. Although artificial intelligence algorithms have access to a large amount of important data, it is possible that they will still struggle to precisely estimate when buses will arrive in real time. It was the bus schedule, which is notorious for being rather unstable, that was to blame for this catastrophe. When there are limited resources available, it may be difficult to implement algorithms that run rapidly, which is required for real-time processing. Due to the fact that ai creates concerns regarding privacy, public acceptance, and security, it is necessary to implement stringent security measures and clarify the regulations that govern the use of data. The reason for the delay is that it makes things more difficult in certain places. There are many issues that have arisen as a result of urbanisation, but artificial intelligence has the potential to assist with each one. It is possible to use it for a wide variety of purposes, including the automation of operations, the creation of forecasts, and the analysis of data in real time. There are many issues that need to be resolved, such as pollution, transportation, and the dearth of goods and services that are within reasonable price ranges. These experts predict that by 2050, the majority of the world's population will live in urban areas. To arrive at this prediction, the data that was used came from surveys to gather popular opinion. Ai has the potential to improve public transport and planning alternatives, thereby contributing to the sustainability of urban areas (mohsen, 2024).

## 2. Background of the study

The article "artificial intelligence in smart cities for on-demand vehicle automatic systems" analyses the different ways ai can assist smart transportation networks. This page provides background information that will be useful for the next investigation. The rapid development of urban populations is exacerbating issues like traffic and inefficient mobility, which these solutions are helping to address. Smart cities may become safer and more welcoming places to live by leveraging ai and ml. Possibilities include dynamic routing, managing traffic congestion, and deploying self-driving automobiles (jagatheesaperumal et al., 2024). Only by placing a premium on people's privacy, constructing the required infrastructure, and making these technologies accessible to everybody will future cities be able to succeed economically and sustainably. The creation of "smart cities" that solve urban problems by combining data with smart technology is a crucial step in the development of ai. In light of the challenges that urban areas face, the concept of "smart cities" has emerged. With the population growing at an alarming rate, the city's transit networks are finding it increasingly difficult to keep up. Their persistence simply adds to the strain on transport networks, which are already strained to their breaking point. Congestion, environmental deterioration, poor living conditions, and resource misallocation are just a few of the many modern-day complaints levelled against urban areas. The idea of "smart cities" has emerged as a benchmark for city development due to these worries. The use of cutting-edge electronic technology is central to "smart city" initiatives, which seek to enhance city services, infrastructure, and residents' standard of living (rosca et al., 2024).

## 3. Purpose of the research

The primary objective of research on artificial intelligence (ai) for smart cities and on-demand vehicle systems is to improve these systems to make them more considerate of the environment, safer for drivers and passengers alike, and more efficient overall. This is the most important goal that the research aims to accomplish. It is now much simpler for autonomous fleets to work together as a consequence of the capabilities of artificial intelligence, which include the ability to anticipate demand, make adjustments to routes in real time, coordinate cars, manage traffic signals, and several other duties. By utilising data that is gathered in real time, these possibilities are made possible. The researchers are putting all of the efforts into improving the overall experience that the researchers provide for the consumers while simultaneously minimising the adverse effects that the researchers have on the community and the environment.

## 4. Literature review

An incredible amount of growth is taking place in the automotive industry globally, even though the need for transportation services is enormous. The world health organisation (who) conducted research on road safety and found that car accidents will be the leading cause of death worldwide by 2030. Numerous companies working on smart city projects face difficulties in managing traffic within their communities (gheorghe & soica, 2025). They are focusing their efforts on making the trip time as short as possible because of this. Not only that, but they also want to reduce the frequency and severity of accidents—two of the biggest issues with itss—by providing safer roadways. The vast majority of these experiments centre on one thing: creating scenarios for intelligent traffic control that can physically move cars around to clear up congestion. An internet-based solution to the issue of human involvement in vehicle ad hoc networks (vanets) is possible through the connection of sensors and physical remote access devices to a network of vehicles. Perhaps a solution can be found here. This problem is made more difficult to solve because vanet nodes move around quite a bit. One potential way to fix this is to link the car network with the sensors and remote access devices. To illustrate this point, consider machine learning, which makes use of artificial intelligence. An enormous improvement would be made to vehicle management with the help of intelligent systems that can learn from previous data and make decisions autonomously, without requiring explicit programming or human input. A method like this would have significant benefits (cirianni et al., 2023).

## 5. Research question

- What is the impact of data availability on vehicle automatic systems for smart cities?

## 6. Research methodology

### 6.1 Research design:

The data was quantitatively evaluated using spss version 25. The researchers utilised the odds ratio and the 95% confidence interval to assess the magnitude and direction of the statistical link. The researchers determined a statistically significant criterion at $p < 0.05$. A comprehensive analysis elucidated the fundamental characteristics of the data. Data obtained

from surveys, polls, and questionnaires, as well as data examined through computing tools for statistical assessment, are often assessed using quantitative methods.

**6.2 sampling:**

Research participants filled out questionnaires to provide data for the study. Employing the rao-soft technique, researchers determined that the study included 657 participants. Researchers distributed 896 questionnaires to the public. The researchers received 823 responses, discarding 45 for incompleteness, resulting in a final sample size of 778.

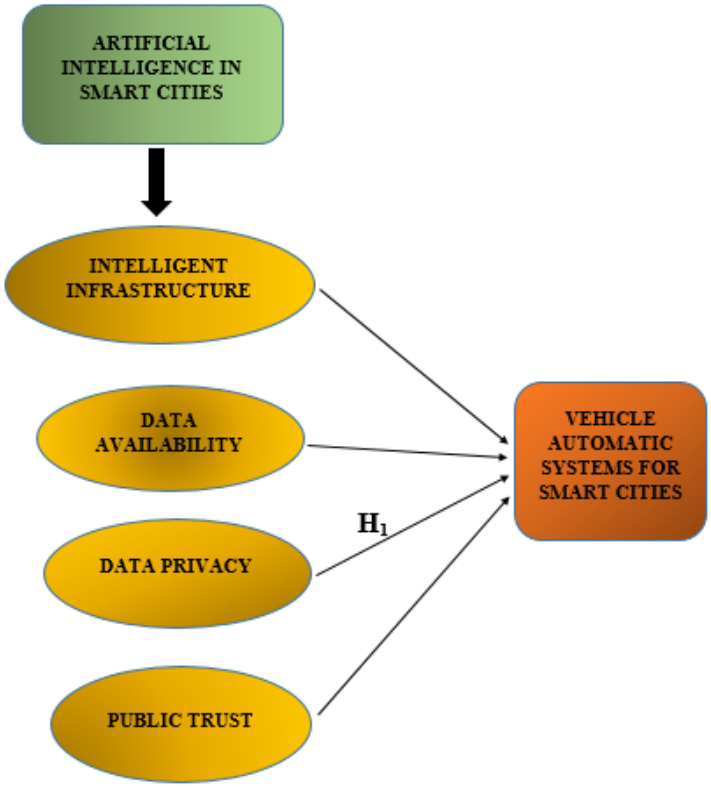
**6.3 Data and measurement:**

The research predominantly utilised data obtained from a questionnaire survey. The participant's fundamental demographic information was solicited first. Participants were then provided with a 5-point likert scale to assess the online and offline channels. The researchers meticulously examined several resources, particularly online databases, for this secondary data collection.

**6.4 statistical software:** the statistical study was performed utilising spss 25 and microsoft excel.

**6.5 statistical tools:** descriptive analysis enabled the understanding of the essential attributes of the data. The researcher must conduct a data analysis utilising anova.

## 7. Conceptual framework



## 8. Results

- **Factor analysis**

Exploring visible data for hidden variables is a common use of factor analysis (fa). Using regression coefficients for evaluations is normal procedure when there are no clear visual or diagnostic clues. Models are crucial for success in fa. One of the main goals of modelling is to identify mistakes, intrusions, and obvious connections. One way to evaluate datasets that come from regression investigations is the kaiser-meyer-olkin (kmo) test. There is confirmation that the model and the variables in the sample are representative. According to the statistics, the data shows that there is duplication. The data is made more understandable by reducing the proportions. The output of the kmo can be anything from 0 to 1. Appropriate sample size is indicated by a kmo value ranging from 0.8 to 1. According to kaiser, these levels are considered permissible: here are the following approval requirements that kaiser has established:

A pitiful 0.050 to 0.059, below average 0.60 to 0.69

Middle grades often fall within the range of 0.70-0.79.

With a quality point score ranging from 0.80 to 0.89.

They marvel at the range of 0.90 to 1.00.

Table1: kmo and bartlett's test

Testing for kmo and bartlett's

Sampling adequacy measured by kaiser-meyer-olkin .974

The results of bartlett's test of sphericity are as follows: approx. Chi-square

Df=190

Sig.=.000

This substantiates the assertions regarding sampling. The researchers evaluated the correlation matrices for significance using bartlett's test of sphericity. The kaiser-meyer-olkin measure indicates a result of 0.974, suggesting the sample is suitable. Upon conducting bartlett's sphericity test, the p-value is determined to be 0.00. If this correlation matrix fails bartlett's sphericity test, it cannot be regarded as an identity matrix.

**Table: KMO and Bartlett's Test**

| KMO and Bartlett's Test[a] | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .974 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 6850.175 |
| | df | 190 |
| | Sig. | .000 |
| a. Based on correlations | | |

Bartlett's test of sphericity provided additional evidence that the correlation matrices were significant. A sample adequacy measure of 0.974 was used by kaiser-meyer-olkin. By

employing bartlett's sphericity test, the researchers were able to attain a p-value of 0.00. Strong enough findings from the bartlett sphericity test to cast doubt on the correlation matrix.

❖ **Independent variable**

- **Artificial intelligence in smart cities:**

There has been an increase in public safety as a result of the capability of artificial intelligence to efficiently disseminate notifications and safety measures. The combination of local artificial intelligence with remote computers allows communities to maintain a close check on potential dangers, issues pertaining to public safety, natural disasters, and odd behaviour. The living conditions of individuals who reside in a "smart city" are improved in a variety of ways, including but not limited to the following: health, accessibility, productivity, and environmental literacy (chen et al., 2024). The infrastructure, services, and administration of a complete city can all be improved with the assistance of artificial intelligence, which can help achieve this objective. If smart cities are going to reach their full potential, artificial intelligence is going to be highly crucial. Research and development in artificial intelligence could result in improved public transportation systems, more efficient use of natural resources, greater living standards, stronger economies, and increased personal liberty for individuals. A better public transit system, reduced congestion, and smoother traffic flows could be the result of applying artificial intelligence to transportation and traffic management. Eventually, these modifications ought to result in a lower consumption of fuel and a lower level of air pollution. Data-driven decision-making is a significant aspect of statistical analysis and predictive modelling. Ai is able to sift through vast volumes of data, identify trends, and make the most efficient use of resources, which is why this transformation is taking place with it. In the long run, the incorporation of all of these elements will enhance the strength of smart cities (kannammal & chandia, 2023).

❖ **Factor**

- **Data privacy:**

"data privacy" refers to the degree to which an individual is able to exercise control over who obtains, stores, uses, and spreads their personal information. The process of putting measures in place to prevent unauthorised access, maintain data that is accurate and complete, adhere to privacy standards, and allow individuals to govern their own data is included in the definition of data security (khaleel et al., 2025). For the sake of brevity, data privacy refers to the right of individuals to decide when, how, and to what extent their personal information is disclosed to third parties. The researchers name, address, phone number, email address, and behaviours, both online and offline, are all examples of personally identifiable information. Similar to how someone might want to exclude certain individuals from a private chat, many people who use the internet have the desire to manage or avoid the acquisition of certain forms of personal data. As more individuals use the internet, the significance of protecting the privacy of their data has increased. There are a lot of online services that require their users to provide certain personal information in order for them to function properly. It's possible that consumers will feel less private than they thought they did if they use apps and platforms that collect and use more data than most people anticipate. If other programs and platforms don't protect the data they collect, user privacy may be at risk. It is a fundamental human right, and as such, many nations have enacted laws to safeguard the right of individuals to privacy. Due to the fact that individuals need to be aware that their personal information will be handled with care before they are ready to use the internet, data privacy is very vital. Businesses demonstrate to their users and customers that they are trustworthy with their sensitive information by taking measures to protect the data contained within their systems (kubik, 2023).

❖ **Dependent variable**

- **Vehicle automatic systems for smart cities:**

Although designed with a human driver in mind, a fully autonomous vehicle is capable of handling all aspects of driving alone. Different automakers may place different features in the automobiles they produce depending on how such features will help everyday drivers. It is possible to classify automated systems into four main types: fixed, programmable, integrative, and adaptive. The following paragraphs will discuss distinct types and their respective advantages. There are many driver assistance technologies that automated systems can include, including adaptive cruise control, lane positioning, parking assist, and traffic jam help. This underscores the need for drivers to remain vigilant for potential hazards and remain prepared to respond promptly (luxshi et al., 2025). Intelligent vehicular automation aims to optimise vehicle management and security. Furthermore, it has the potential to make the pilot more adept at controlling the vehicle. Before the researchers can widely implement the driving direction system in future vehicles, the researchers must resolve a number of concerns. Current theoretical and experimental endeavours to tackle vehicle control issues are regarded as cutting-edge. Sensor issues exacerbate the many problems with driver assistance systems. Technological breakthroughs have solved many of the issues with sensor-driven automobiles' high failure rate in the past. An in-depth understanding of the various human variables involved is essential for everyone driving an autonomous vehicle. Automation in smart cars is possible because of technologies that combine electrical and multi-agent systems (alahi et al., 2023).

- **Relationship between data privacy and vehicle automatic systems for smart cities**

Autonomous vehicles require a substantial quantity of data to work properly, which is one of the reasons why people are particularly concerned about the possibility of data exploitation and privacy issues. Consequently, the protection of the private information of individuals is becoming an increasingly critical concern in smart cities that make use of technology that is autonomous (mohsen, 2024). Through the collection of data, autonomous vehicles (avs) will, in theory, make travelling on highways safer and more convenient. This data, on the other hand, has the potential to reveal sensitive information that individuals would rather keep private. When it comes to the creation and implementation of smart city vehicle automation systems, the protection of data confidentiality is an incredibly important factor that must be taken into consideration. The basis of the issue is the massive amounts of data that these systems absorb, process, and then send out into the world. The most recent on-demand and self-driving cars are equipped with cutting-edge sensors, cameras, gps, and machine learning algorithms, which allow them to collect information in real time about pedestrians, roads, traffic, and municipal infrastructure. Despite the fact that the publication of this data raises legitimate issues regarding privacy, it may also lead to the improvement of mobility services, the reduction of routes, and the facilitation of effective traffic control. According to the point of view, the technology that enables self-driving cars and the technology that protects data privacy are two sides of the same coin. In order to ensure the success of autonomous transportation, it is necessary for us to gather a substantial amount of valuable information. If this information fell into the wrong hands, people might stop trusting the government or be spied on. Due to the fact that mobility is connected with other systems, such as the iot, cloud computing, and smart infrastructure, smart cities are more likely to have data vulnerabilities. This is the reason why this is the case. Many people in the region are concerned about privacy issues because self-driving cars collect data from passengers and upload it to city-wide platforms. A significant number of individuals are concerned that the practice would constitute an invasion of their privacy. The system will need

to be built from the ground up in order for the researcher to be able to implement security features that guarantee ethical leadership, data protection, and compliance with government regulations. In light of the fact that autonomous vehicles have the potential to violate fundamental civil rights, it is of the utmost importance to find a middle ground between privacy, ingenuity, and efficiency (rosca et al., 2024).

Following the aforementioned dispute, the researcher posited the subsequent hypothesis to assess the correlation between data privacy and vehicle automatic systems for smart cities.

***"$h_{01}$: there is no significant relationship between data privacy and vehicle automatic systems for smart cities."***
***"$h_1$: there is a significant relationship between data privacy and vehicle automatic systems for smart cities."***

**Table 2: $H_1$ ANOVA Test**

| ANOVA | | | | | |
|---|---|---|---|---|---|
| **Sum** | | | | | |
| | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
| **Between Groups** | 39588.620 | 286 | 5675.537 | 1061.642 | .000 |
| **Within Groups** | 492.770 | 491 | 5.346 | | |
| **Total** | 40081.390 | 777 | | | |

This study produces significant findings. The f value is 1061.642, achieving significance with a p-value of .000, which is below the .05 alpha level. This indicates the, ***"$h_1$: there is a significant relationship between data privacy and vehicle automatic systems for smart cities."*** Is accepted and the null hypothesis is rejected.

## 9. Discussion

In order to make the world a better place for future generations, ethical artificial intelligence systems aim to make it simpler for everyone to obtain information and resources. Important people and government leaders need to be able to convince more people to accept artificial intelligence in order for society and the economy to have a secure future. Healthcare, pollution, energy consumption, safety, and security are only a few of the major issues that plague modern towns. These urban areas are also confronted with a great deal of additional challenges. Before beginning their data collection on artificial intelligence technologies and the primary applications of these technologies in smart city settings, the researchers first conducted a comprehensive assessment of the relevant literature. Smart cities differentiate themselves from traditional cities by utilising a wide variety of artificial intelligence technology. The term "intelligent mobility" refers to a subfield of artificial intelligence that is working to improve public transportation and eliminate carpooling. Among the many essential parts of intelligent transport systems are state-of-the-art traffic control systems and autonomous vehicles. Programs for a smarter environment can track pollution levels in the air and water, streamline garbage collection, and encourage long-term viability through less waste and increased efficiency. To fulfil the requirements of the people, to hasten the process of decision-making, and to simplify the procedures of the government are all objectives of smart governance. Virtual assistants that are driven by artificial intelligence and that can aid individuals in communicating with their elected officials are a good example of this trend. Ai is utilised in

smart economy initiatives for a variety of purposes, including but not limited to the following: predicting changes in the economy, customising marketing campaigns, identifying opportunities for employment, and fostering inventive thought. To make life better, safer, and healthier for everyone, digital efforts, telemedicine solutions, and artificial intelligence work together to accomplish this goal. It is possible for smart people's initiatives to assist with urban regeneration efforts. These initiatives provide residents with the information, skills, and resources they require. Members of the community or educational organisations frequently carry out programmes that emphasise the need for digital literacy.

## 10. conclusion

Cities are rapidly adapting to these new and innovative communication methods. Several pneumatic tubes can detect variations in the vehicle's internal pressure while it's close by. Traffic reports now routinely incorporate these expressions, along with metrics such as average speed and vehicle counts. A rising number of people are using video cameras that detect radio-frequency identification (rfid) to learn about traffic. To acquire more accurate data about traffic flow, the network architecture meticulously incorporates the use of video cameras. Mobile apps, conventional road signs, and radio broadcasts are among the various methods used for data collection and organisation. In essence, these unique city grants aim to increase youth literacy rates and acknowledge their significant contributions through the various components of the smart society project, providing them with a wealth of information. Over the coming decade, the researchers will hear a lot about autonomous vehicle control systems, especially when connected, computer-controlled vehicles can perform all of these tasks. It is necessary to collect a large amount of communication-related data before developing the network flow model, which will assist with space control and administration. Smart communities may soon be a reality, thanks to the fast development of ai. Smart cities have the potential to improve city people' quality of life by addressing issues that are common to urban areas. Smart citizens, smart environments, smart mobility, smart administration, and smart lifestyles are the six primary types of smart cities that this study mainly explores. The study was successful in its aims of identifying the most pressing ai solution needs, the challenges these solutions encounter in practice, and the potential future routes they may take. The time frame of the literature review was 2021–2024.

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