A LOOK INTO ARTIFICIAL INTELLIGENCE IN SMART CITIES FOR ON-DEMAND VEHICLE AUTONOMOUS SYSTEMS.

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ABSTRACT

Artificial intelligence has made the process of city planning considerably easier and more familiar. Compared to people living in rural areas, city dwellers are far more likely to learn about innovative problem-solving techniques and anticipate potential future difficulties. By 2050, experts predict that more than 70% of the global population will call an urban area home. This highlights the critical necessity for an environmentally friendly, user-friendly, and highly efficient public transportation system inside urban areas. This comprehensive review examines fifty peer-reviewed publications covering the subject of urban mobility as it relates to AI, the Internet of Things, and information and communication technology. The publications were published between 2015 and 2024. One of the most important criteria used to choose the papers was the clarity and amount of commitment shown in their presentations. The primary responsibility of this team is to optimise traffic signals in real time and to do research on intelligent routing systems and prediction algorithms. Reduced traffic congestion, improved public transport, and enhanced road safety are all possible outcomes of the widespread adoption of autonomous vehicles. Not only that, but there are a plethora of other factors beyond the ones just mentioned that make this very evident. It is imperative that smart cities and urban mobility use AI in order to discover answers to numerous difficulties. The digital divide across countries is a prime example of the kind of problems that fall under this umbrella.

Keywords: Artificial Intelligence, Smart City, Smart Transport, Autonomous Vehicles, Remote monitoring.

INTRODUCTION

Artificial intelligence, or AI, is a set of skills that lets machines act like people in many areas, such as learning, thinking, making decisions, creating things, and improving efficiency. AI stands for “artificial intelligence.” A combination of vision intelligence and artificial intelligence can not only understand human languages, which makes communication easier, but it can also find and organise things in the surroundings. Nearly three-quarters of humanity will be residing in urban areas by the year 2050, according to experts. Some of these megacities have already found a way to combat heavy traffic, but it is still important to build smart cities so that megacities can be more liveable and sustainable in the future. This is done to make megacities last longer (Mourtzis et al., 2022). The transport sector has been going through a revolution

because artificial intelligence can make many systems work better. Thanks to advances in technology, transportation has become much more efficient. There have also been advances in constructing personalised itineraries; processing and analysing data; predictive modelling; traffic optimisation and simulation; and self-driving cars. This technology makes it possible to spot patterns, guess how traffic will change in the future, and figure out the best ways to manage it. Machine learning algorithms may look at enormous volumes of data from many different places. Over the past few years, artificial intelligence has significantly advanced. Because of this, self-driving cars can now quickly investigate their surroundings, evaluate them, and make decisions that are based on the information they have. Artificial intelligence has made it possible to create models for traffic simulations that can accurately simulate how traffic works in the real world. Therefore, this development may facilitate the evaluation and improvement of traffic regulation technologies. Artificial intelligence is having a big impact on the rapid growth of the transportation business in many ways. Intelligent Transportation Systems (ITS) have to deal with problems such as being too complicated, not being popular enough, and needing to handle data in real time. Some of these problems are related to privacy, high computational costs, possible security risks, the need to keep data safe, and processing in real time. The researcher should take the time to consider all of these things. Even though they have access to a lot of useful information, it may be challenging for algorithms that use artificial intelligence to accurately predict when buses will arrive in real time. Bus schedules are known for being unreliable, which is why this incident happened. Real-time processing can be challenging when resources are limited because it requires algorithms that operate very quickly. Artificial intelligence needs tight security measures and clear rules for managing data since it raises concerns about privacy, public acceptance, and security risks. This is because it makes things harder in certain areas. The growth of metropolitan regions has led to many problems, but artificial intelligence can help address them all in some way or another. It is great for automating tasks, predicting outcomes, and analysing data in real time, among other things. Pollution, transportation, and the unavailability of affordable goods and services are some of the issues that need fixing. These experts think that by 2050, most of the people in the globe would probably live in cities. This prediction is based on estimates of the population. Because AI can make transit and planning options more people-friendly, it is conceivable to make cities more sustainable (Khan et al., 2020).

BACKGROUND OF THE STUDY

“Artificial Intelligence in Smart Cities for On-Demand Vehicle Automatic Systems” delves into the several ways AI offers assistance to smart transportation systems. The purpose of this article is to provide background information that will be useful for the subsequent investigation. Cities are seeing rapid population growth, and these solutions are assisting with the problems of traffic congestion and inefficient transport (Alizadeh & Sharifi, 2023). Smart cities could become more welcoming and safe places to live with the help of machine learning (ML) and AI. Options include dynamic routing, the deployment of self-driving automobiles, and the

management of traffic congestion. If the researcher's want cities to be more sustainable and financially successful in the future, the researcher's need to take steps to protect people's privacy, provide the right infrastructure, and make sure these technologies are accessible to everyone. Building "smart cities" that address urban issues through the integration of data and smart technologies is a crucial step in the advancement of artificial intelligence. The development of "smart cities" is a response to the problems that urban areas encounter. The present transport networks are under tremendous pressure from the ever-increasing demands of city dwellers. The current transport networks are already under a great deal of stress from this strain. Congestion, pollution, dangerous situations, and resource waste are just a few of the many issues that modern cities are infamous for. In response to these concerns, the concept of "smart cities" has arisen as a new standard for urban planning. For smart cities to achieve its goals of better city administration and infrastructure and higher to improve the living conditions of its citizens, cutting-edge electronic systems should be put into place (Vasudavan et al., 2019).

PURPOSE OF THE RESEARCH

To increase the security of traffic and enhance the effectiveness of self-driving cars, as well as to improve them for the environment, the fundamental purpose of the research that is currently underway on AI for smart cities and on-demand vehicle systems is to improve them. Artificial intelligence is able to forecast demand, make adjustments to routes on the fly, coordinate cars, regulate traffic signals, and make it easier for autonomous fleets to work together. All of these capabilities are gained through the utilisation of real-time data. The work is carried out with the intention of enhancing the experience of the client while simultaneously reducing the amount of influence that it has on the environment. Autonomous vehicles that are powered by artificial intelligence have the potential to drastically reduce the number of accidents and incidents that are caused by human error.

LITERATURE REVIEW

While the demand for transport services is huge, the car industry is expanding at an astounding rate all over the world. According to the findings of a study on road safety that was carried out by the WHO, it was determined that, by 2030, automobile accidents will also be the main cause of mortality. A significant number of businesses that are engaged in the construction of smart cities encounter challenges when it comes to the administration of traffic inside their respective communities (Lyu & Hao, 2021). They are concentrating their efforts on minimising the amount of time that is required for travel as a result of this. In addition, they aim to make roads safer in order to minimise the amount of accidents that take place, which are two of the most serious problems associated with intelligent transport systems (ITSs). One of the primary focuses of the bulk of these studies is the development of dynamic traffic control scenarios that make use of intelligent technology to move autos around to alleviate any traffic jams or bottlenecks that may be occurring. By linking sensors and physical remote access devices to a network of

automobiles through the internet, it is feasible to find a solution to the problem of human engagement in vehicle ad hoc networks (VANETs). This presents an opportunity for the identification of a solution. The fact that VANET nodes move around quite a bit makes solving this problem more challenging. Establishing connections between the network of autos and the sensors and remote access devices is one possible approach to resolving this issue. An illustration of such a strategy would be the use of artificial intelligence in machine learning. Intelligent systems that are able to learn from prior data and make decisions without the need for human input or explicit programming would be advantageous for vehicle management since they would considerably improve the situation. Such an approach would be a big advantage (Jonek-Kowalska & Wolniak, 2024).

RESEARCH QUESTION

What impact does data availability have on automated vehicle systems in smart cities?

RESEARCH METHODOLOGY

Research design

A quantitative analysis of the data was performed 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 with computational tools for statistical assessment, are often assessed using quantitative approaches.

Sampling

Research participants completed questionnaires to furnish data for the study. Utilising the Rao-soft tool, researchers ascertained that the study comprised 657 individuals. Researchers disseminated 896 questionnaires to the public. The researchers obtained 823 replies, eliminating 45 due to incompleteness, yielding a final sample size of 778.

Data and Measurement

The research mostly utilised data obtained from a questionnaire survey. The participant's fundamental demographic information was solicited first. Participants were thereafter 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.

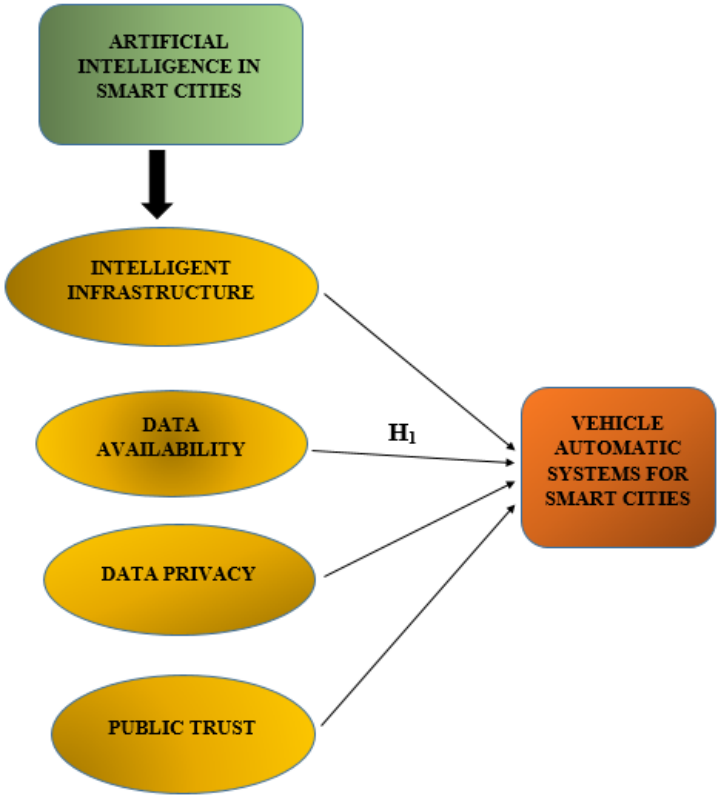
Statistical Software

The statistical analysis was conducted using SPSS 25 and Microsoft Excel.

Statistical Tools

The basic features of the data were understood by use of descriptive analysis. The data must be analysed using ANOVA by the researcher.

CONCEPTUAL FRAMEWORK



RESULTS

Factor Analysis: A common application of Factor Analysis (FA) is to ascertain the presence of latent variables within observable data. In the absence of readily discernible visual or diagnostic indicators, it is customary to employ regression coefficients to provide ratings. In FA, models are crucial for success. The objectives of modelling are to identify errors, intrusions, and evident correlations. The Kaiser-Meyer-Olkin (KMO) Test is a method for evaluating datasets generated by multiple regression analyses. They confirm that the model and sample variables are representative. The data exhibits duplication, as indicated by the figures. When the proportions are diminished, the data becomes more comprehensible. The KMO output ranges from zero to one. If the KMO value ranges from 0.8 to 1, the sample size is deemed sufficient. These are the allowable limits, as per Kaiser: The subsequent approval requirements established by Kaiser are as follows:

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.

The results of Bartlett's test of sphericity are as follows: approx. chi-square

df=190

sig.=.000

This proves that the statements made for sampling were legitimate. A significance assessment of the correlation matrices was carried out by the researchers using Bartlett's Test of Sphericity. According to the Kaiser-Meyer-Olkin measure, an adequate sample is indicated by a value of 0.974. Based on Bartlett's sphericity test, the p-value is 0.00. If this correlation matrix does not pass Bartlett's sphericity test, then it is not an identity matrix.

Table 1. Testing for KMO (Kaiser-Meyer-Olkin) and Bartlett's Sampling Adequacy Measured by 0.974.

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 further validated the relevance of the correlation matrices. The Kaiser-Meyer-Olkin metric of sample adequacy is 0.974. The researchers obtained a p-value of 0.00 via Bartlett's sphericity test. The findings of the Bartlett sphericity test were significantly robust to invalidate the correlation matrix.

INDEPENDENT VARIABLE

Artificial Intelligence In Smart Cities: The ability of artificial intelligence to deliver immediate safety measures and notifications has rendered the general public significantly safer. Communities can monitor potential threats, natural disasters, public safety concerns, and suspicious conduct by connecting cameras and sensors to a remote server enhanced with local artificial intelligence. A "smart city" improves the living conditions of its residents in various ways, including their health, accessibility, productivity, and knowledge of environmental issues (Chiordi et al., 2022). This process is accomplished by integrating artificial intelligence into every aspect of a city's infrastructure, services, and administration. It is impossible for smart cities to

operate at their full potential without making extensive use of artificial intelligence. Research and development in artificial intelligence may result in a number of positive results, including improved public transport systems, improved management of natural resources, improved governance, improved quality of life, greater economic strength, and increased personal agency. Implementing artificial intelligence in transportation and traffic management may result in improved public transit systems, reduced congestion, and an improved flow of traffic. As a result of these adjustments, there should be a reduction in fuel use and pollutants in the air over the long run. The process of making decisions based on data is a crucial component of statistical analysis and predictive modelling. This transition is occurring as a result of artificial intelligence's ability to sift through mountains of data, identify trends, and maximise resource utilisation. Bringing all these factors together will eventually make smart cities more robust over time (Wu, 2022).

FACTOR

Data Availability: The provision of goods and services to customers is dependent on the availability of data for businesses. By ensuring that their IT infrastructure is always operational, businesses can guarantee that their data will continue to be accessible in the event that their network experiences a disruption. In the context of data availability, the state of having access to data that is assured is referred to (Dong & Liu, 2023). Businesses are unable to provide their products to customers if they do not have data. By ensuring that their information technology (IT) infrastructure is always operational, businesses can guarantee that their data will continue to be accessible in the event that their network experiences a disruption. In the context of data availability, the state of having access to data that is assured is referred to. An organisation is said to be assuring data availability when it takes measures to ensure that all of its data is accessible to partners, end-users, and the organisation itself at all times and from any place. When organisations have access to data at all times, they are able to operate efficiently. It is possible to define the availability of a data asset as the percentage of time that it is accessible and usable and available. As a standard representation, it is typically depicted as a series of nines, with each nine representing a 99.9% availability rate. The availability of data is of the utmost importance for application users. An app's ease of use is directly related to the amount of data it can access. Furthermore, when switching between devices, users expect their applications to remain synchronised. This is practically impossible unless the data can be freely transferred and is easily accessible. Users also anticipate that their data can be restored from the cloud in the event that their device is lost, stolen, or damaged in any way (Caprotti & Liu, 2022).

DEPENDENT VARIABLE

Vehicle Automatic Systems For Smart Cities: The controls of a completely autonomous car are built for a human driver, yet it can nevertheless handle all parts of the driving process without aid. When designing cars, different companies may prioritise different features based on how

they will benefit regular drivers. Automated systems can be broadly categorised into four types: fixed, programmable, integrative, and adaptive. The next paragraphs will go over the benefits and distinctions of each type (Davide et al., 2021). Adaptive cruise control, lane positioning, vehicle parking assist, and traffic jam assist are just a few of the driver aid technologies that automated systems can combine. Because of this, drivers must constantly scan the road ahead to ensure they are prepared to take prompt action if necessary. Management and security of vehicles are the goals of intelligent vehicular automation. Furthermore, it may enhance the pilot's ability to control the vehicle. It is critical to address some issues before the driving direction system can be widely used in future cars. Recent theoretical and experimental work is regarded as cutting edge when it comes to vehicle control difficulties. There are already a lot of problems with driver assistance systems, and sensor difficulties make things much worse. While sensor-driven cars did have a high failure rate in the past, many of these problems have been addressed by technological advancements. A thorough comprehension of the many human factors involved is essential for anyone operating an autonomous vehicle. The smart car automation system works by utilising technologies that are integrated with electrical and multi-agent systems (Jain et al., 2021).

Relationship Between Data Availability and Vehicle Automatic Systems For Smart Cities: The efficiency and expansion of car automation systems in smart cities are both significantly impacted by the availability of data. On-demand and self-driving automobile systems require a vast amount of dependable, up-to-date data on a wide scale to function properly and safely. Smart cities are constantly receiving fresh data from various sources, including IoT sensors, GPS systems, cameras, traffic management systems, cell phones, and social media. While simultaneously communicating with other vehicles and the city as a whole in a seamless manner, automated systems in automobiles are able to forecast the number of individuals who will be interested in embarking on a trip, combine and make the data accessible, and make intelligent decisions (Al-Besher & Kumar, 2022). One of the advantages of having quick information access is that it enables self-driving cars to make better decisions thanks to the information they have. The weather, traffic, highway conditions, and the activities of other drivers on the road are all examples of things that these autos require information about in real time. Having access to data that is both trustworthy and open enables them to perform situational awareness analysis in real time. Both the likelihood of accidents and the safety of navigation are improved as a result of this. In the event that there is a backlog or a barrier, for instance, high-definition maps that are updated dynamically can allow vehicles to adjust their paths. Without this knowledge, the cars would not be able to make judgements as effectively, which would have a negative impact on both the efficiency and the safety of the operation. Second, a massive amount of data must be accessible to ensure the most efficient and accurate scheduling and routing of cars on demand. The optimum allotment of the fleet, shorter wait times for customers, and fewer trips with empty vehicles are all possible outcomes that can be achieved with the assistance of predictive analytics that possess the capability to examine both historical and current travel demand data. Such an approach helps with sustainability by

reducing the amount of energy used and the amount of carbon emissions that are produced. In addition, it makes processes more efficient (Lyu & Hao, 2021).

Following the prior argument, the researcher developed the subsequent hypothesis to assess the relationship between Data Availability and Vehicle Automatic Systems for Smart Cities.

"H_{01}: There is no significant relationship between Data Availability and Vehicle Automatic Systems for Smart Cities."

"H_1: There is a significant relationship between Data Availability and Vehicle Automatic Systems for Smart Cities."

ANOVA					
Sum					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39588.620	349	5438.563	1015.415	.000
Within Groups	492.770	428	5.356		
Total	40081.390	777			

Table 2. H1 ANOVA Test.

This study's findings are substantial. The F-value is 1015.415, and the p-value is 0.000, which is below than the 0.05 alpha level, indicating statistical significance. Because of this, it's possible that scientists will back the competing theory, ***"H_1: There is a significant relationship between Data Availability and Vehicle Automatic Systems for Smart Cities"*** is accepted and reject the null hypothesis.

DISCUSSION

Encouraging individuals to acquire the essential information, skills, and tools for the next generation of civilisation is the goal of ethical AI systems. If powerful individuals and government officials are successful in pushing for more AI adoption, society and the economy will be better off in the long term. Environmental damage, health care, security and safety, energy usage, and many other issues rank high among the numerous challenges that modern cities encounter. The researchers first performed a thorough literature review before gathering information on artificial intelligence technology and their most important uses in smart city settings. There are a great deal of distinctions among the many AI applications found in smart cities. One area of AI called "intelligent mobility" is working to make people's lives easier through improving transit networks and reducing traffic jams. Smart mobility primarily consists of two parts: autonomous vehicles and sophisticated traffic management technologies. Contrarily, smart environment projects that leverage smart technology allow people to track air and water pollution levels, handle waste more effectively, and strive for sustainability through resource efficiency and less harm. Smart governance refers to the use of artificial intelligence to improve the efficiency of

government operations, speed up decision-making, and cater to citizens' needs more effectively. One of the many ways this is happening is through the use of chatbots and other forms of artificial intelligence as virtual assistants to link people with their representatives in government. In contrast, smart economy projects apply AI for a range of tasks, such as forecasting monetary trends, personalising marketing campaigns, finding qualified job applicants, and promoting new and creative ideas. Digital initiatives, telemedicine solutions, and artificial intelligence all collaborate in various ways to make people's lives easier, safer, and healthier. In contrast, the goal of the smart people programmes is to provide locals with the knowledge, skills, and tools they need to take part in and profit from urban regeneration projects. Most of the time, this is achieved through community-led projects or through programmes that teach people how to use digital resources effectively.

CONCLUSION

The people who live in urban areas are rapidly becoming accustomed to these novel and forthcoming modes of communication. When it is in close proximity, a number of pneumatic tubes are able to detect changes in the internal pressure of the vehicle. The usage of these phrases is now standard practice in traffic reports that include information such as average speed and vehicle counts. A growing number of individuals are taking advantage of radio-frequency identification (RFID) detecting video cameras in order to obtain information regarding traffic. A careful utilisation of video cameras is incorporated into the design of the network in order to obtain more precise information regarding the flow of traffic. Data collection and management can be accomplished in a number of different ways, such as through the use of mobile applications, traditional road signs, and broadcasts on radio. In a nutshell, these are one-of-a-kind city grants that have the objective of enhancing the literacy rates of young people and acknowledging the significant contributions they make through the different components of the smart society project, which provide them with access to a great deal of information. Control systems for self-driving cars are going to be a major topic of discussion in the next ten years, particularly when computer-controlled self-driving automobiles that are networked together are able to do all of these functions. However, in order to successfully develop the flow model of the network, which will assist with control of space and administration, a significant amount of information pertaining to communication must first be gathered.
It is now conceivable for smart towns to grow into a reality as a result of the rapid rise of artificial intelligence. By addressing issues that are common in urban areas, smart cities have the potential to improve the quality of life for the people who live there. The following are the six primary categories of smart cities that are investigated in this study: smart citizens, smart environment, smart mobility, smart administration, and smart lifestyle! It does this in order to determine what the most significant applications of AI solutions are, what challenges they encounter when they are put into action, and what potential paths they may follow in the future. It was between the years 2021 and 2024 that the literature review was conducted. This is an in-depth look at the concepts of smart cities that are being implemented in a variety of different regions.

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