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Artificial intelligence on the smart city

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Abstract

A smart city is an urban area that uses advanced technologies and data analysis to improve its residents' quality of life, promote sustainability, and improve urban services. Smart cities benefit from several technologies, including Internet of Things (IoT) sensors, connected devices, artificial intelligence (AI), and big data analytics to collect and analyze data from various sources in real time. The goal of a smart city is to use this data to enhance the efficiency and effectiveness of urban services such as transportation, energy, water management, waste management, and public safety. The future of cities is likely to be shaped by a combination of technological, social and environmental trends. Our future cities will have some features, including smart infrastructure, sustainable design, sustainable transportation, urban resilience, digitization, and citizen participation.

Keywords: *smart city; artificial intelligence; The Internet of things.*

Introduction

Artificial intelligence is undoubtedly part of the cities of the future. Many cities today rely heavily on artificial intelligence to predict weather, traffic, air pollution, demographic developments, and many other factors (31). ChatGPT is the most popular artificial intelligence (AI) software. However, very important questions arise: What can AI software do for cities? And which cities already use it? What role will artificial intelligence play in the city of the future? Cities are a key empowering factor of productivity and economic development and essential to the social and political well-being of individuals and society as cities are the place most people now call home. However, there are many problems that impede economic growth, social and environmental justice and equality. Traffic congestion is a major problem all over the world and costs national economies billions of pounds every year (2). Moreover, poor housing conditions, resulting in an increased need for healthcare services, have put great pressure not only on people's lives but also on local and national healthcare systems (6). In addition, growing populations and changing demographics - for example, a growing young population in many African cities and an aging population in most parts of Europe - have already started putting a lot of pressure on public services and the built environment. The global housing crisis is just one example of this. The concept of the smart city

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is one response to the growing challenges that the urban centers: environmental degradation, increasing economic inequality, growing population that overburdens social and physical infrastructure. The smart city aims to improve the cities' efficiency in operations, services and energy and make them better places to live for all (13). Smart cities are already using artificial intelligence and big data to create better databases, create holistic opportunities in the built environment, and address challenges such as climate change (8). Until now, these technological advances are tools rather than approaches in themselves. They can only be as good as inputs, which means that even the most advanced AI programs rely on the data out there. The much-talked-about ChatGPT is a language model developed by OpenAI that is designed to generate human-like text that can answer questions, write stories, and participate in conversations. The software's answer tends to be a good bird eye's view on a topic so that it sounds comprehensive and diplomatic, taking into account several points of view (12). ChatGPT can be considered modest, in the sense that when the language model does not know the answer or is asked about something personal, it apologizes and admits that it 'has no ability to predict future events or understand the long-term consequences of actions.' The software is keen and understands that in urban planning there are always countless factors to consider and that every city looks different. ChatGPT is also self-critical. When it is asked about the role of artificial intelligence in urban planning, it points out that Artificial Intelligence is unlikely to replace human planners 'in the foreseeable future.' It also lists challenges related to data and AI, such as data bias, privacy issues, and automation leading to job loss(17), as potential problems for Artificial intelligence in urban planning. ChatGPT also lacks creativity, i.e., the intrinsic human tendency to dream, to realize dreams that seem fanciful, to hope for better future cities, and to dare to make decisions.

What is a smart city?

A smart city is an urban area that uses advanced technologies and data analysis to improve its residents' quality of life, promote sustainability, and improve urban services. Smart cities use a range of technologies, including Internet of Things (IoT) sensors, smart devices, artificial intelligence (AI), and big data analytics to collect and analyze data from various sources in real time. The goal of a smart city is to use this data to enhance the efficiency and effectiveness of urban services, such as transportation, energy, water management, waste management, and public safety (15). By doing so, smart cities aim to improve the livability, sustainability, and economic competitiveness of urban areas. The most important examples of smart city applications include traffic management systems that optimize traffic flow based on real-time data, energy-efficient street lighting that adapts to traffic and pedestrian flows, and waste management systems that use sensors to optimize waste collection methods. Smart cities often prioritize citizen participation and collaboration to ensure that technology is used for the benefit of all residents (19).

How can artificial intelligence improve smart cities?

Artificial intelligence (AI) has the potential to enhance the functionality of smart cities in several

ways, such as:

Intelligent Traffic Management

AI-powered systems can monitor traffic conditions in real time and predict traffic patterns. This data can also be used to improve traffic flow, reduce congestion, and improve the overall efficiency of transportation systems (11).

Energy management

Artificial intelligence can improve the energy use of buildings and city infrastructure by analyzing data on energy consumption patterns. It can help cities reduce their carbon footprint and become more sustainable (24).

Preventive maintenance

Artificial intelligence can also monitor a city's critical infrastructure, such as roads, bridges, and buildings by analyzing data about usage, weather conditions, and other factors. AI systems can predict when maintenance or repairs will be needed, reducing downtime and costs.

Public Safety

AI-powered video surveillance systems can detect and alert authorities about potential security threats, such as suspicious activity or accidents. Artificial intelligence can also help respond to emergencies by predicting where resources are needed based on data analysis (14).

Citizen services

Chatbots and AI-powered virtual assistants can provide citizens with quick and efficient access to city services, such as waste management and public transportation. Further, artificial intelligence can analyze citizen feedback to identify areas for improvement and services that are better tailored to citizens' needs. In general, artificial intelligence has the potential to greatly enhance the functionality and efficiency of smart cities, provide better services and improve the quality of life for residents (15).

What are the risks of artificial intelligence in urban planning?

While artificial intelligence has the potential to enhance urban planning and improve the quality of life for citizens, it also poses many potential risks, including bias. Even though artificial intelligence algorithms are as unbiased as the data they are trained on, if the data used to train the AI system is biased, the resulting decisions may also be biased and this may lead to discriminatory outcomes in areas like housing, education, and public services provided to citizens (1). The issue of privacy also occupies a good space, as artificial intelligence requires large amounts of data to function, which may include personal data about citizens, which poses a risk of misusing this data, breaching activities, or data falling into the wrong hands. This endangers the privacy and security of citizens (17). Automation can improve efficiency, but it has the potential to eliminate jobs, increase income

inequality, and cause many employees to lose their jobs. Artificial intelligence will automate certain jobs in urban planning, leaving many employees without jobs and increasing unemployment rates and lack of transparency. Artificial intelligence systems are opaque and difficult to understand, making it difficult to assess their decision-making processes. This can lead to mistrust of AI-powered urban planning and lead citizens to feel disenfranchised. Further, as cities become increasingly dependent on artificial intelligence, there is a risk that they will become totally dependent on these systems, which may lead to a lack of resilience in the face of unexpected events, such as natural disasters or cyber-attacks. Therefore, AI-Powered urban planning should be developed, considering transparency, accountability, and inclusiveness. There should also be a focus on ensuring that AI is unbiased, privacy-conscious, and benefits all citizens equally.

Will artificial intelligence take over urban planning jobs in the future?

While AI has the potential to automate some tasks in urban planning, it is unlikely to completely replace human urban planners in the foreseeable future. Moreover, artificial intelligence could be useful in tasks such as data analysis, mapping, and simulation (22), which could help urban planners make more informed decisions. However, urban planning also requires a range of skills that are not easily automated, such as critical thinking, creativity, and empathy. Here, urban planners play an important role in shaping the built environment and ensuring that it meets the needs of diverse communities. They must take into account several factors, such as social justice, environmental sustainability, and economic development that require human judgment and decision-making (37). While artificial intelligence can assist urban planners with some tasks, it cannot replace the accurate judgment and contextual understanding that human planners bring to the job. Furthermore, urban planning involves working with a number of stakeholders, such as community groups, businesses and government agencies, to reach consensus and build support for planning initiatives. Building these relationships and engaging in collaborative decision-making processes requires human skills that cannot be easily automated. In short, while artificial intelligence can assist urban planners with some tasks, it is unlikely to replace human urban planners in the foreseeable future, as their experience and judgment are essential in shaping the built environment to meet the needs of diverse communities (38).

What will our future cities look like?

The future of cities is likely to be shaped by a combination of technological, social and environmental trends. Here are some potential features of our future cities:

Smart Infrastructure: Cities will be more connected and integrated, with advanced sensor networks and real-time data analysis to optimize resource use and improve the efficiency of urban services (28).

Transportation: Cities will prioritize accessible, sustainable transportation, with a focus on public transportation, electric vehicles, and active transportation options such as cycling and walking (2).

Urban Resilience: Cities will be designed to be more resilient to natural disasters, climate change, and other shocks. This could include infrastructure improvements such as sea walls and flood protection measures, as well as a focus on community preparedness and resilience.

Mix-use development: The cities will integrate a mix of residential, commercial and public spaces in a way that enhances community interaction, reduces commute times and enhances a sense of community.

Digitization: Cities will become increasingly digital, with advanced technologies, such as artificial intelligence, blockchain, and the Internet of Things (IoT), being used to improve urban services and enhance the citizen experience.

Citizen participation: Cities will prioritize citizen participation, with a focus on engaging citizens in urban planning and decision-making processes. Citizens will be empowered to shape the future of their cities and have a greater say in how resources are allocated (30).

In general, the future of cities is likely to be shaped by a combination of technological, social and environmental trends, with an emphasis on sustainability, resilience, and citizen participation. Here, the ethical implications of smart city technology must be taken into consideration. Smart city solutions can have ethical implications, such as concerns related to privacy, security, and data use. Smart city experts must consider the ethical implications of technology and work to ensure that smart city initiatives are designed with transparency, accountability, and inclusiveness in mind (22). Medical care is essential to the thriving growth of smart cities, which have assumed that high quality medical services is the most challenging goal of city government. Since the medical service mostly depends on the competence of the medical personnel, smart healthcare technologies can be the right solution for the complex and poorly connected daily healthcare problems. The main attention is given to improving the medical service through corresponding examinations and trend analysis, using the Internet of Medical Things (IoMT), electronic health recordings, mobile cloud computing (MCC)(4), and machine learning applied to the vast amount of diverse information (6). The main challenges and potentials of smart and healthy cities are presented because a healthy city is a prerequisite for a successful city and a major outcome of smart cities. The implementation of a new MCC resolution ensures that there is a reliable and effective platform for stakeholders to transfer their information online (7), which enables more mature decision-making and enhances the participation of ordinary people in society (19). Major language models such as ChatGPT can also bring many benefits to the world of urban planning. For example, based on artificial intelligence models, architects and designers can generate new ideas for creative projects with more effective and efficient design (16). Because language models can quickly and easily generate a wide range of ideas and concepts, and work with huge amounts of textual data, they are extremely valuable for creative brainstorming. Further, by generating a large number of potential design ideas in a short period, they inspire and support designers, engineers, and architects who have tight deadlines. At the same time, language models such as ChatGPT use their deep understanding of language to

identify potential problems or weaknesses in designs and their approach to the design process helps designers and planners improve and refine their designs, making projects more effective. While artificial intelligence can't take over the intrinsic human process of providing an artistic and unique approach to problems, it can support the creative process and research any technical challenges (8). It appears that the role of major language models in future cities will be primarily auxiliary, automating some of the tedious and time-consuming tasks in both design and urban planning work. Dubai has already used artificial intelligence such as ChatGPT to answer common citizen questions and respond to reported problems with municipal services. For designers and planners, large language models can be beneficial by automatically generating large amounts of data. Floor plans, building layouts or urban design specifications can be generated by artificial intelligence, which saves a lot of time and effort for designers and allows planners, architects, and designers to focus more on the creative aspects of their work (12). Artificial intelligence can complement and enhance the skills of city planners and architects but cannot replace them. We must also bear in mind the risks that come with AI. Designing tools like ChatGPT to generate text based on the input they receive cannot cause harm or engage in harmful activities by themselves. As with any technology, there are some potential drawbacks with big language models that urban planners must keep in mind when integrating artificial intelligence into the city of the future. These include misusing the technology, for example, by creating propaganda or fake news, bias in the training data because large language models are only as good as the input provided by their creators, reliance on artificial intelligence that may also lead to job losses (13), loss of creativity because artificial intelligence isn't a substitute for human creativity or intelligence, and the lack of humanity since large language models do not have feelings or independent thoughts. Therefore, planners and architects must take relevant steps to mitigate the risks of using artificial intelligence because their task is to ensure that technology is used properly, responsibly, and ethically. A major consideration is to check for bias against vulnerable populations, constantly verify information (3), and involve different groups of society in the planning process for creating human-centered cities rather than AI -focused ones. Planners will continue to be the guiding force for the cities of the future. While artificial intelligence can support architects, planners, and designers with many tasks, provide objective opinions, and help stimulate creativity, it can't replace the human element of creating livable cities that work for all. At the same time, the emergence of ChatGPT is a sign for everyone working in this field that artificial intelligence will play an increasingly important role in the cities of the future. It's not just a 'trend to observe,' it's something to actively interact with and learn more about. Artificial intelligence can certainly improve cities, but it is also a flourishing industry in its own right. With the rapid development of modern communications, the advent of 5G, and the growing nature of Internet of Things (IoT) technology, artificial intelligence software for smart cities is big business. In 2019, the industry was valued at $673.8 million (€573.2 million). This number is expected to reach $4.9 billion (€4.3 billion) by 2025. Moreover, with a full set of modern smart technologies, 5G connectivity, and interconnected data banks, it is easier than ever for artificial intelligence programs to analyze and process data. This can help solve many problems in city management.

The addition of artificial intelligence can also help cities make the right changes quickly and efficiently. Further, urban planning is a difficult process; any potential development must be carefully researched, tested, and designed to satisfy a wide range of stakeholders. In its present form, it is tedious and time consuming, and more studies must be done and excessive bureaucracy often gets in the way of efficient problem solving (15). Using a combination of artificial intelligence, heat maps, and Application Programming Interfaces (APIs), governments can now access vast amounts of data and can use this data to make informed decisions and enact changes that can enhance city life. Modern AI services give city officials an accurate way to measure specific factors within a city. Armed with this data, decision-making processes can be accelerated and changes that would otherwise take months of surveys, research, and planning can be implemented in a fraction of the time.

Modern artificial intelligence platforms process information from open and authorized data portals, using a wide network of screens, sensors, and Internet of Things systems to gain insight into citizens' habits, desires, and needs. Artificial intelligence programs can also monitor the multifaceted world of city infrastructure (17), from mobility to real estate, and examines it through many different lenses, taking into account demographics, sustainability and everyday citizen opinions to identify problems and predict potential solutions. These data networks will continue to grow as new buildings are developed with sensors and Internet of Things infrastructure. In addition, smart technology continues to evolve and become a greater part of our daily lives. With so much data, AI is required to process everything. The task is too enormous and daunting for humans to decide, so it is up to AI to make use of the data.

Artificial intelligence (AI) has enormous advantages for intelligent data processing and automation, which has the potential to impact every area of our daily lives and influence the planning and implementation of smart city projects across all six business areas. However, the creation of artificial intelligence also raises some important questions. If we relinquish administrative oversight of certain AI processes and services, how can we ensure that they will be inclusive? What will the labor market look like in the future, and what are the implications of machine intelligence in education? What would policymakers, in particular, need to catch up with the curve and shape a normative legal framework so that cities can make the most of what artificial intelligence offers (20)? A key empowering step in making a city smarter is to improve its connectivity, the availability of access to its data and the speed of its networks, including the Internet of Things (IoT), direct information on what the city has to offer to its stakeholders and to benefit from the network effect – the bigger the platform the smarter it becomes - as AI refers to the ability to learn to code (22). In the context of smart cities, adopting machine learning models for operational decisions makes a sense (1). One of the main potential benefits of artificial intelligence for smart cities is the low-cost, customized manufacturing of any product, which is called Industry 4.0. Automated manufacturing reduces labor costs, making domestic production increasingly economical and reflecting the tendency for sending it abroad. Industry 4.0 relies on mixing robots with smart,

teachable programs. The concept of manufacturing will completely change because flexibility will overtake scale as the key to the future of production. This is expected to boost economic growth by increasing productivity, which is already noticed in the retail and aviation industries. Robots have been integrated with machine learning to prepare shipments for Amazon and for manufacturing simplified for 3D printed jet engine parts. One of the companies poised to capitalize on these possibilities is iCarbonX, which was founded in China in 2015 with funding from a group of biotech, electronics, and online innovation investors. iCarbonX has already been listed as one of Fortune's top 50 companies "leading the AI revolution," boasting the ability to measure human adaptive immune response. It has publicly introduced its digital health management platform (Meum), whose founder Jun Wang ambitiously claims that it will digitize, analyze, and understand life. For the end user, Meum is a kind of personal guide, capable not only of assessing health and fitness but also of predicting health outcomes and giving advice. It also allows access to apps that monitor and track fitness, skincare, and nutrition, but is also open to developers and researchers (33).

Besides healthcare and manufacturing, investors are currently developing artificial intelligence for online retail and networking, chatbots such as WienBot in Vienna, sophisticated traffic control systems, and simulating new mobility solutions. Many of the recent artificial intelligence headlines have concerned its application to Autonomous Vehicles (AVs), which are being developed as a safer and logistically smarter alternatives to fault-prone human drivers. This may replace private vehicle traffic in the distant future. For example, BMW and Intel have joined forces to produce Levels 3 to 5 AVs by 2021, and plans from Ford and its academic partners at the University of Michigan are no less ambitious. However, putting an artificial intelligence at the wheel will require it to make many decisions that, as mundane as they may seem, will have major safety implications; decisions that could literally mean life or death for its occupants or pedestrians. There will inevitably be situations where artificial intelligence must weigh the value of life and choose between two negative outcomes. This kind of decision is hard enough for a human being; how and when should a machine discriminate? (18).

Training and application of artificial intelligence

Regardless of ethical questions, the real world is messy, it does not follow organized rules, and people do not always make rational or predictable decisions. Thus, it is something very difficult for AI to emulate, especially without the kind of instant recognition of a word or concept and its easy translation from one context to another that even young children take for granted. Thus, the usefulness of an artificial intelligence model in the real world will depend strongly on the quality and scope of its training, which is based on the data sets given for the study. It also comes down to the perceived value of artificial intelligence, both to society as a whole and financially, that entire companies are dedicated to developing and training artificial intelligence models. One of the examples is the San Francisco-based platform, Appen, which trains and tests 'human-in-the-loop (HTL), machine learning models (those that require some form of human interaction). It develops

labeled sets of data appropriate for proper training of the model. These labels are essential to the way the device interprets the data being presented. The range of data types this company works with - text, images, product information, audio and video - reflects the vast capabilities of AI. Well-known brands such as eBay, Adobe, and Spotify are recruiting AI services (10). To ensure equality, the European Union has mandated a set of ethical guidelines governing AI development and use within Europe. The aim of these guidelines is also to boost public and private investment in artificial intelligence to help governments prepare for the expected social and economic changes from its implementation—changes that are only partially visible (11).

The impact of artificial intelligence

The adoption of systems that can grow smarter over time is expected to drive the job market towards a workforce with higher digital and technical skills, better connected to exchange local expertise across multiple stakeholders, and with smarter supply chains to fuel the demand industry. This is indeed the goal of most smart cities looking to transition to an innovation-driven economy. At least in the short term, this shift poses a significant risk to employment and equality, both of which severely affect the economy and the "center" of the overall city. As jobs are replaced by automation, those who invest in empowering factors will end up necessitating strong and clear governance and forward-thinking policies. There is still a major factor to wait and observe (34), with some experts predicting very optimistically and others predicting humanity's doom as machines take over our lives although similar things have been said of the ubiquitous smartphones with intelligent digital assistants.

Building Smarter: Intelligent Techniques for Design and Construction

The smart city strategy that is now transitioning into the 'fourth generation', is increasingly focused on collaboratively identifying community needs before implementing infrastructure and/or technological changes with the empowerment of society in the development of a smart city. The meaning of 'intelligence' must be defined in order to produce buildings that truly enable a higher quality of life and generate more sustainable lifestyles. A smart city is also as much about stimulating collaboration as it is about sustainability; that means leveraging the most innovative 'intelligence' technologies and processes to ensure that new infrastructure is built not only in the most collaborative way, but in the most resource-efficient way, as well. BIM (Building Information Modeling) and CIM (City Information Modeling) collect all information about a building and its construction in one place, meaning that anyone working on a project can access and use information about any aspect of the infrastructure being built. For any purpose, whether discovering property-specific information about a material used or modeling a modification to the original plan, this 'spreads knowledge of the project among all stakeholders and allows for more collective decision-making.' BIM uses data and software to visualize and manage the entire building lifecycle - from its inception and design to its eventual or potential demolition and reuse of its materials. Spaces, systems, products and sequences are shown on a relative scale and the entire

project. This also allows the construction to be digitally tested - almost like a 'digital twin' - and any potential errors or incidents reported before and during each stage in the project (21). This is where projects like the UN-funded Minecraft Urban Planning Project demonstrate the huge potential of virtual reality in engaging the local community to plan and build their own local area. This initiative has now been rolled out all over the world in developing regions. With both BIM and CIM, knowledge of assets increases continually throughout the project lifecycle, and it is much easier to spot potential errors or discrepancies before and during each phase of the project, reducing the risk of errors and/or accidents, minimizing costs failure, and increasing profitability. It allows architects to make informed design choices, citizens to virtually test projects before they are implemented and have access to transparent information about projects happening in their local area, and builders to reduce waste, reduce site downtime costs, and complete projects in a timely manner. CIM (City Information Modeling), a relatively new adaptation of BIM technologies, goes a step further than BIM, integrating information provided by BIM into broader city planning and development. There are several benefits of integrating BIM at different spatial levels within a city that can be listed as follows (21):

Centralize and contextualize information: BIM (Building Information Modeling) allows architects, builders, and designers to manage the entire project lifecycle of any infrastructure or building construction - from its inception and design to its eventual or potential demolition and reuse of its materials - in one place.

Increase Collaboration: BIM is a collaborative tool that facilitates collaboration and enables better information sharing, management, and communication between the different teams involved in a construction project. All teams contribute information and benefit from information entered by others.

BIM-enabled smart 3D models encourage coordination of services. Much of the geospatial data involved in these models is continually collected from sensors implanted everywhere - on infrastructure, CCTV cameras, across road network - though of course it's combined with existing GIS datasets for more context. The compilation and use of data from different areas of the city - and different public service departments - promotes a teamwork approach, allowing not only the coordinated design of individual buildings, but also of entire areas, facilitating integrated services and coordinated maintenance programs for certain assets.

Reducing risks: When building public infrastructure - a road, a tunnel, a bridge, or a building - the risks are high. Creating models of the environments, in which new projects will be placed through BIM and CIM, allows testing the project before and during the construction process and serves as a sort of virtual 'digital twin' or 'proof of concept' stage.

Improve productivity, efficiency, and results: In traditional construction processes, key knowledge of the project and assets are often lost between phases when one team hands off to another. BIM

prevents this by centralizing all information, so that all resources are shared, and standardizing procedures and standards are integrated. In this way, the experience is consistent and standardized, and all relevant information and errors are consolidated into a single platform so that they can be systematically resolved by developers and management. This allows them to perform more effective performance analysis and make more accurate assessments of the condition of the assets involved, seeing exactly how the buildings at hand are functioning and where any efficiencies can be achieved and enabling better utilization of assets and resources (31).

Making cities more environmentally and socially sustainable: apart from the economic benefits of BIM models mentioned above, there are also social and environmental benefits. Cities want to use data to regulate the quality of life and safety and security of their communities beyond economic opportunity. BIM and CIM offer a way to do this. For example, more accurate arrangement of materials, enabled by BIM, will result in less waste going to landfill. An improved simulation of energy analysis, especially across entire regions (37), would result in lower energy demands from the built environment and help reduce greenhouse gas emissions. Simplifying the building process and being able to visualize in real time how the entire ecosystem of a building or city is functioning allows those who manage these systems (whether small or large) to adjust resources and energy use accordingly or set up flexible models of consumption that respond to the trends reflected by long-term data. BIM can also have social impacts. As we have seen above, it can be used as one tool to engage the public and communities in assessing the needs of the built environment in the future and to help local authorities make better decisions regarding planned investment in infrastructure and design buildings and sites.

Virtual reality software also allows planners to visualize developments in an immersive way before they are built. They can identify and correct design elements that may impede community life, negatively affect certain social groups, or affect the making of places before they are actually implemented. This is especially important when it comes to involving the local community in the design process. Here, construction projects are wirelessly monitored, making them safer for the surrounding community. It relies heavily on the Internet of Things - using low-power, long-range sensors embedded at key points on a construction site to collect real-time data and transfer it wirelessly to servers located elsewhere. The data is then processed by the software to produce actionable insights.

These sensors can transmit information in real time. For example, ground stability, or tilt measurements in metro or train line constructions. The ability to continuously monitor the construction site and model future stages of construction also means that the margin for error is significantly reduced, reducing the risk of accidents that could endanger workers or those living nearby or cause inconvenience. This means, for example, that new metro or train lines can be built to connect marginalized communities (physically, socially and economically) to other parts of the city without the need for displacement and/or evacuating families due to safety concerns. Wireless monitoring of construction projects means improved tools and monitoring, which in turn means

that neighboring communities are less likely to be affected by noise pollution or ground movements since there is less margin for error as the whole process is accurately monitored and managed in real time (25). Applications or programs that use artificial intelligence and/or machine learning can perform a number of tasks during the construction and development planning phases. There are a number of artificial intelligence technologies now available, such as detecting errors in construction more effectively than the human eye, thus improving the safety and efficiency of construction sites. These applications generally focus on using machine learning for pattern recognition and machine vision for image recognition. Smarttag by Smartvid.io, Smart Construction by Komatsu, and Doxel are all examples of this. In the future, heavy equipment will likely have cameras placed on it that can collect data, and in combination with drone-based terrain visualization, artificial intelligence will allow construction site operators to make evidence-based decisions about how best to ensure productivity and safety.

On the other hand, it will help them monitor the fixed infrastructure and transportation of people/equipment in real time. Artificial intelligence will also be increasingly used in the planning world to not only make processes more efficient but also, together with citizen input, to better identify the needs and wants of the public. One of the examples is urban mobility management. As it is, data collected by smartphones, for example, is already used in some cities to determine movement across the city on various modes of transport. Citymapper is an excellent example of an app that provides a service to citizens, allowing them to plan multimodal trips around the world, while also collecting data on how people travel through these cities. When this data is combined with artificial intelligence, it can then be used by city councils to manage traffic and public transport in real time and to improve their long-term transportation planning strategy. In other words, planners can use large datasets and models generated through artificial intelligence software to determine the best future changes to implement, whether changing road networks, creating new cycle paths, or creating designated pedestrian zones (32). We can talk here about autonomous robots, which is a very promising new technology entering the construction industry.

They provide automation of repetitive and tedious tasks normally performed by humans, improving overall operational efficiency and productivity. For example, robotic construction workers are replacing humans in essential jobs on construction sites as they can work continuously and faster than humans. One robot, invented by an Australian inventor, can lay about 1,000 bricks per hour, roughly 150 homes a year; another, Tiger Stone road builder, works four times faster than a normal human builder, laying roads "like a carpet." . Other types of autonomous robots for the construction industry also include white-ant--inspired robots, which, like white ants, collaborate on the same project, interacting with what they encounter, and bridge-building robots, which can actually 3D print bridges (usually steel) in the middle -air. These robots should make the construction process safer and more efficient in the future, as humans no longer need to carry out basic construction tasks or those in hazardous environments. Machines can perform the simplest, traditionally complex constructions such as building bridges (29).

References

Ahmad SF, Rahmat MK, Mubarik MS, Alam MM, Hyder SI. Artificial Intelligence and Its Role in Education. Sustainability. 2021; 13(22):12902. https://doi.org/10.3390/su132212902.

Akhtar, Mahmuda & Moridpour, Sara. (2021). A Review of Traffic Congestion Prediction Using Artificial Intelligence. Journal of Advanced Transportation. 2021.

Alfouri, A. (2017). Open Access Applications in Libraries. In First International Conference on Libraries, Information and Documentation: Open Access to Information. Remah Research Center..

Alfouri, A., & Abudrea, S. (2017). Syrian asylum and its impact on the educational sector in Jordan. In risk management in the Islamic financial industry conference (Vol. 1). Remah Research Center.

Alfouri, A., & Khalaf, S. (2017). Cloud Computing Applications in Libraries. In ICEPUB-The University of Jordan Library. University of Jordan.

Alfouri, A., & Sakher , S. (2023). Quality assurance in medical education at the faculty of medicine, Al-Balqa Applied University: Case study. Journal of Jilin University (Engineering and Technology Edition), 42(07-2023). https://doi.org/DOI 10.17605/OSF.IO/AKPW5.

Alfouri, A., Khalaf, S., & Al Khateeb, K. (2018). Green cloud computing and environmental sustainability. ICEPUB-The University of Jordan Library. University of Jordan.

Allam, Z., & Dhunny b, Z. (2019). On big data, artificial intelligence and smart cities. Cities, 89(June 2019), 80-91. https://doi.org/10.1016/j.cities.2019.01.032.

Almahairah, M., Al- lawama, H., Salah, L., Alhawamdeh, A., Ali Hijazi, H., AlFouri, A., & Sakher, S. (2022). The Mediating Effect of Employee Behavior on Strategic Human Resource Management Practices and Organizational Performance in Jordanian Telecommunication Companies. International Journal of Membrane Science and Technology, 10(3). https://doi.org/10.15379/ijmst.v10i3.1708.

Appenusa company (2023, August 22). https://appenusa.company/.

Artificial Intelligence in smart cities and urban mobility [Film]. Policy Department for Economic, Scientific and Quality of Life Policies- European Parliament. (2023).

Assbeihat, J., & Rafi, N. (2021). Management of artificial intelligence traffic systems in smart cities. Academy of Strategic Management Journal, 20(2).

Basterrechea, R. R. and Polisena, V. Y.. Smart City as Geometry of Nature - Smart Government's Ability to Model Public Affairs as Quantum Iteration (2019). (French Version: https://core.ac.uk/download/pdf/322501046.pdf).

Dash, B., & Sharma, P. (2021). Role of Artificial Intelligence in Smart Cities for Information Gathering and Dissemination (A Review). Academic Journal of Research and Scientific Publishing.

Golubchikov O, Thornbush M. Artificial Intelligence and Robotics in Smart City Strategies and Planned Smart Development. Smart Cities. 2020; 3(4):1133-1144. https://doi.org/10.3390/smartcities3040056.

Hamour, Randa Abu, Areeg Alfouri, and Muhammad Alshurideh. "Remote Working in the COVID-19 Era." The International Conference on Artificial Intelligence and Computer Vision. Cham: Springer Nature Switzerland, 2023.

Herath, H., & Mittal, M. (2022). Adoption of artificial intelligence in smart cities: A comprehensive review. International Journal of Information Management Data Insights, 2(2022).

https://doi.org/10.1016/j.jjimei.2022.100076.

Hryniewicz, Konrad & Grzegorczyk, Tomasz. (2020). How different autonomous vehicle presentation influences its acceptance: Is a communal car better than agentic one?. PloS one. 15. 10.1371/journal.pone.0238714.

Jayachandran, T., Dinesh, S., Eswaran, M., Praveen, K., & Thennarasu, S. (2020). Smart Caregiver using Artificial Intelligence. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 9(III).