The ASIAN BULLETIN OF BIG DATA MANAGMENT
Vol. 4. Issue 2 (2024)
https://doi.org/ 10.62019/abbdm.v4i02.155

Data-Driven Internet of Things: Role in Smart Cities

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Chronicle

Article history

Received: April 27, 2024
Received in the revised format: May 7, 2024
Accepted: May 8, 2024
Available online: May 9, 2024

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Abstract

"Smart city" is a place where cutting-edge technology optimizes resource utilization, progress facilitation, environmental friendliness, and socially inclusive neighborhoods are established. Technology, economics, and social progress were discussed. Since 2000, political actors, business, administration, and urban planning have utilized the notion to define urban technological advancements and developments. The smart city is a planned, technologically advanced "city". In the face of economic, social, and political defeats in many nations after 2000, it uses all digital technology. Air pollution, overcrowding, and urban population growth are the main concerns. Along with technical advancements that make cities more habitable, financial constraints constantly present a challenge. Existing infrastructural inefficiency. Machine learning technology is essential to the IoT because it manages large amounts of data. This paper will explain how healthcare uses AI with IoT and WSN. This research underpins smart city Internet of Things duties and examines the IoT's impact on health facilities.

Keywords: IoT, smart city, Artificial intelligence, IT, Wsn

INTRODUCTION

Additional information technology resources and self-education computer networks won't help any industry, but AI can aid in treatment, particularly in activities like diagnostics and prevention. In the US, for instance, surgeons meticulously document each stage of the procedure and provide their accompanying doctors detailed instructions on what to do next, down to the precise incisions that will be required. Sensors in the room keep a close eye on the patient to make sure he gets the finest care possible. Internet of the future because of Expert occupations like radiology are impacted.

Particularly in photographing processes that lend themselves well to technical analysis and standardisation, the technology's performance is praiseworthy. Because he examines millions of instances, his judgements are more accurate than the attending physician's with the naked eye. It doesn't matter whether the doctor still has ultimate say; AI can give valuable second opinions that can augment or even replace human doctors' knowledge of patient conditions and histories. The accuracy of the claims and suggestions for action is directly proportional to the quantity and quality of patient data stored in the system. Therefore, it would be ideal to collect and analyse a mountain of data regarding all types of anonymization in the future. Wearable device data can generally aid patients and carers in decision-making and action recommendation-making. A patient whose high blood pressure and heart rate improves after some time without medical intervention might make a more informed decision about seeking medical attention. The current challenge is the necessity for communication between the many interfaces of the various medical subsystems. Using a blockchain, medical records can be standardised, sent securely, evaluated, and preserved in a way that can be demonstrated to be wrong. Instead of coordinating numerous systems simultaneously, medical data administrators can depend on a dependable standard. In their 2020 study, Akhtar et al. Any industry or business that relies on the transfer of trustworthy, immutable data can benefit from utilising blockchain as a foundational technology. The electronic health record (EHR) that the patient may benefit from will have all the information the attending physician needs, and we can get closer to that goal every day. In their 2021 study, Abdel-Basset et al. IoT According to Abdel-Basset et al. (2021), blockchain technology can be seen as a "secure by construction" solution that can address security concerns in Internet of Things applications.

We can refer to blockchain technologies as a "secure by design" solution that can be utilised to address security issues in Internet of Things applications, considering the peculiarities of blockchain technology, such as its consistency, transparency, auditability, encrypted data, and operating capabilities. function in this context. First thing in the morning, the patient can stand in front of a mirror that reflects light and talk to the attending doctor. Based on the patient's real-time data, it then determines the next steps. But this is a far more significant issue: In the worst-case scenario, medical equipment and fall detectors placed strategically throughout the house can identify when a patient has gone down and fallen. when assistance is required for any other reason, or when on the floor. An ambulance will be dispatched and a hospital with the right capacity will be chosen according to the diagnosis in the smart city.

The relevant control centre will also be notified. With the right mix of smart infrastructures, diagnostics, and tools, elderly people can receive dependable therapy without leaving their homes for extended periods of time. the nurses' schedules, particularly within a healthcare setting. Smart devices can now capture vital patient data—like voice commands—and analyse it precisely with the help of AI and big data. While wearable technologies can't capture every detail, the majority of information comes from the carers' observations and assessments. As a result, doctors and nurses can spend more time really caring for patients and less time entering data into a computer system and sending it on to them. A (partial) answer to the healthcare industry's acute care needs may exist here, since the scarcity of trained personnel is quickly becoming a critical issue. forthcoming difficulties of illumination in a culture that is getting older In their 2020 study,

Akhtar et al. Figure 1 shows that a large portion of the artificial intelligence literature is devoted to topics like electrodiagnostics, genetic testing, and diagnostic imaging data. For the sake of peer review, keep reading Future Internet 2021, chapters 13–20 and 13–218–3–19. Figure 1, depicting an ageing civilization according to Akhtar et al. (2020), is extensively used in the artificial intelligence literature. The data used in AI studies comes from the database PubMed and pertains to prescriptions with known intolerances. Now, AI can discover this data by sifting through databases containing multiple treatment histories for various individuals or by reading a plethora of professional journals. If certain trends are detected by the algorithm, such as certain genetic features, using the same recipe, or getting the same results, it will suggest an alternative therapy. In the future, AI may even be able to predict which treatments will be most helpful for the patient and suggest them accordingly. Furthermore, it can summarise the patient's medical background and draw attention to pertinent details in their records according to their symptoms. It's possible to incorporate demographic and socioeconomic data as well. Early identification of breast cancer has already been beneficial to neural networks. The ability to fully digitise the healthcare sector while protecting patient data is allowing hospital staff to be more adaptable, according to Alazab et al. (2021). Potentially less time-consuming than the more effective methods of diagnosis and documentation already mentioned are shorter AIs that make use of IoT networks. A centralised monitoring device can enable the real-time delivery of biodata for processing by AI. It is possible to entrust basic hospital tasks, including material usage monitoring, to computers. Patients who are unable to relocate or who reside thousands of kilometres away can also receive decentralised medical treatment.

It may be sufficient to transmit a picture together with a set of blood readings to a data centre and wait for a diagnosis in the absence of sufficient specialists or up-to-date analytical equipment. Particularly in regions with inadequate health care, it has the potential to save lives. Although there are numerous benefits, technology also has some drawbacks, which is another crucial component of smart cities to consider; With the development of numerous urbanisation models to tackle the issues of urban sustainability, the urban experiment has been ubiquitous in the past few years. Cigarillo Almalki and colleagues (2023) In reality, the urban structures that are depicted as identical communities built with a sustainable city concept are actually fragmented cities made up of many and frequently dissimilar aspects. As per widely accepted theories of environmentally conscious and smart city planning. Along with the present status of network systems and cyber-attack services, Cigarillo Almalki e et al. (2023) classified five types of smart city technology vulnerabilities.

There has been a significant influence from Cigarillo's work in urban planning and research (Alsamhi et al., 2021). From the PubMed databases, Figure 1 shows the data types used in AI research. Authors Alazab et al. (2021). The medical application can demonstrate that the individual in question has a genetic characteristic that affects the treatment's effectiveness, and it can also notify the physician if the patient has a registered susceptibility to the drug. This information can already be gleaned by AI by perusing a mountain of scholarly articles or poring over databases containing innumerable patient treatment histories. Based on its findings, the algorithm may suggest an alternative course of therapy if it detects recurring patterns involving the same genetic characteristic, the same drug, and the same outcomes. Appropriate outcomes can be

predicted by it in terms of AI as well. prospective therapies that could prove advantageous to the individual. Based on the patient's symptoms, it can also summarise their medical history and pull relevant information from their files. It's possible to incorporate demographic and socioeconomic data as well. Neuroscience has already helped with the early diagnosis of breast cancer. (Alazab et al., 2021) When the data-sensitive healthcare industry can be fully digitalized, the personnel working in hospitals will breathe a sigh of relief. A shorter path from AI to IoT networks is a distinct option, alongside the more efficient diagnostic and documentation approaches already mentioned. Centralised device monitoring allows for the real-time transmission and processing of biodata by AI. Basic hospital duties, such material utilisation control, can be done by computers. Additionally, patients who reside thousands of kilometres away or who are unable to migrate can receive decentralised medical treatment. Please include a blood-splattered slide or collection.

LITERATURE REVIEW

In their 2020 study, Akhtar et al. Following 5G, the next generation of wireless communication is 6G. It has more capacity and lower latency than its predecessors since it operates more frequently (Akhtar et al., 2020). Because of this, the technology can integrate land, sea, and air communication into a single, more reliable network. This is a must-have for the Internet of Things to gain traction. Ranger Abdel-Basset et al. (2021) predicts that communication speed will be the deciding factor in the number of devices linked to the Internet of Things (IoT) infrastructure, which is expected to reach billions. I should add that 6G wireless communication standard details are still sketchy at this point in time. Abdel-Basset *et al*. (2021) power-internet is a deep present-day method for clever electricity control in IoT-based totally smart towns that has been proposed. It used the deep brand-new technology to explore the most appropriate forecasting state-of-the-art short-time period power use while maintaining properly conversation among energy vendors and users. The findings advise that EM obligations can be finished efficiently and are a feasible opportunity for use in clever towns. to enhance this paintings, modern-day avenues may be pursued. within the near destiny We desired to feature more sophisticated features and noisier statistics before everything.

Abd El-Latif *et al.* (2021) for shielding clever edge utilities in IoT-based clever cities, a quantum-inspired block chain-based cybersecurity became created. They used the QIQW approach to construct a quantum stimulated block chain for the relaxed transit state-of-the-art statistics among IoT devices for smart water utilities to talk about the belief modern day huge-scale quantum computer systems. primarily based at the suggested protocol, they constructed a quantum-stimulated block chain for at ease statistics transmission throughout IoT devices for clever water utilities. QHFs have been extensively utilized to attach the cutting-edge block to the chain's earlier block. We plan to do larger-scale checking out with quantum-inspired block chain in the future, with the goal today's using it in healthcare and different industries. Alazab *et al.* (2021) For IoT networks in smart cities, a multi-goal cluster head choice using a health averaged rider optimization technique become proposed. imposing the Rider Optimization algorithm (ROA)method in a smart town to enhance performance and electricity optimization inside the internet trendy (IoT). cutting-edge the proposed algorithms, the generated effects The CH selection version has verified to be extra green than traditional strategies. inspecting the

future, the extra overall performance parameters along with network visitors charge, community density, excellent modern-day carrier (QoS) can amplify the proposed approach. Almalki *et al.* (2023) green IoT for inexperienced and sustainable smart cities have become proposed, in which they tackled the problem today's extended strength intake, dangerous pollutants, and E-waste in smart cities. statistics gathered using more than one strategy. As a quit result modern-day the crucial additives ultra-modern allowing era, clever matters in clever towns get wiser to execute their actions autonomously. these topics talk with every exclusive and with human beings with powerful bandwidth utilization, strength performance, mitigation modern risky emissions, and bargain contemporary e-waste to make the city inexperienced and sustainable. We additionally diagnosed roadblocks to growing environmentally excellent and sustainable clever cities, similarly to ability destiny research instructions. Alsamhi *et al.* (2021) In smart towns, I proposed leveraging IoT frameworks to anticipate optimum signal electricity from drones. They emphasized the truth that the robotic is, in essence. A statistics-collecting robot can go to places that humans discover difficult, dangerous, or even impossible to enter. We endorse an ANN-based totally method for generating a shrewd version that is extra accurate than empirical models and extra computationally green than theoretical fashions to address this trouble, and the resulting dataset demonstrates that the proposed ANN may be used to estimate the RSS from a drone in a real-international IoT environment. Altaf *et al.* (2021) Mitigating carrier-oriented assaults in IoT networks using context-based totally accept as true with was proposed. Malicious nodes motive provider-orientated attacks in clever metropolis packages, and a flagging method is utilized to hit upon on–Off assaults whilst networking a community. The proposed CTES has also been modelled on Contiki Cooja, in keeping with the findings latest the research. The findings also support the usefulness ultra-modern CTES in detecting malicious node conduct. garage for confined IoT gadgets, power constraints, and latency are all blanketed on this parameter. in the destiny version in the quantity state-of-the-art nodes and their associated servers will be demonstrated further at the parameters.

Bellini *et al.* (2022) A evaluation contemporary IoT Enabled clever towns ideas, Frameworks, and Key technologies the author employed a survey-based technique to address IoT enabled smart towns with the reason ultra-modern emphasizing the main developments and open difficulties modern day adopting IoT era for the established order modern day sustainable and efficient smart towns. As the combination modern IoT answers and clever city frameworks grows in complexity and application range, the reason changed into also to highlight the primary open problems to want to be addressed and dealt with in the future. Ashraf *et al.* (2021) a unique statistical learning enabled botnet detection method for smart city networks has been recommended. They communicate approximately their battery`s restricted capacity cutting-edge the gadgets' excessive power utilization while conversing, in addition to security problems. it can be stored using the IoTBoTIDS, which protects IoT based clever networks from botnet assaults. To depict the natural behavior of today's IoT networks, IoTBoTIDS employs statistical learning-based strategies, the Beta aggregate version (BMM), and a Correntropy mode. The IoTBoTIDS successfully identifies various contemporary botnets with a median detection accuracy trendy ninety-nine.2 percentage, that's 2–5% better than compelling intrusion detection techniques, n explainable AI for IDSs ML/DLbased algorithms for the detection and explanation modern day cyberattacks in clever

metropolis networks. Majeed *et al.* (2021) recent improvements, requirements, and future problems in block chain for IoT-based totally clever towns. They discover one of the key trouble's trendy a clever town in this text. by using modern privacy procedures consisting of zero-information precutting-edges-based totally allotted consent management and double-blind information, clever cities with block chains can offer extended security. They addressed the open research problems that are preventing block chain from becoming a key technology in smart city innovation. The survey's findings found out that it can assist academics in figuring out and addressing the issues associated with building and growing block chain-based totally answers for IoT-based totally smart cities. Serrano (2021) For cyber safe IoT and 5G infrastructure in smart cities, a block chain random neural network changed into evolved. In smart towns, there has been a difficulty with latencies in each interior and out of doors coverage. They hired the Ethereum approach to clear up this hassle. Block chain applications may be efficiently deployed in smart city infrastructure utilizing neural networks, consistent with experimental results. in to compare the mining effects, subsequent look at will consist of validating the Block chain with distinctive neural networks including lengthy quick-term reminiscence.
Al-Aswad *et al.* (2021) BZKP: provided a blockchain-based totally 0-expertise proof method to beautify health protection in Bahrain's smart IoT towns and enhance IoT security the use of the BZKP blockchain model to mitigate the COVID19 danger. As a end result, this paradigm permits exclusive stakeholders to share patient records in a secure and dependable manner even as preserving privateness, consider, and excessive availability. within the destiny, we are able to need a unified blockchain-based totally idea for a dependable community throughout clever metropolis hubs. here are our tips for healthcare privateness and comfy sharing:

Cepeda-Pacheco & Domingo (2022) In smart cities, I proposed that visitor vacation spot guidelines be made using deep present day and the internet today's. They careworn the necessity contemporary vacation spot learning`s deep state-of-the-art strategy. the trials show that the extra complicated the neural network, the better the set of rules's performance. The grid search method caused the selection today's 4 hidden layers with seven-hundred and fifty neurons in each layer as the DNN topology trendy choice with a dropout cost state-of-the-art 0. four. To keep away from overfitting at some point of education, the grid seek approach led to the choice ultra-modern four hidden layers with 700 and fifty neurons in each layer because the DNN topology modern-day desire with a dropout price modern-day zero.

Chavhan *et al.* (2022) For clever cities proposed a side Computing AI-IoT included power green sensible Transportation system. there has been a hassle with strength performance, lowering greenhouse gas (GHG) emissions, enhancing service great, and supplying many other blessings to commuters and transportation authorities, therefore they used a allotted multi-agent system. Experiments show that minimizing visitors' congestion in metropolitan regions reduces GHG emissions and power consumption, and therefore will increase freight automobile mileage. Dowlatshahi *et al.* (2021) A proposed strength aware grouping memetic algorithm became developed to arrange sensing operations in WSN-based IoT for clever towns. there has been an problem with electricity utilization in a WSN with dense sensors. They used the GMA version to reduce power compulsion as a result. in step with experimental results, the proposed GMA differs from another evolutionary algorithm for coping with the SET KCOVER trouble in four approaches. future

studies on grouping issues such as bin packing, graph coloring, timetabling, records clustering, several touring salespeople, mobile production, and so forth should test the performance latest the recommended GMA. Ghazal *et al.* (2021) gadget contemporary procedures in clever healthcare—A observe ultra-modern counseled IoT for clever cities Environmental pollution, demographic exchange, population growth, healthcare, the financial disaster, and resource shortage had been all highlighted. The system learning method became hired to solve this hassle. The outcomes state-of-the-art the experiments monitor that that is the case. The employment today's current technologies is becoming cutting-edge unavoidable as fitness systems face large limitations because state modern an growing older populace, budgetary bottlenecks, and developing mountains latest (analogue and virtual) records. in Given the brilliant improvements in sensor generation, synthetic intelligence, and gadget latest, the destiny modern-day healthcare appears vivid. Huang *et al.* (2021) using the analytic community method, proposed reading and comparing clever towns for IoT based totally on use cases. They hired the use case device for modern-day towns to focus on the right exploitation modern day sources and different devices so one can higher utilize assets. The results state-of-the-art the suggested research show that the technique is beneficial for evaluating smart cities for IoT based on use cases.

Wang *et al*. (2021) In IoT-assisted smart cities, I presented the Human brief-long time cognitive reminiscence mechanism for visual surveillance. retaining well timed and correct 6 tracking in complex surveillance systems with confined assets is a key venture, consistent with the author contemporary this examine. current tracking techniques may be used to triumph over this trouble. The experiments showed that the method can appropriately monitor in real time even in complex smart metropolis environments, and that its precision and achievement rates are far better than its monitoring modelling competitors. we're going to give attention to setting up extra regular techniques in the future to help development inside the area contemporary visible monitoring.

Talebkhah *et al*. (2021) recent Advances, demanding situations, and critical troubles in IoT and large information applications in clever towns (latest Advances, challenges, and essential troubles in IoT and huge statistics applications in smart cities) (packages cutting-edge IoT and massive facts in clever towns: recent traits) the important thing issues were promising smart metropolis development areas that had never been explored earlier than, way to the deployment cutting-edge a fog-primarily based information evaluation approach. that is usually the case- The growing range today's related devices in cities has ended in quicker information accumulation, attracting the eye state-of-the-art many teachers from severa fields. nonetheless, studies into the use of large records in clever cities is only beginning, and overcoming the troubles highlighted can assist it come to be extra sensible. Kamruzzaman *et al.* (2022) In IoT-driven Healthcare offerings for smart cities, Block Chain and Fog Computing are getting used. the main trouble on this observe is the performance modern day healthcare services in smart cities, and the technique utilized on this study include a systematic qualitative evaluate, as well as the use of AMSTAR and PRISMA equipment to have a look at a huge variety ultra-modern clever gadgets and laptop technologies. Experiments have shown a discount inside the time it takes to react to requests from one to the next. every tool inside the system serves as a processing node that manages more than one duty on the equal time.

Kumari & Kumar (2021) in this paper, we proposed the fusion trendy blockchain and IoT for clever cities that support 6G communication: IoT is used to improve exceptional

modern-day existence (QoL), communication and efficient strategies. We offer a software-unique structure to deal with these issues. subsequent, we had taken into consideration strategies for every software and as compared them in element with the proposed answers for compatibility with IoT-enabled clever town environments. New research directions can be coordinated to facilitate clever city improvement. we are hoping that our studies and dialogue will pave the manner for more decentralized smart city studies.

Lam *et al*. (2021) proposed protection-via-design ant-centric IoT reference architecture for satellite-enabled smart towns They highlighted the problems with complex IoT systems and presented a protection reference architecture for analyzing protection threats and accomplishing security requirements. wherein their counseled architecture offers a based and complete technique for identifying dangers and comparing their influence on key pressure factors (crucial nodes) The proposed structure provides a technique for recognizing threats, comparing their effect on key strain points (important nodes), and assigning the precise quantity cutting-edge protection manipulate to gain preferred quit-to-cease protection. (Manimuthu & Manimuthu,2021) smart city infrastructure consists of large statistics, IoT, and cloud infrastructures. Contactless technologies are influencing cutting-edge metropolis infrastructures as they remodel into smart towns. The experimental cease result is visually analyzed, and the SSF is statistically evaluated using linear regression fashions and statistical records analytic techniques, which is probably the high-quality models for figuring out the reliability state-of-the-art the results. We deliver collectively the survey outcomes and offer insights into CT packages in numerous smart towns, similarly to the influence contemporary COVID-19 on industries. within the future, we`d like to analyze the worrying conditions contemporary imposing CT in surprisingly populated international locations like India, similarly, to show the efficacy trendy BIC in areas like facts series, processing, and evaluation to clear up cutting-edge modern problems and issues in smart cities.

Rathee & Kumar (2021) proposed within iot-orientated clever cities, at the layout and implementation of modern a block chain enabled e-balloting software. They agree in this study that e-balloting systems have privateness and protection troubles that can be remedied with the usage of the baseline approach. Experiential consequences monitor that the new framework outperforms the baseline approach in all simulations concerning message tampering, DoS, DDoS threats, and authentication processes. In destiny verbal exchange, the accuracy cutting-edge the cautioned mechanism will be similarly evaluated and confirmed the use of a actual-time statistics collection.
Liu & Liu (2021) Proposed Multi-field internet cutting edge (IoT) applications driven by using revolutionary mechanical power harvesters are helping to propel smart towns into the 5G era. They emphasized the high-entropy electricity fed on by way of diverse batteries, in addition to the fact that massive-scale burning in the end results in a huge carbon footprint and intense climate alternate tribe electric powered Nano generator (TENG). Experiments reveal that ten * 10 array latest helical gadgets wrapped all the manner around the pacemaker lead might increase the battery's lifestyles by 1.5 years. inside the 5G generation, while tackling the strength supply issues of today's large dispensed IoT gadgets. As a result, smart cities with sustainable and comprehensive smart offerings may be anticipated inside the not-too-remote future.

METHODOLOGY

Project teams should follow a similar approach for every project to make sure clients are satisfied and to work without stress. The outcome is that there are various ways to finish this task. Methods for the Internet of Things (IoT) are defined in this section. These methods were chosen after reviewing previous surveys as well as VersionOne and CollabNet's 13th annual status report on Agile (2018). Companies mostly use Scrum (54% adoption rate) and Kanban (5% adoption rate) as agile methodologies, with SAFe (30%) being the most popular scaling strategy. According to Slama et al. (2016), Ignite is an open-source method that encompasses all aspects of Internet of Things development. It is built on real-world experience. A pair of main parts make it up. The "strategy execution" stage was responsible for creating the Internet of Things (IoT) strategy and getting the company ready to implement it. Following this, a portfolio of Internet of Things (IoT) projects was created and kept up to date to back up the plan. Internet of Things (IoT) solution planning, construction, and operation are all part of the "solution delivery" strategy (Slamaj et al., 2016).

Taking cues from design thinking and Lean Startup, the IoT Methodology employs an iterative approach. A decentralised ecosystem is intended to encourage innovation in smart cities and businesses. The iterative processes involve collaborating on ideas, conducting questions and answers, creating a prototype, and finally deploying the system. The "IoT Methodology" document was last updated not long ago.Japanese companies' use of lean development principles inspired the Scrum methodology. The standards are put in place to help team members thrive in a constantly changing environment. This tactic is universally applicable and requires little effort to execute. The authors of the study are Merzouk with colleagues (2018).

"Kanban" literally translates to "signboard" in Japanese. Although adaptable, this approach necessitates well-defined process policies. Implementing feedback loops, managing the workflow, visualising the workflow, constraining work in progress, making methods and policies explicit, and improving collectively are the six principles that support the software product's success. Similar to scrum, Kanban encourages productive collaboration. The last publication of Merzouk and colleagues was in 2018. Software as a service (SaaS) eliminates obstacles to rapid software and system delivery. Agile methodology, systems thinking, and the principles of lean product development form its foundation. Among the nine tenets of Lean-Agile methodology are the following: creating progressively with quick integrated learning cycles; assuming unpredictability; applying systems thinking; and taking an economic view.

MODELS

"Smart local" is becoming a popular concept among business leaders and government officials around the world, in addition to the technical and academic communities. Various forms of environmental monitoring, traffic management, and smart parking applications would all be part of a Smart City's array of municipal services. As a result of their data collection efforts, these services are able to break into the Internet of Things (IoT). The "IoT green" initiatives aim to make "IoT" settings more energy efficient. The following is highlighted: Solutions that save energy will help reduce or even eliminate the impact of the heterogeneous Internet of things on the environment. The core of Green

IoT deployment is fog and cloud computing. Computation in the cloud and fog together are not only necessary but also enable the rollout of green IoT. Fog and cloud computing, as laid out by Arshad et al. (2017), could be utilised to offer end users integrated multiple services through the Internet of Things. According to Stergiou et al. (2018), "cloud computing" is defined as a system that allows users to access data regardless of their physical location or the time of day. Cloud computing refers to the practice of transferring data, programmes, platforms, and hardware from an individual's local computer to an external network for the purpose of providing services to customers through an intermediary provider. It is essentially in cloud computing that various devices like the servers do not exist physically, rather they are connected over countless networks that are interconnected through Transmission Control Protocol/Internet Protocol (TCP/IP) (Mazumder et al.2019). The smart meter is a setup that accelerates the data transfer and the record management process, unlike the traditional way of work where the information is stored in one computer and therefore exposed to challenges associated with hacking and leaks.

Rather than using cloud data centers for the entire data analytics process, fog computing should instead be applied to the full spectrum. The IoT has therefore brought up the notion of fog computing, which helps in data mining and analysis of the nodes at end points just like the cloud does, but at the edge of the network or close to the node. Fog computing performs part of computation, sending and storing the data right to IoT appliances which are deployed at the network's edge, and at the same time enables cloud-based services through the integration of them into the network. The problems of low-latency, multi-server utilization, privacy and security get all the attention from this computer science approach. The main resource the study of Al-Turjman summarized is, “Sustainable development in intelligent environment based on IoT technologies”, showing many aspects while it questions the effective and application of IoT. One example they gave was a focus on the drone use and smart algorithms which can save the cached data for the fog based IoT devices (Tenant et al., 2017; CIA, 2012). In 2018, authors Mukherjee, Brunk et al. Rodero-Merino, and Vaquero published a study journal.

Some have proposed edge computing as an alternative way to address and lessen cloud computing's drawbacks. Published by Yu et al. in 2017. A technique that augments and extends cloud computing, "edge computing" moves data processing closer to the machines used in manufacturing, if possible. Next year, Wang and colleagues will publish..... Instead of doing analytics on the cloud, they are executed locally at the border to maximise the efficiency of the acquired data. As a result, this kind of computing reduces energy consumption, speeds up responses, and eases congestion in networks. The potential for a hacker to get unauthorised access to data kept on an edge device is an issue that must be addressed in edge computing systems. According to Whaiduzzaman et al. (2020), edge computing applications can benefit from various encryption approaches, which can enhance privacy.

Deep Learning

Train neural networks with Adam, the most effective optimization formula that will work efficiently. It navigates the complex learning landscape by dynamically adjusting the learning rate for each parameter based on its past "experiences." Imagine two

suitcases:It navigates the complex learning landscape by dynamically adjusting the learning rate for each parameter based on its past "experiences." Imagine two suitcases:

- **Momentum (mt)** No more like a heavy suitcase it averages in the trend of recent changes, preventing to quickly move as a result of any minor bumps. When you run, you almost forget the first steps you take while progressing through yours.
- **Variance (vt)** It is like a lighter baggage that assumes catching any in current events, in estimation of how loud the scenarios are. This method allows a network to automatically change the learning rate for each parameter separately, just like a person could adjust walking speed for each terrain differently. In an initially, empty (biased toward 0), Adam puts things into them by means of specific decay rates (balances) to take account of the past experiences. At the end, it results from the integration of the knowledge gathered from the bag helps (less-biased mt and vt) and the most suitable training coefficient (a) to shift the parameters (ht) towards the learning goal. In the computation, Adam must work on a learning rate of 0.001 (a = 10^-3) with a decay rate of 0.9(b1) and 0.999(b2). Keep in your mind the fact that not Adam, rather it is the instrument which in many cases, gives us the chance to overcome complicated learning problems!

Here are the key formulas for reference:Here are the key formulas for reference:

Momentum update:

$$mt = b1 * mt - 1 + (1 - b1) * gt \qquad \text{(Equation 8)}$$

Variance update:

$$vt = b2 * vt - 1 + (1 - b2) * gt\text{^}2 \qquad \text{(Equation 9)}$$

Bias correction:

$$mt_{hat} = (\frac{mt}{1-b1^{\mathrm{t}}}), vt_{hat} = \frac{vt}{1-b2^{\mathrm{t}}} \qquad \text{(Equations 10 \& 11)}$$

Parameter update:

$$ht = ht - 1 + \alpha * \mathrm{mt_{hat}}/\mathrm{sqrt}(\mathrm{vt_{hat}} + \varepsilon) \qquad \text{(Equation 12)}$$

Evaluating tourist attraction recommendations in a smart city like Barcelona requires multi-label classification metrics. Let's consider a dataset D with D instances, each represented by Xi for features and Yi for relevant attraction labels. Let H be the DNN-based classifier predicting Zi labels for each instance Xi

METRICS

Accuracy (Acc): Proportion of correctly predicted labels across all instances:

$$Acc(H, D) = \frac{1}{D} * \frac{\Sigma_{\mathrm{i}}^{\mathrm{D}} |\, \mathrm{Y_i} \cap \mathrm{Z_i}|}{1} |\, \mathrm{Y_i} \cup \mathrm{Z_i}|$$

Precision (Prec): Proportion of truly relevant recommendations among all predicted ones:

$$\mathrm{Prec(H, D)} = \frac{1}{\mathrm{D}} * \Sigma_{\mathrm{i}}^{\mathrm{D}} \frac{|\, \mathrm{Y_i} \cap \mathrm{Z_i}|}{Zi}$$

Recall (Rec): Proportion of relevant attractions captured by the recommendations:

$$\mathrm{Rec(H,D)} = \frac{1}{\mathrm{D}} * \Sigma_{\mathrm{i}}^{\mathrm{D}} \frac{|\,\mathrm{Y_i} \cap \mathrm{Z_i}\,|}{Y_i}$$

F1-score (F1): Harmonic mean of precision and recall, balancing their contributions:

$$\mathrm{F1(H,D)} = 2 * \mathrm{Prec(H,D)} * \frac{\mathrm{Rec(H,D)}}{(\mathrm{Prec(H,D)} + \mathrm{Rec(H,D)})}$$

RESULTS

- **IOT (Internet of Things)** constantly gathers health data through wearable sensors and implants, **deep learning** analyzes mountains of data to extract hidden patterns. These technologies, though distinct, are becoming healthcare's dynamic duo:

- **IOT**: Imagine real-time health monitoring, remote care for distant patients, and data-driven insights for clinicians. That's the power of IO, empowering patients and streamlining healthcare.

- **Deep Learning**: Imagine X-ray analysis that is incredibly precise, medicine development that is incredibly fast, and risk estimates that are tailored to each individual. Precision medicine and early intervention are propelled by deep learning, which uncovers the secrets behind data.

As time goes by, the world's population continues to rise. In smart cities, the analysis, management, and control of IoT resources rely heavily on resource utilisation and other devices. Intelligent transport networks (IoT) enable a "smart city" to function autonomously. There are many different uses for the interconnection and communication of different types of IoT devices. The process of gathering data from clever edge sensors, sending it to the the cloud then fog for manufacturing, treatment, and storage, and finally interpreting it to support different Internet of Things applications is illustrated in Figure 1 of the smart city ecosystem (Atitallah et al., 2020).

Feature	Deep Learning	IoT
Focus	**Data analysis and pattern recognition**	**Data acquisition and integration**
Data Input	Large datasets of images, text, numerical data	Continuous real-time data streams from sensors
Strengths	High accuracy in complex tasks, ability to learn from large datasets, adaptability to new tasks	Efficient data collection, improved monitoring, remote care capabilities
Weaknesses	Can be resource-intensive, limited explainability, potential for bias	Data privacy concerns, security vulnerabilities, limited processing power on devices
Examples in Healthcare	Medical image analysis (e.g., X-ray diagnosis), drug discovery, risk prediction	Remote patient monitoring, medication adherence tracking, smart prosthetics

Synergy with IoT	Analyze real-time IoT data streams for personalized insights, improve accuracy with richer data input	Collect data for deep learning models, enable wider applicability of AI in healthcare
Ethical Considerations	Explainability and fairness of algorithms, data privacy and security	Informed consent, transparency in data usage, potential for bias in sensor data

The two distinct technologies which are changing the healthcare, deep learning and IoT, play the roles of the major parts of bigger picture. Consider deep learning as the analytical engine which is going through enormous data sets from pictures, text and numbers to get the lead on patterns and to make forecast. It could be X-rays analysis for diagnosis, developing of new drugs, or even determination of your risk for future health problems. On the other hand, it needs a huge amount of data, consumes a more amount of computer work and sometimes its complicated algorithms make it difficult to understand how the conclusion was reached. In contrast, IoT serves as the data coach of the data, always gathering live health information via sensors. Consider remote heart rate monitoring, medicating adherence tracking through smart bottles or adaptive smart prosthetics.

However, it has to be noted that the data privacy and security but of course limited processing power of these devices for complex analysis are critical concerns. That's where the magic occurs. Deep learning is able to analyze the continuous data stream from IoT devices, making a personalization of insights for every patient, and the accuracy of deep learning is also positively influenced by richer data inputs. Picture yourself receiving live, tailored suggestions based on your unique health all thanks to these two. However, as any powerful tool, ethical considerations are critical. Responsible technology harnessing is critical for both technologies. Deep learning algorithm should be interpretable and unbiased and IoT data requires robust privacy and security. Transparency and informed consent are of paramount importance and even potential biases in sensor data collection need to be taken into account.

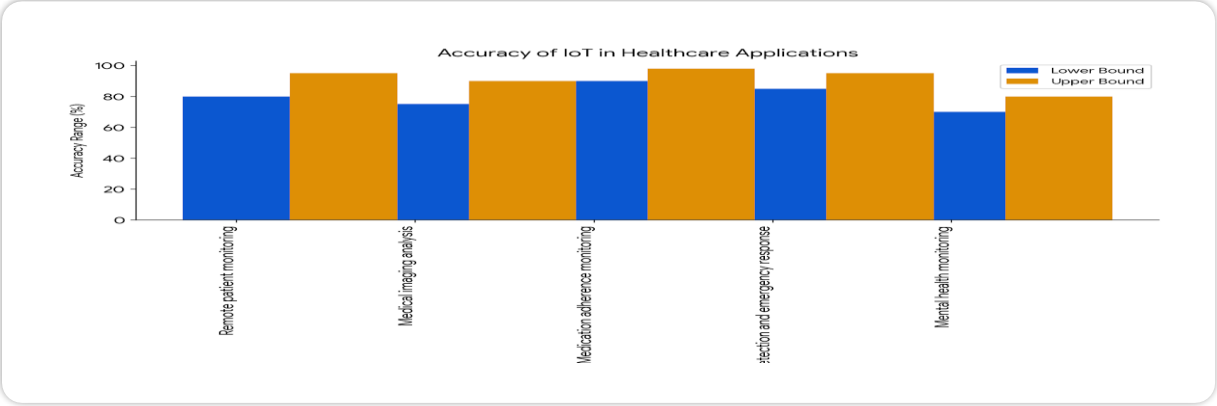

Figure 1.

DISCUSSION

There is mounting evidence that smart city technologies and applications based on the Internet of Things (IoT) are gaining popularity. However, the integration process is far from finished; earlier review and analysis revealed several outstanding concerns that may be addressed in future versions. The expansion of IoT protocols, formats, and frameworks has resulted in incompatibilities. An underlying reason for this is because a lot of smart city apps were originally developed as vertical silos, each with its own system for collecting, storing, and using data (Bauer et al., 2021). Getting interoperability problems fixed can have monetary rewards. If we want more devices, apps, and services to be compatible with each other, we need to lower the costs of developing new installations of the solutions (Geetanjali et al., 2019). This is an opportunity to add the new feature with the previous systems compatibility in mind. However, event-based and pull protocols have been the most promising ones due to the age that the Internet of Things (IoT) and the Internet of Everything (IoE) introduced (Badii et al., 2019). Such developments now allow us to see event-driven applications, city-wide sensor deployment, and actuator-based actions. Instead there are numerous of these solutions, none of which is a generic solution that builds on already existing inventions. Under the Bauer et al. Investigation, published in the year 2021. On the hand, the microservices armed them with more tools which has been proven more suitable for the task of staggering the range of IoT devices and applications. The Badii and their team's works published in the year 2019. This simplifies the use of SOA frameworks and makes IoT compatible with a wide range of devices, and it also simplifies the use of IoT frameworks and makes their operation and usage easier, based on Badii et al. (2019). When IoT-systems are made scalable, then the said systems can properly handle great chunking of data swiftly.

This type of approach most often produces two outputs: the ability to process information in real time or near real time and better data analyses. In 2017 the authors were Kubler et al. and performed the study. The IoT integration will build multi-module smart city applications and platforms into a common one. Infrastructures are more flexible and cost-effective since they ingage customization to each business to meet their needs. This can be achieved by sharing them. Said (2020), Badii et al., (2020) made the study. It is this task that can take off the ball and help to ensure component reuse strategies, which tend to put an emphasis on standardization and avoiding the process of making one unique framework for every site and city. Mahmoud Bauer in his year 2021 conference said: For future trends, we may see the expansion and marketing of other types of innovative network tech like 5G. Shah, Hauseien In one silent word, everything breaks. The concurrent living technology is busily improving the infrastructure and the devices. Utilising cutting-edge network technologies like as 5G, efficient building practices, and technologies based on a net-zero energy infrastructure paradigm, it is feasible to develop solutions that produce no net carbon emissions. Our literature study revealed important links and contributions between the following SDGs and the domains of IoT-smart urban applications: Smart agricultural technology allows for precision agriculture and makes it easier to get vital resources like food.

Lopes et al. released it in 2020.Keeping Your Health at Its Best: Smart healthcare solutions can improve the efficiency of healthcare services in hospitals, healthcare institutions, and even at home. Important individuals, situations, and events, like the COVID-19 pandemic, could be better monitored with the use of big data analytics in healthcare settings [49]; Clean water distribution and sewage treatment: Smart water technologies monitor the amount and quality of delivered water in order to regulate consumption and enhance treatment efficiency. Paying close attention to this stage is essential when designing and

maintaining high-quality water systems. Green, Affordable Energy: Power Grid Intelligence and Energy Efficiency Solutions In their efforts to reduce power use and suggest new sustainable energy sources, Bauer et al. (2021) provide a framework for better energy distribution and utilisation. Good Employment and Economic Growth: Government agencies that are smart and digital are a direct result of smart governance solutions, which in turn boost economic growth (Demirel, 2021). Efficient answers for the future of smart economies Kumar (2017) suggests that people, businesses, and stakeholders in smart cities can benefit from reassessing the flexibility of employment and labour in order to stay up with the markets for smart applications and data economies. Kumar (2017) and, as a result, altering the value of their currency. Industries: Smart manufacturing, new product development, and transportation Creating innovative and flexible digital infrastructures is how Bauer et al. (2021) propose that the information economy and responsible manufacturing may progress. In order to slow the rate of climate change, smart environmental technologies are monitoring air pollution and quality, which aids in regulating the burning of fossil fuels and cutting down on emissions of greenhouse gases. Because they allow organisations to make decisions based on data, Demirel (2021) contends that smart governance solutions are crucial for justice, peace, and strong institutions. In turn, this increases equality and social justice by making citizen engagement more inclusive and deliberative, which leads to a consensus that benefits everyone.

CONCLUSION

A "smart town" is a hard and fast of technologies and thoughts that purpose to make a town more efficient, technologically superior, environmentally sustainable, and socially inclusive. It offers the subject of technical, economic, and social improvement. because 2000, many political, commercial enterprises, authorities and urban events have used the time to identify innovation and development inside the urban context. The term "clever metropolis" refers to a town that uses virtual technologies to cope with economic, social, and political demanding situations dealing with public-commercial societies at the turn of the millennium. This white paper describes the use of IoT and WSN with artificial intelligence in healthcare. These studies will function as a foundation for destiny studies into the functioning of the net of factors, especially in smart towns of fitness.

DECLARATIONS

Acknowledgment: We appreciate the generous support from all the supervisors and their different affiliations.

Funding: No funding body in the public, private, or nonprofit sectors provided a particular grant for this research.

Availability of data and material: In the approach, the data sources for the variables are stated.

Authors' contributions: Each author participated equally in the creation of this work.

Conflicts of Interests: The authors declare no conflict of interest.

Consent to Participate: Yes

Consent for publication and Ethical approval: Because this study does not include human or animal data, ethical approval is not required for publication. All authors have given their consent.

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