IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, September 2023

The Part of Appliance Culture and the Internet of Things in Smart Buildings for Energy Proficiency-A Review Paper

Kunal Dilipkumar Rathod and Jagravi Manohar Wasekar
U.G. Students, Department of Computer Science and Engineering
Jawaharlal Darda Institute of Engineering and Technology, Yavatmal, Maharashtra, India

Abstract*: Machine learning can be used to automate a wide range of tasks. Smart buildings, which use the Internet of Things (IoT) to connect building operations, enable activities, such as monitoring temperature, safety, and maintenance, for easier controlling via mobile devices and computers. Smart buildings are becoming core aspects in larger system integrations as the IoT is becoming increasingly widespread. The IoT plays an important role in smart buildings and provides facilities that improve human security by using effective technology-based life-saving strategies. This review highlights the role of IoT devices in smart buildings. The IoT devices platform and its components are highlighted in this review. Furthermore, this review provides security challenges regarding IoT and smart buildings. The main factors pertaining to smart buildings are described and the different methods of machine learning in combination with IoT technologies are also described to improve the effectiveness of smart buildings to make them energy efficient.*

Keywords: machine learning; Internet of Things; smart buildings; challenges in smart buildings; IoT applications

I. INTRODUCTION

The Internet of Things has grown drastically to become one of the most significant inventions of the 21st century. The IoT consists of a collection of connected physical objects that are linked together by sensors, applications, and other technologies for data integration and exchange across devices and systems [1]. These devices connect using the Internet protocol (IP), which is the same technology that is used to recognize computers on the Internet and allows users to interact with one another via the Internet. The goal of the Internet of Things is to have devices that can self-report data and information regularly, enhancing efficiency and delivering essential information speedier than a system that is based on human input [2]. Smart buildings use connected technologies, devices, data analytics, and automation to control infrastructures, such as security, lighting, ventilation, heating, and air conditioning [3]. Smart heating, ventilation, and air conditioning (HVAC) controls can reduce HVAC usage, especially during peak energy demand periods, by limiting power consumption in unoccupied building zones, detecting and diagnosing issues, and limiting energy consumption. Machine learning can be used to automate a wide range of tasks. Smart buildings, which use the Internet of Things (IoT) to connect building operations, enable activities, such as monitoring temperature, safety, and maintenance, for easier controlling via mobile devices and computers. Smart buildings are becoming core aspects in larger system integrations as the IoT is becoming increasingly widespread. The IoT plays an important role in smart buildings and provides facilities that improve human security by using effective technology-based life-saving strategies. This review highlights the role of IoT devices in smart buildings. The IoT devices platform and its components are highlighted in this review. Furthermore, this review provides security challenges regarding IoT and smart buildings. The main factors pertaining to smart buildings are described and the different methods of machine learning in combination with IoT technologies are also described to improve the effectiveness of smart buildings to make them energy efficientOne of the most key technologies to consider when designing smart buildings is a fire alarm system. An IoT-based fire alarm system is essential to ensure the protection of people's lives and to reduce the amount of damage as much as possible. In [5] the author explained behaviors and energy consumption trends using the machine learning

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 1, September 2023

algorithm (also known as J48) and the Weka API and then classified it according to energy consumption. For home comfort, security, and energy-saving, HEMS-IoT, a smart energy management system that is based on the big data for the home and machine learning, was proposed. Machine learning and big data are crucial because they allow the system to track and classify energy usage efficiency, recognize user behavior patterns, and keep the buildings occupants comfortable. In [6] the authors start by exploring the numerous security issues that IoT applications face, second, to address current security concerns, the authors conducted a survey. Away for developing smart building applications that link the IoT with smart building web services is described in [7]. Ref. [8] demonstrate how the IoT can be applied to design smart buildings; the team employed a smartphone app and also open-platform servers. As a result, they devised a system for controlling the devices that included relays and a low-cost microcontroller Arduino board. An Android smartphone application is also included with the smart system, and users can interact with it.

II. THE ROLE OF IOT DEVICES IN SMART BUILDINGS

We investigated and analyzed prior material in the fields of machine learning and the IoT, and their role in smart buildings. The papers that made a substantial contribution to our research are included in the following paragraphs. In it is stated that many smart devices, including sensing devices, cell phones, and other smart devices, are linked through the IoT. These devices can exchange information and interact with one another. The IoT is a technology that connects Internet-connected gadgets, and enables communication and interaction throughout the physical world, by extending the current Internet. In according to the authors, agriculture, military, household appliances, and personal healthcare are just a few of the applications and services available through the Internet of Things. A new framework is presented by for delivering and maintaining ubiquitous connectivity, real-time applications, and solutions for transport system requirements, based on machine learning and IoT capability. An intelligent system was also created by to enable real-time monitoring and operation of appliances in a smart house utilizing a low-cost IoT platform for the lab, which is a free and open-source Internet of Things platform. Data regarding the home, such as temperatures, light levels, and resident behaviors, are collected using installed sensors and cameras. If the data exceed the specified thresholds, the inhabitants of the home are notified via text messages/emails, allowing them to modify the environment by manipulating the gadgets. To detect aberrant situations, the system was programmed using artificial intelligence. With current developments, standard buildings can be changed into smart buildings at a reasonable cost by taking advantage of recent advances in machine learning (ML), sensor devices, large-scale data analytics, and the Internet of Things. Only minor infrastructure improvements are required. A three-tier IoT-based extensible architecture for processing sensor data and identifying the most important clinical indicators to diagnose heart disease through the use of ROC analysis, the most important clinical markers that signal potential heart disease, are determined; this model is proposed by . Smart lighting uses modern controls to eliminate over lighting by including day lighting and improved functions for detecting occupancy and dimming. Light level controllers for luminaries are rapidly evolving and gaining adoption throughout the industry. Step and continuous dimming control are rewarded in demand-response schemes . Lighting management systems can be programmed to regulate smart lighting systems that are controlled wirelessly. Retrofitting is made easier with wireless controllers, while lighting management capabilities provide users with access to controls through web-based dashboards.

III. ARTIFICIAL NEURAL NETWORKS (ANNS)

Artificial Neural Networks (ANNs) Smart building strategies aim to reduce energy usage and improve client satisfaction and comfort. They are based on the use of intelligent sensors and software to analyze both external and indoor elements to provide comfortable monitoring, as well as safety devices for energy usage management. Artificial neural networks (ANNs) can learn the most important information trends in a multidimensional environment. ANNs have been used in the application of solar energy to estimate building heating needs . ANNs are also being used in ventilation, solar radiation, air-conditioning technologies, power-generation modeling and control, load forecasting, and refrigerators. The random forest model was used to estimate energy consumption in residential structures, and the Bayesian regularized neural network (BRNN) approach is used to predict several building energy demands from an environment input data set . The use of the ANN approach makes it possible to monitor in real-time, for example, an artificial neural network (ANN) can beused to estimate and forecast the temperature of a specific area in the building .

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 1, September 2023

Many different scenarios can be simulated using the energy simulation software, Energy Plus, creating an abundance of data that can be used to train an ANN model and calculate energy usage . Neural networks may not always produce the same results for the same input; neural network-based systems and solutions require extensive training . The flow of input signal analysis to obtain energy estimation is contained in the signal. The outcome of the energy calculation from the input signal is widely used to obtain actions regarding hardware/software-based smart building functionalities. Mobile phones can also be used to acquire voice instructions to regulate the electrical appliances in intelligent buildings . The user can use a mobile phone to enter voice commands, which are then shared with the building's energy management system via Bluetooth and Wi-Fi communication, and then analyzed to decode the necessary actions of electrical appliances.

IV. AI-BASED APPROACHES IN SMART BUILDINGS

Smart building is a building that is equipped with automated control systems and makes use of information to increase the operation of the building as well as the level of comfort for its users. Artificial intelligence (AI) combined with buildings and IoT devices have the potential to improve inhabitant experience, operational efficiency, and space and asset utilization . With the use of AI, building systems can now integrate excess data from IoT devices and occupant behavior independently to develop knowledge, optimize processes, and enhance environmental effectiveness.

IoT and AI platforms' learning capabilities allow for the creation of innovative new services for interacting with building occupants. Through automated operation processes, these technologies have the potential to decrease costs . In smart buildings, energy consumption can be reduced by implementing AI technology for improved control, consistency, and automation. Different machine learning algorithms are compared and applied in smart buildings. In buildings' energy systems, AI-based techniques are being applied. Diesel generators (DGs), wind turbines (WTs), photovoltaic panels (PVs), thermal energy storage systems, electric energy storage systems, lighting systems, HVAC systems, window management systems, blind systems, electric vehicles (EVs), electric heaters (EWHs), gas boilers, and washing machines (WMs), are all examples of energy equipment used in smart buildings It is critical to schedule such equipment in a coordinated way because they have significant social, environmental, and economic implications

V. CONCLUSION

Researchers in the field of smart buildings are looking to machine learning approaches for managing, analyzing, and improving the energy efficiency of smart buildings. In this study, the most essential factors of smart buildings are discussed, with a special emphasis on what is currently required of smart building and why machine learning algorithms are important for integration with the IoT to make buildings energy efficient. The use of IoT technology in smart buildings provides numerous benefits, but it also has some challenges. In this review, an overview of the topic of Internet of Things technology, as well as its role in smart buildings has been described. The platform of IoT devices and their basic components are also presented. Internet of Things (IoT) devices in smart buildings present many challenges and those challenges need solutions. We have shown many essential factors and characteristics of smart buildings, which are described above, and those factors require integration with machine learning to solve energy efficiency and other challenges. In this review, we outline the most common machine learning algorithms that can be combined with IoT to make smart buildings more energyefficient. These machine learning methods can play a vital role with IoT to make smart buildings more energy efficient.

REFERENCES

[1]. Zúquete, A.; Gomes, H.; Amaral, J.; Oliveira, C. Security-Oriented Architecture for Managing IoT Deployments. Symmetry 2019, 11, 1315. [CrossRef]

[2]. Nappi, I.; de Campos Ribeiro, G. Internet of Things technology applications in the workplace environment: A critical review. J. Corp. Real Estate 2020. [CrossRef]

[3]. Dos Santos, D.R.; Dagrada, M.; Costante, E. Leveraging operational technology and the Internet of things to attack smart buildings. J. Comput. Virol. Hacking Tech. 2021, 17, 1–20. [CrossRef]

[4]. Khajenasiri, I.; Estebsari, A.; Verhelst, M.; Gielen, G. A review on Internet of Things solutions for intelligent energy control in buildings for smart city applications. Energy Procedia 2017, 111, 770–779. [CrossRef]

[5]. Machorro-Cano, I.; Alor-Hernández, G.; Paredes-Valverde, M.A.; Rodríguez-Mazahua, L.; Sánchez-Cervantes, J.L.; OlmedoAguirre, J.O. HEMS-IoT: A big data and machine learning-based smart home system for energy saving. Energies 2020, 13, 1097. [CrossRef]

[6]. Mohanta, B.K.; Jena, D.; Satapathy, U.; Patnaik, S. Survey on IoT security: Challenges and solution using machine learning, artificial intelligence and blockchain technology. Internet Things 2020, 11, 100227. [CrossRef]

[7]. Mavropoulos, O.; Mouratidis, H.; Fish, A.; Panaousis, E.; Kalloniatis, C. A conceptual model to support security analysis in the internet of things. Comput. Sci. Inf. Syst. 2017, 14, 557–578. [CrossRef]

[8]. Lawal, K.; Rafsanjani, H.N. Trends, benefits, risks, and challenges of IoT implementation in residential and commercial buildings. Energy Built Environ. 2021, 3, 251–266. [CrossRef]

[9]. Cui, L.; Yang, S.; Chen, F.; Ming, Z.; Lu, N.; Qin, J. A survey on application of machine learning for Internet of Things. Int. J. Mach. Learn. Cybern. 2018, 9, 1399–1417. [CrossRef]

[10]. Javed, A.; Larijani, H.; Wixted, A. Improving energy consumption of a commercial building with IoT and machine learning. IT Prof. 2018, 20, 30–38. [CrossRef]

[11]. Hussain, F.; Hassan, S.A.; Hussain, R.; Hossain, E. Machine learning for resource management in cellular and IoT networks: Potentials, current solutions, and open challenges. IEEE Commun. Surv. Tutor. 2020, 22, 1251–1275. [CrossRef]

[12]. Blasch, E.; Pham, T.; Chong, C.-Y.; Koch, W.; Leung, H.; Braines, D.; Abdelzaher, T. Machine learning/artificial intelligence for sensor data fusion–opportunities and challenges. IEEE Aerosp. Electron. Syst. Mag. 2021, 36, 80–93. [CrossRef]