APPLICATIONS OF AI, IOT, CPS FOR ENGINEERING EDUCATION: A REVIEW

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Abstract

As there is advancement in technological areas like robotics, autonomous systems, quantum computing, our imperative habits are transforming. The way we think and learn is essential to acknowledge our educational systems. The competition is increasing amid the global powers and the military industrial complexes. To support national goals, new trends must be examined efficiently in engineering and technological education. Nowadays, the industry is demanding graduates who have expertise in communication skills, problem solving math skills, employability and value. Innovations are complicated to accomplish in engineering and industrial projects. One of the presently emerging areas in educational technology is Artificial Intelligence, Internet of Things, and Cyber Physical System. While it has been over the last few years, it is yet ambiguous for educationists how to form a didactic asset of it on an expansive scale, or how it can literally impact purposely on instruction and learning in the field of engineering education. In this survey we explores an analysis based on the applications of AI, IOT, and CPS in education through a systematic review. The application of the AI and IoT in cloud system is discussed with the shortcomings of the current systems.

Keywords

Artificial Intelligence, Cyber Physical Systems, Internet of Things

1. Introduction

Artificial Intelligence is described as the intelligence performed by automobiles and PC's in achieving covert tasks much akin to how typical humans think and execute. Thus AI is also described as machine intelligence [1].The utilization of artificial intelligence connects across various applications like Human Computer Interaction (HCI) based smart developer, using computer vision for constructing smart surveillance solutions. Robust and stable decision making systems must be created to assess, employ and predict peculiar patterns by preparing gigantic volumes of application data. The advancement of AI empower intelligent operators have established the tone to oust most of the human efforts with smart agents. It covers tracking attendance, monitoring classroom exercise, and student and teacher demeanor monitoring [2].

2. Review Studies

Samarakou et al. [1], conferred an application based on Artificial Intelligence for the Student Diagnosis, Assistance, Evaluation System, and an open learning system for unattended students. Pillay et al. [2], investigated AI to be integrated into the engineering program to adorn engineers with the essential skills to carry out the complicated issues that the fourth industrial innovation will cater to. Mathews et al. [3], provided an analysis on applications of artificial intelligence in higher education through an organized review. Burd et al. [4], presented a broad survey of studies on

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Artificial Intelligence and in engineering and manufacturing. They analysed the articles based on a proposed taxonomy. Grimheden et al. [5], explored the CPS applications briefly in education domain.

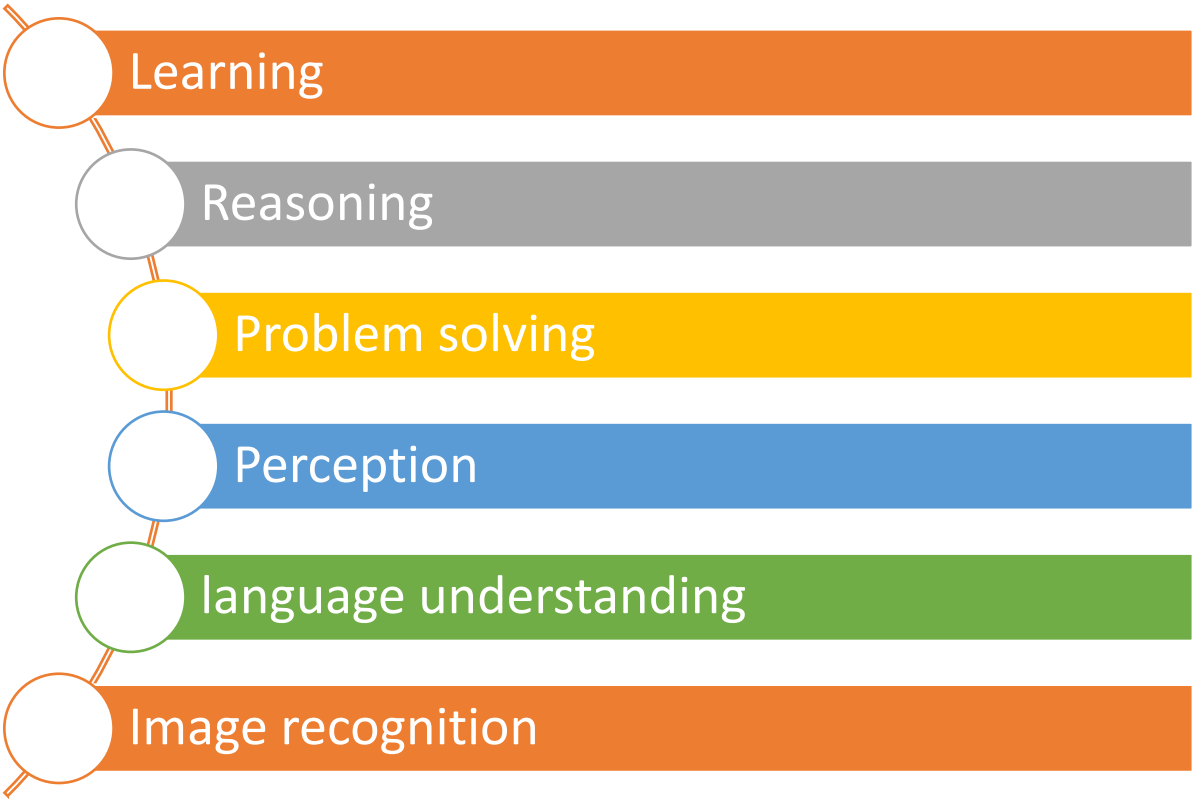

Figure 1: The Components of Artificial intelligence

Martin et al., analysed the possibilities of the CPI utilization in engineering education. Moreira et al. [6], had systematically reviewed survey, architecture, fundamental technologies, and applications of IoT. Barnes et al. [7], analysed the safety issues of AI independently and search advanced issues and results. Ramlowat et al. [8], focused explicitly on applications of internet of things in education system. Rawung et al. [9], survey the potential applications, challenges of CPI. Gunes et al. [10], presented the concepts, issues, applications in CPS. Majeed et al. [11], focused on how IOT is making campuses smart. Pai et al. [12], demonstrated various applications of IOT in education field. Rho et al. [13], described technologies and applications in CPS domain.Kondaka et al. [16] propounded an algorithm known as iCloud Assisted Intensive Deep Learning (iCAIDL), that support medical domain utilizing an intelligent cloud system bridging the deep learning techniques with the cloud system for effective healthcare. Sejidiu et al. [17] presented a review based on the integration of semantics within the sensor data focussing on the solutions of providing the semantic annotations on sensor data clarifying the requirements of the existing systems.

3. Applications of AI

- **Big Data:** Most industries depend massively on data. Knowledge has turned into a hot asset that many management wants to beat the clash devoted to. AI can serve institutions with best algorithms proficient of identifying aberration and codify results to improvise the operations. Engineers use big data and Artificial Intelligence to promote large-scale civil projects. The technology can benefit them by analyzing where pupils are and what public framework projects they can achieve to address issues [14].

- **Internet of Things:** The Internet of Things (IoT) has set off long ago. Many organizations regularly working to get everyone associated. Smart devices allows pupil to be in touch wherever they are. Connectivity has aided the engineering sector along with IoT devices that make feasible for professionals to auditor projects casually. The Internet's transformation and advancement is growing. In the last few years, the Internet has bolstered itself by joining people from all over the earth through laptops, PC's, and smartphones [11], Nowadays, with the transformation of the comprehensive online network, a broad area of devices like home devices, automobiles, and electronic apparatus along with collection of smart devices interact using the Internet services hence establish the IoT. Various terminologies have emanated from the article on internet of things technology specifically the Internet of Everything (IoE), the Internet of Anything (IoA), or the Industrial Internet of Things (IIOT).

4. Architecture of IoT

The architecture of Internet of Things in Fig. 2 contains layers that analyze the peculiar automation used from the low level layers for maintaining the sensors, actuators and network function to the uppermost layers for operation and information delivery [8]. The application layer serves as a terminal to the function of IOT. Network layer achieves the assignment linked with the transport and network layers in the background of the model known as an "Open Systems Interconnection (OSI) model" of communication. The layer called device layer carries out the process of the physical layer [6].

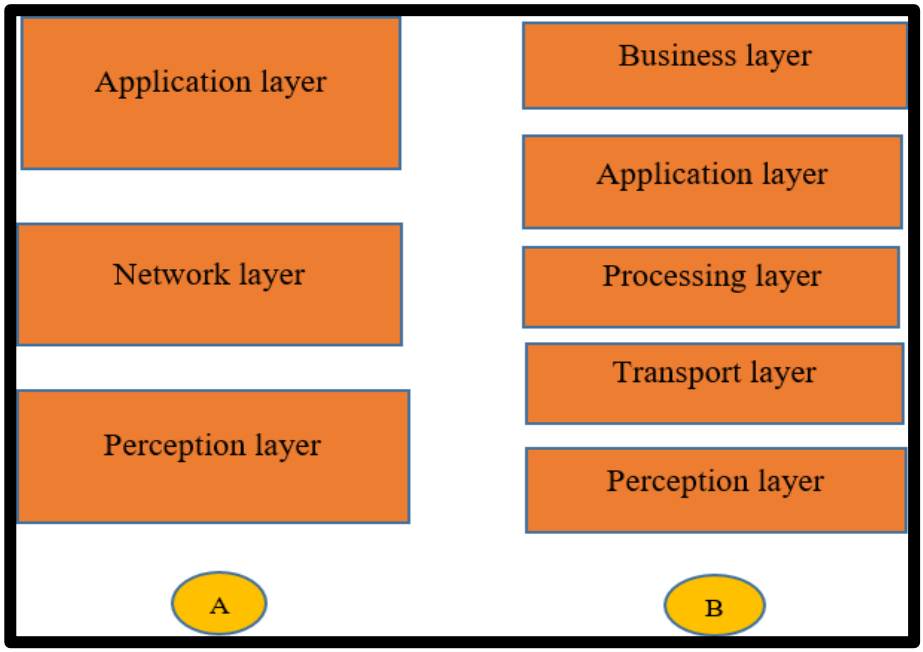

Figure 2: The Architecture of IOT

5. Internet of Things in Education

The education domain is supposed to go through enormous transformation due to the internet of things. From the last few years, the internet of things application has managed to strengthen educational assets in the structure of ascendable, rich media content [6], Bagheri et al. [8], focused on an education business model and vital aspects like managing energy and monitoring the ecosystem,

healthcare supervision of students, connection of lecture rooms and improvisation of instruction-learning processes.

- **Green Internet of Things in Engineering Education:** The facet related to the utilization of green internet of things techniques in the education sector like engineering to set up smart lecture rooms [11]. Sustainability of resources is the main focus for IoT in domains like engineering education. To accomplish this, a number of tasks must be taken up as alleged by the author.

6. Cyber Physical System

The Cyber-physical systems (CPS) are defined as engineered systems that are developed and built on the logical integration of computational algorithms and physical components. It can be small and closed, such as an artificial pancreas, or extensive, convoluted, and analogous, like a local energy grid [15]. The technology frames the earlier development of computers, embedded systems in equipment whose fundamental aim is not computing, like automobiles, medical equipment, and scientific apparatus.

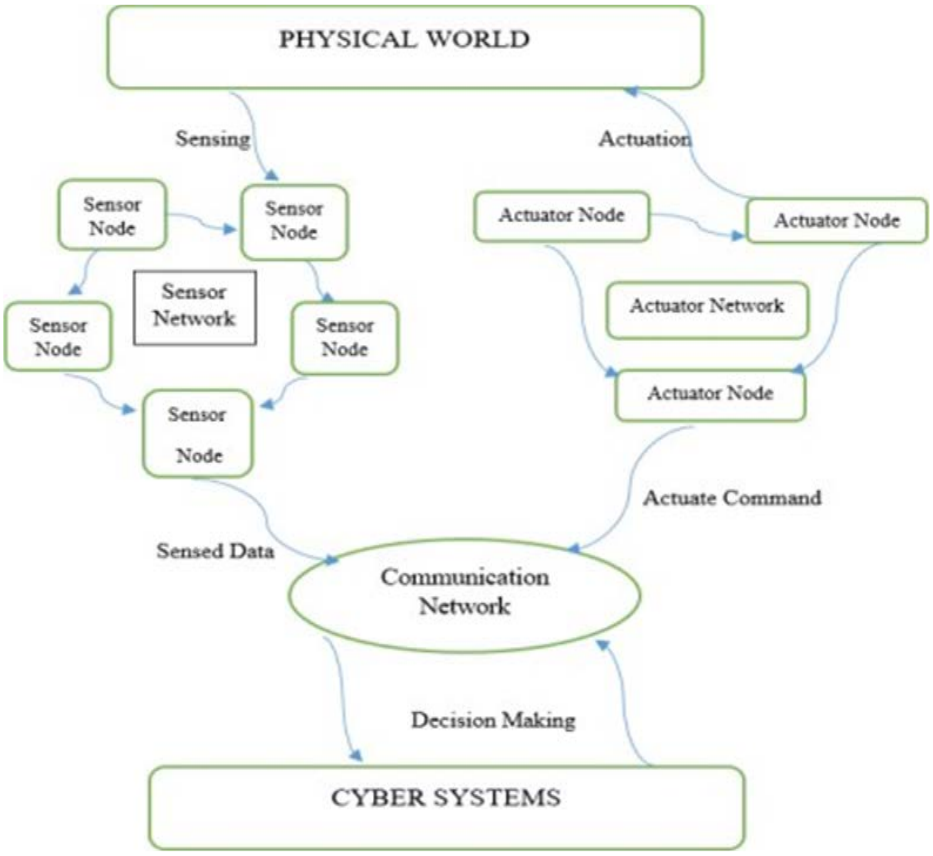

Figure 3: The CPS Holistic View

6.1. Cyber Physical System Applications

- Aeronautic applications: Cyber-Physical Systems are used for various aeronautic applications like Structure Health Monitoring, flight test instrumentation, Pilot- crew communications, inflight entertainment Wireless Cabin, and flight landing [5].

- Smart grid: It is an ecosystem that relies on information procurement estimation and decision making. Mostly, used in transmission and delivery. In generation, it will rule the network's connectivity along with operational facet in the generation of electricity [10]
- Humanoid robots: It can be useful in taking care of the older people at homes and for personal purposes [13].

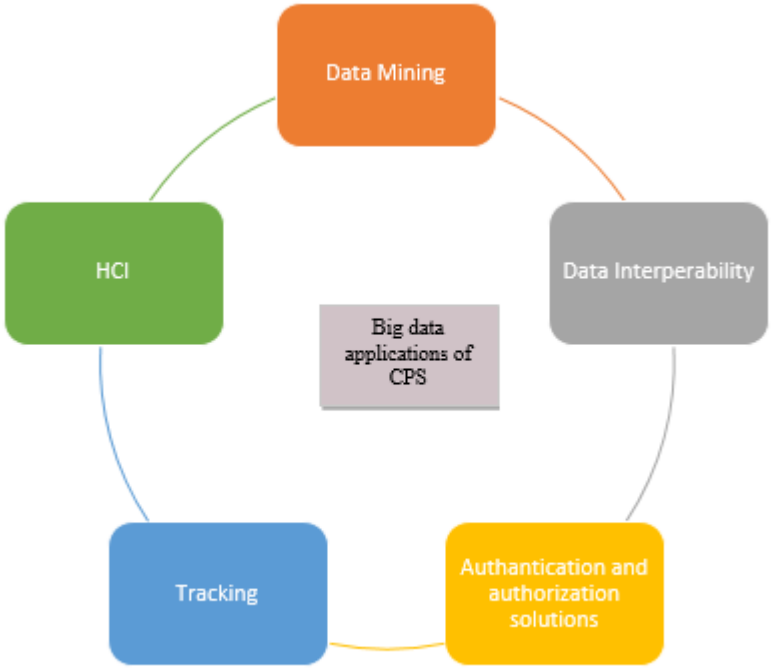

Figure 4: The CPS Applications

7. Conclusion

This review paper explained the applications of Artificial Intelligence, Internet of Things, Cyber Physical systems in brief. Cyber physical systems cater superior results to the real time issues facing nowadays. CPI changes the perception of how humans communicate with the outside world. Artificial Intelligence boosts the aspect of education by predicting students' psychology. On the other hand, the Internet of Things supports research that fundamentally changes the way in which learning is delivered to learners. Using real objects and associating them as a learning resource through the IoT, brings tremendous benefits in engineering education. The IoT in medical domain also encourages the on time health facilities available to elder people with the guarantee of the health data. The limitation of this field is the lack of proper authentication of the data which is need to overcome for the robustness.

References

[1] M. Samarakou, M. Grigoriadou, and M. Samarakou, "Knowledge Management & E-Learning engineering education engineering education," vol. 8, no. 3, pp. 496– 513, 2016.
[2] N. Pillay, B. T. Maharaj, and G. Van Eeden, "AI in engineering and computer science education in preparation for the 4th industrial revolution: A South African perspective," 2018 World Eng.

Educ. Forum - Glob. Eng. Deans Counc. WEEF- GEDC 2018, pp. 1–5, 2019, doi: 10.1109/WEEF-GEDC.2018.8629703.
[3] S. P. Mathews and R. R. Gondkar, “Solution Integration Approach using IoT in Education System,” Int. J. Comput. Trends Technol., vol. 45, no. 1, pp. 45–49, 2017, doi: 10.14445/22312803/ijctt-v45p109.
[4] B. Burd et al., “Courses, content, and tools for internet of things in computer science education,” ITiCSE-WGR 2017 - Proc. 2017 ITiCSE Conf. Work. Gr. Reports, vol. 2018-Janua, pp. 125–139, 2018, doi: 10.1145/3174781.3174788.
[5] M. E. Grimheden and M. Törngren, “Towards curricula for Cyber-Physical Systems,” 2014 Work. Embed. Cyber-Physical Syst. Educ. WESE 2014 - Proc., vol. 14, no. October, pp. 53–60, 2014, doi: 10.1145/2829957.2829965.
[6] F. T. Moreira (&), F. R. , Andreia Magalhães, and and M. Vairinhos, “The Power of the Internet of Things in Education: An Overview of Current Status and Potential. Smart Innovation, Systems and Technologies, 51–63 | 10.1007/978-3- 319-61322-2_6,” Citizen, Territ. Technol. Smart Learn. Context. Pract. Smart Innov. Syst. Technol., 2018, doi: 10.1007/978-3-319-61322-2.
[7] T. Barnes, K. Boyer, S. I. H. Hsiao, N. T. Le, and S. Sosnovsky, “Preface for theSpecial Issue on AI-Supported Education in Computer Science,” Int. J. Artif. Intell. Educ., vol. 27, no. 1, pp. 1–4, 2017, doi: 10.1007/s40593-016-0123-y.
[8] D. D. Ramlowat and B. K. Pattanayak, Exploring the internet of things (IoT) in education: A review, vol. 863. Springer Singapore, 2019.
[9] R. H. Rawung and A. G. Putrada, “Cyber physical system: Paper survey,” Proc. - 2014 Int. Conf. ICT Smart Soc. “Smart Syst. Platf. Dev. City Soc. GoeSmart 2014”, ICISS 2014, pp. 273–278, 2014, doi: 10.1109/ICTSS.2014.7013187.
[10] V. Gunes, S. Peter, T. Givargis, and F. Vahid, “A survey on concepts, applications, and challenges in cyber-physical systems,” KSII Trans. Internet Inf. Syst., vol. 8, no. 12, pp. 4242–4268, 2014, doi: 10.3837/tiis.2014.12.001.
[11] A. Majeed and M. Ali, “How Internet-of-Things (IoT) making the university campuses smart? QA higher education (QAHE) perspective,” 2018 IEEE 8th Annu. Comput. Commun. Work. Conf. CCWC 2018, vol. 2018-Janua, pp. 646– 648, 2018, doi: 10.1109/CCWC.2018.8301774.
[12] S. S. Pai, Vikhyath, Shivani, Sanket, and Shruti, “IOT Application in Education,” Int. J. Adv. Res. Dev., vol. 2, no. 6, pp. 20–24, 2017, [Online]. Available: https://www.ijarnd.com/manuscript/iot-application-in-education/.
[13] S. Rho, A. V. Vasilakos, and W. Chen, “Cyber physical systems technologies and applications,” Futur. Gener. Comput. Syst., vol. 56, pp. 436–437, 2016, doi: 10.1016/j.future.2015.10.019.
[14] J. Beck, M. Stern, and E. Haugsjaa, “Applications of AI in education,” XRDS Crossroads, ACM Mag. Students, vol. 3, no. 1, pp. 11–15, 1996, doi: 10.1145/332148.332153.
[15] L. Hu, N. Xie, Z. Kuang, and K. Zhao, “Review of cyber-physical system architecture,” Proc. - 2012 15th IEEE Int. Symp. Object/Component/Service- Oriented Real-Time Distrib. Comput. Work. ISORCW 2012, pp. 25–30, 2012, doi: 10.1109/ISORCW.2012.15.
[16] Kondaka, L. S., Thenmozhi, M., Vijayakumar, K., & Kohli, R. (2021). An intensive healthcare monitoring paradigm by using IoT based machine learning strategies. Multimedia Tools and Applications, 1-15.
[17] Sejdiu, B., Ismaili, F., & Ahmedi, L. (2020). Integration of Semantics Into Sensor Data for the IoT: A Systematic Literature Review. International Journal on Semantic Web and Information Systems (IJSWIS), 16(4), 1-25.