APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN THE AVIATION INDUSTRY

Abstract

The future can now be predicted sophisticatedly by using Artificial Intelligence. Real-time complexities are not cumbersome anymore. Inculcation of Artificial Intelligence using a set of Defined algorithms paves the way for better solutions, making the procedure "time efficient."Machine Learning, Deep Learning, and Natural Language processing come under one Umbrella. A Lot of data can now be stored and processed intelligently, which shows a macro-level impact. Many artificial intelligence specialists suggest that the growth of artificial Intelligence will be exponential. Artificial Intelligence has already scattered many jobs, mainly white-collar jobs. A typical task such as graphic design can now be done efficiently with the help of artificial intelligence tools. This technology improves daily; it learns, trains employees, and works for even bigger purposes. Integrating advanced Artificial Intelligence Systems in IOT devices is a great example to learn from. Artificial Intelligence is ultimately a game changer. Digitalization drives artificial Intelligence.

Keywords: Artificial Intelligence, Digitalization, Deep Learning, ML, Technology

Author

Anmol Agarwal
School of Computing
DIT University
Dehradun, Uttarakhand, India

I. INTRODUCTION

In a random esteemed daily, anyone can find tons of NEWS regarding bumper growth in the advanced Artificial Intelligence sector. Technology is not confined to theories anymore. Indeed, it has a vital practical approach- it works for an ordinary citizen. Artificial Intelligence is a wise dominance of science cum art all together on a set of obstacles. Furthermore, it is one of the critical pillars in the growth and development of Emerging Companies and startups.

Artificial Intelligence Adds Fuel to The Aviation Industry. A. It can be fitted right into the pocket. Upon looking back in time, it is evident that with this helping hand, tasks would not have been easier to manage at the stipulated time.

Correctly implementing object-oriented algorithms benefitted many, ranging from small-scale industries to multinational companies. It can adapt itself no matter how vigorous the real-time complexities are.

Advanced AI, equipped with enormous data, can make things Picture Perfect. By the current timeline, the overview has been depicted with various real-life examples.

Artificial Intelligence technology has its own merits. Problems get quickly resolved at the backend using duly guided AI models. The Whole concept of AI in the Aviation Industry is bound together in a concise manner for a better understanding of the Reader. The language is simple for easy grasping.

"Time efficiency is a need of an hour."

Therefore, A. It came into effect and has become an indispensable part of the transport network system, especially The Airways.

II. LITERATURE REVIEW

Concerns about societal effect, accuracy and trust, and governance are relevant to all AI applications. Oncologists may increase the benefits of AI while minimizing its risks by using AI ethics and trust frameworks. As AI continues to permeate every industry, it will be crucial for companies to work together to exchange knowledge and best practices; this includes creating unusual collaborations in fields as different as engineering and oncology [1]. To shed light on the current state of Conversational AI in the AEC sector, this study performed a Focus Group Discussion to identify obstacles and verify promising avenues of research. The results show that the potential of Conversational AI applications in the AEC sector is substantial yet still needs to be explored [2]. In[3], this article explores the current tools that use machine learning and mixed reality in the aviation sector. Intelligent design, production, testing, and service in aeronautical engineering are being investigated to improve worker efficiency. To that end, studies are being conducted on autonomous, self-service, and data visualization systems.

In [4], the companies may save money on storage and better serve their clientele and employees by employing a well-thought-out inventory categorization system. Using the

Neutrosophic Fuzzy EDAS approach, this research seeks to achieve high inventory management efficiency in the aviation sector by categorizing spare parts stocks. In[5], studying factors influencing blockchain adoption in the airline business reveals valuable information. Blockchain technology can potentially revolutionize many areas of the aviation industry, and this article uses the technology acceptance model to explain why this change is happening. It was proposed that aircraft MRO procedures be simulated using the discrete-event simulation system AnyLogic, which would allow for integrating Lean and Industry 4.0 techniques. In [6], the authors proposed a simulation process methodology and a process flow chart for airplane repair. It offers a list of inventions and a discussion of technical path dependence and value proposition, all of which contribute to the development of modern aviation. Academics and professionals may use this summary to confirm that these developments have led to a more efficient, agile, sustainable, and safe industry globally [7]. This essay examines the potential allure of clusters for worldwide affiliates during the Fourth Industrial Revolution using the Aviation Valley in Poland as an example[8]. In[9], the authors examined the many uses aerospace has used intelligent materials. This report will set the path for future work in aerospace by assisting prospective students and researchers in gaining a comprehensive understanding of smart materials employed in that industry[9]. To better equip decision-makers with Safety Intelligence, the paper provides examples of data-driven studies and a comprehensive safety dashboard that can be constructed utilizing TOKAI data. This is made feasible by standardizing a common vocabulary and taxonomy for discussing extraordinary and routine matters[10]. Specifically for the aviation sector, evaluating the most recent developments in AM technology, material concerns, post-processes, and design considerations is essential. The economic impacts of the AM process, such as the digitization of spare parts and its effect on the environment, are also studied. This analysis has valuable implications for the academic and business worlds[11]. In[12], it examines the accident problem and suggests solutions based on machine learning strategies using cutting-edge Natural Language Processing tools. The methods are then applied to the standard accident causation model developed by the Software Hardware Environment Liveware (SHEL) and evaluated on a dataset of actual collisions.

Among the themes identified for future strategic planning following the recovery from the pandemic crisis are the potential of the Southeast Asian MRO market, substantial government assistance, and the development of modern digital technologies. Strategic priorities should bolster local transportation infrastructure and supply networks, enforce strict rules, adopt cutting-edge technologies, and train workers in specialized fields[13]. Chlorella pyrenoidosa microalgae are processed into jet fuel. Experiments using a Box-Behnken design conserved costs.Robust predictive modeling using a neuro-fuzzy technique with an R-value greater than 0.9995[14]. In[15], the authors identified the most significant human variables influencing the unsafe conduct of Brazilian offshore aviation operations by pilots. Managers and aviation safety professionals may better understand the industry and their organizations by mapping these human variables and their impact on pilots' safety behavior[15].

III. ADVANTAGES OF ARTIFICIAL INTELLIGENCE

There are various Advantages of AI are:

1. AI plays a significant role in the Aviation Industry under Profit Maximization techniques.
2. It is equipped with valuable individual data, which helps the manager with catalog building and classification.

3. Due to its robust nature, it is being used by big firms to generate their outreach.
4. AI specialists explicitly suggest that the Implementation of AI models and Machine Learning possibly generates a good R.O.I
5. Implementation of AI-driven chatbots simplifies the task to a great extent.
6. Google Lens, an image recognition technology, can translate text into various languages supported by Google.
7. More advanced deep-learning routines are used to empower real-time detection capabilities
8. One of the most significant merits of using AI is that it works 24×7 without interruptions and has no downtime.
9. Because of AI, a 40% relative improvement is seen in the accuracy of weather forecasting and wind pattern identification.
10. Last but not least, Artificial Intelligence refines operational efficiency, avoids costly mistakes, and increases end-user satisfaction.

IV. IMPORTANCE OF AVIATION INDUSTRY

"Quality standards seek no compromise." As capital income has increased since then, various operations have been digitized, and there is a potential requirement for resources that will maximize the outcome and balance the economy.

Apart from carrying passengers as a tier 1 or tier 2 flight, a significant part of aviation goes towards importing and exporting goods. Aviation education is essential in fostering future Industry professionals.

Did you know?

>>In the early 1900s, a 245-metre-long airship was made and launched at Friedrichshafen, Germany. The "Golden Age" of the airships ended on May 6, 1937, when the Hindenburg(airship) caught fire. A total of 36 people were killed in the mishap.

Figure 1: Golden Age

We need sophisticated aviation stuff not only to travel from one country to another, which comes under tourism, but also for economic balance along with an optimum supply of resources.

For example, Mango from west India is exported to different parts of neighboring countries. Another example is that most online parcels arrive from metro cities because manufacturing plants have been installed there. So, a significant portion of cargo is transported via Airways.

Techniques like machine Learning and deep learning are used in Industries to optimize the output speed and streamline processes. Such mechanisms indirectly boost this industry, making tedious procedures easy and getting them done efficiently.

Note: Air India is one of the most prominent tycoons in the Aviation Industry. Furthermore, it holds more than 18% of the market share in this field if we talk of emerging aviation giants from India.

V. CHALLENGES IN AVIATION INDUSTRY

Many hurdles affect the aviation sector, thereby making procedures complex and time-consuming. Some of them directly impact this industry:

1. Stringent environmental restrictions
2. Severe competition
3. System complexity
4. An increase in air pollution.
5. Loss of control in flight [LOC1]
6. Last but not least, the aerodynamics of the model.

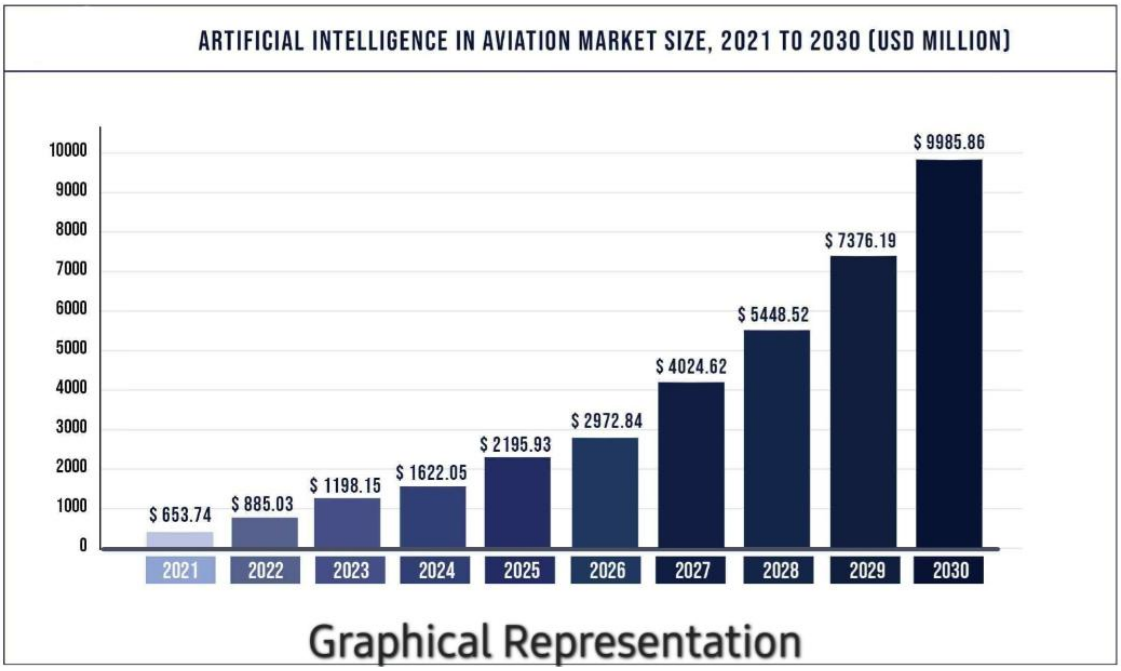

Figure 2: Graphical representation of AI and Aviation in the market
Source: www.precedenceresearch.com

VI. AI IN AVIATION SYSTEMS

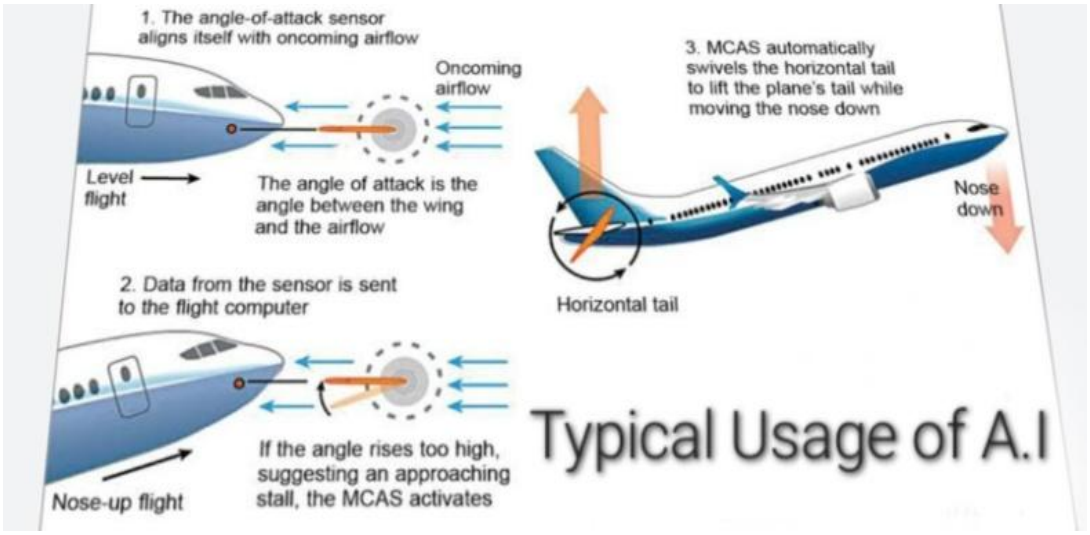

Figure 3
Source: https://www.mdpi.com/2071-1050/12/21/8994

Did you know?

>>Private airlines account for over 70 percent of the domestic aviation market share. Various virtual tracks have been laid down just to minimize any traffic. They follow the same paths for the daily movement of freight and passengers.

1. **Training of Novice Aspirants:** AI-driven tools serve as a guide because usually A. I simulators train them for upcoming opportunities. The whole module/simulator can be customized according to the trainee's academic background and intellect—furthermore, A. I systems are deployed in the cockpit to assist the pilot. e.g., The Maneuvering Characteristics Augmented System (MCAS) is an advanced tool to correct any inaccuracy in the Angle of Attack(AOA). The above figures show the use of MCAS.

2. **Avoidance of Catastrophic Mishaps:** Airways is the only form of transport where you can't just apply brakes to stop the vehicle when an obstacle is correct at the front. But in rare cases, due to some misunderstanding, two planes can fly via the same path. To avoid collisions, A. I systems are installed, so any risk factor can be speculated well in advance. It can tell either of them to change the altitude. Air traffic controllers can also oversee planes leaving or approaching the runway using AI and intelligent cameras.

3. **Prioritize Customer Experience:** Apart from seeking profit, Commercial Airlines also ensures that customers feel comfortable. Client satisfaction and service quality are crucial. Therefore, a robot does the job perfectly. They are primarily available at check-in points and are free to move on the desired predefined pathways.

4. **Passenger Identification:** Security is one of the topmost concerns at the international airport. Illegal activities such as smuggling can be done, and terrorists may also travel via international borders if proper checking is not done. Therefore, the safety of an individual

is ensured by using facial recognition to detect suspect individuals. Security has been refined due to biometric scanners and facial recognition technologies.

5. **Crew Management:** The scheduling department must assign crews to each of the thousands of flights operated daily. This is a tedious task. AI puts multiple factors into the task basket: flight route, crew member licensing and qualification, aircraft type and fuel usage, and work regulations. Personal issues such as vacations and days off to approve conflict-free schedules for pilots and flight attendants. Training requirements like pairing senior crew members with junior ones and government regulations have to be considered. Thanks to A.I for making tasks easier.

VII. CONCLUSION

Upon critical analysis of this technology, it is highly expected that it will result in exponential benefits to the different modes of transport, especially Airways. Still, much needs to be discovered in this domain. New mind-boggling features such as Auto-Pilot mode can pass instructions independently without human intervention. Undoubtedly, AI is the building block of such systems. The impact of Artificial Intelligence will indeed be seen on the transport network in the years to come.

REFERENCES

[1] R. Hallows, L. Glazier, M. S. Katz, M. Aznar, and M. Williams, “Safe and ethical artificial intelligence in radiotherapy – lessons learned from the aviation industry,” Clinical Oncology, vol. 34, no. 2, pp. 99–101, 2022. doi:10.1016/j.clon.2021.11.019

[2] A. B. Saka et al., “Conversational Artificial Intelligence in the AEC industry: A review of present status, challenges and opportunities,” Advanced Engineering Informatics, vol. 55, p. 101869, 2023. doi:10.1016/j.aei.2022.101869

[3] Y. Jiang, T. H. Tran, and L. Williams, “Machine learning and mixed reality for smart aviation: Applications and challenges,” Journal of Air Transport Management, vol. 111, p. 102437, 2023. doi:10.1016/j.jairtraman.2023.102437.

[4] E. Cakmak and E. Guney, “Spare parts inventory classification using neutrosophic fuzzy EDAS method in aviation industry,” SSRN Electronic Journal, 2022. doi:10.2139/ssrn.4068618

[5] X. Li, P.-L. Lai, C.-C. Yang, and K. F. Yuen, “Determinants of blockchain adoption in the aviation industry: Empirical evidence from Korea,” Journal of Air Transport Management, vol. 97, p. 102139, 2021. doi:10.1016/j.jairtraman.2021.102139

[6] A. Korchagin, Y. Deniskin, I. Pocebneva, and O. Vasilyeva, “Lean maintenance 4.0: Implementation for Aviation Industry,” Transportation Research Procedia, vol. 63, pp. 1521–1533, 2022. doi:10.1016/j.trpro.2022.06.164

[7] B. A. Pereira, G. Lohmann, and L. Houghton, “Technology trajectory in aviation: Innovations leading to Value Creation (2000–2019),” International Journal of Innovation Studies, vol. 6, no. 3, pp. 128–141, 2022. doi:10.1016/j.ijis.2022.05.001

[8] B. Jankowska, E. D. Maria, and J. Cygler, “Do clusters matter for foreign subsidiaries in the era of industry 4.0? the case of the Aviation Valley in Poland,” European Research on Management and Business Economics, vol. 27, no. 2, p. 100150, 2021. doi:10.1016/j.iedeen.2021.100150

[9] K. Sharma and G. Srinivas, "Flying smart: Smart materials used in the aviation industry," Materials Today: Proceedings, vol. 27, pp. 244–250, 2020. doi:10.1016/j.matpr.2019.10.115

[10] R. Patriarca, G. Di Gravio, R. Cioponea, and A. Licu, “Safety intelligence: Incremental proactive risk management for Holistic Aviation Safety Performance,” Safety Science, vol. 118, pp. 551–567, 2019. doi:10.1016/j.ssci.2019.05.040

[11] A. Gisario, M. Kazarian, F. Martina, and M. Mehrpouya, “Metal additive manufacturing in the Commercial Aviation Industry: A Review,” Journal of Manufacturing Systems, vol. 53, pp. 124–149, 2019. doi:10.1016/j.jmsy.2019.08.005

[12] G. Perboli, M. Gajetti, S. Fedorov, and S. L. Giudice, "Natural language processing for the identification of human factors in aviation accidents causes: An application to the shel methodology," Expert Systems with Applications, vol. 186, p. 115694, 2021. doi:10.1016/j.eswa.2021.115694

[13] J. Liangrokapart and T. Sittiwatethanasiri, "Strategic direction for aviation maintenance, repair, and overhaul hub after crisis recovery," Asia Pacific Management Review, vol. 28, no. 2, pp. 81–89, 2023. doi:10.1016/j.apmrv.2022.03.003

[14] Z. Said et al., "Multi-attribute optimization of sustainable aviation fuel production-process from microalgae source," Fuel, vol. 324, p. 124759, 2022. doi:10.1016/j.fuel.2022.124759

[15] D. A. Sant'Anna and A. V. Hilal, "The impact of human factors on pilots' safety behavior in offshore aviation companies: A Brazilian case," Safety Science, vol. 140, p. 105272, 2021. doi:10.1016/j.ssci.2021.105272

