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Brief Review Paper : Comparative Research – Methodology Research Paper

Safe Aircraft Take-Off and Landing using Maglev Technology

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Abstract: Magnetic Levitation (Maglev) technology, which promises to revolutionize aircraft take-off and landing procedures, is redefining the future of aviation. This study examines how Maglev technology is being creatively applied in the aviation sector, with an emphasis on how it can improve sustainability, efficiency, and safety. Conventional runways and landing gear systems have historically been used for aircraft takeoff and landing. But in these crucial flying phases, the incorporation of Maglev technology offers a paradigm change. Maglev systems have many benefits, including the ability to drastically reduce friction between the aircraft and the runway by utilizing strong magnetic forces.

Keywords: Air Cart, Aaviation, Maglev, CO2, ARDC, VTOL.

1. Introduction

Societies and economies are very interested in the air transportation system. This system currently has a lot of problems, including capacity, security, safety, sustainability, and environmental impact. These issues call for completely novel or innovative remedies. Stakeholders in the aviation industry and air transportation system defined the challenging visions to better meet customer needs and ensure that air travel in the future will be safer, more environmentally friendly, more economical in terms of time, and more secure. The weight of the aircraft directly affects the environment and the economy. While many methods and tools exist, they allow for only modest aircraft weight reductions.

Still, significant outcomes indicate for creative, original, and inventive solutions. Using ground-based power to launch and recover an aircraft was one of the concepts arising from the EC-sponsored "Out-of-the-Box" project. The most notable findings from an initial investigation into multiple methods (such as microwave technology) that use electricity from the ground to help aircraft take off and land were linked to the technological advances of magnetic levitation.

2. Literature Review

Chihiro Inoue et al. (2023), highlighted that innovative research has been encouraged by the urgent need to achieve zero emissions of carbon in the aviation industry by 2050, as demonstrated by a groundbreaking study carried out at Japan's Fukuoka International Airport. Through the use of cutting-edge infrared camera technology with an exceptionally narrow bandpass filter, the study was able to achieve on-site, direct, and selective imaging of carbon dioxide (CO_2) emissions from aircraft, which represents an important turning point in emissions monitoring.

Nils Boysen et al. (2018), brought up three new goals for the aircraft landing problem, which was a significant innovation. By taking into account the total number of passengers landed, the frequency of landings by each airline, and the number of passengers landed by each airline over the course of the planning horizon, these objectives are intended to fairly distribute the workload of ground staff.

D.M. Liu et al. (2018), This creative method makes use of a unique combination which enables neural networks to learn and fuzzy sets to represent language. An efficient way for ANFIS to model aircraft landing trajectory tracking is by using both zero and first-order Takagi-Sugeno inference systems, particularly in auto-landing flight path scenarios.

L IU Wei et al. (2017). explored an extensive mathematical model using a tensor-based technique for carrier-based aircraft ski jump take-off. The carrier, the aircraft body, and the movable landing gear components are all distinguished as distinct entities in this model before being combined into a multi-rigid-body system with flexible

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links. Each of these entities has dynamic equations that are derived from basic concepts like Euler transformations and Newton's laws.

Hangxuan HE et al. (2022) emphasized the use of Active Disturbance Rejection Control (ADRC) to regulate pitch control for fixed-wing UAVs engaged in vertical takeoff and landing. The study focused on reducing height fluctuations during the hover-to-level flight transition. In order to solve the difficulties in adjusting parameters for ADRC and the demand for accurate and timely control, the authors present the Multi-Strategy Pigeon-Inspired Optimization (MSPIO) algorithm.

Tianlong LIN et al. (2023), discussed the growing interest in adaptive, morphing flaps in civil aviation, emphasizing the potential benefits in terms of enhanced high-lift performance and reduced fuel consumption per flight. Through the use of flap morphing, it is possible to establish a single configuration for the flap and then dynamically adapt its shape to satisfy the unique aerodynamic requirements of the landing and take-off phases.

Oliver Westcott et al. (2023) examined the impact of two tandem, edgewise, stationary propellers on a wing's aerodynamics. Through the methodical manipulation of these propellers' stationary positions, the study finds that while these propellers have little effect on lift, they can have a substantial impact on drag, which can increase by as much as 30% when they are positioned perpendicularly to the wing chord as opposed to parallel.

P. Casau D et al. (2011), specifically the autonomous transition of a model-scale fixed-wing
UAV from hover to level flight. In order to solve this issue, the authors divide the UAV's flight envelope into three separate regions: level flight, transition, and hover, each of which
uses a different controller.

Bhargav I. Gajjar et al. (2021) focused on the particular difficulties that arise when UAVs take off and land on aircraft carriers. In contrast to the Air Force and Army's use of UAVs, aircraft carrier operations require a seamless technological transition that respects current policies and practices.

Liu Hailiang et al(2014) talked about how important it is to quickly evaluate the ground handling qualities of a new transport aircraft in the late preliminary design stage. In order to satisfy this criterion, the researchers created an intricate nonlinear model of aircraft ground motion, which they combined with a pilot model to produce an all-encompassing simulation code. Predicting an aircraft's behaviour during take-off, landing, taxiing, turning, and braking is made possible by this code.

Mohammed El Adawy et al. (2023) covered this complex process. Across the globe, unmanned aerial vehicles, or UAVs, have been widely used for military and commercial purposes. However, UAV design involves complex optimization factors and decision-making. The main objective of designing, building, and testing an electrically powered radio-controlled aircraft is to maximize payload capacity and achieve safe take-off, cruise, and landing.

Anna Kwasiborska et al. (2017), the sequencing problem is significant in the aviation industry and is found in a variety of fields, including science, industry, and economics. Not only can direct flights be made possible by efficient sequencing, but it also makes passenger interchanges easier.

Dimas Numan Fadhil et al. (2019). The Journal of Terr mechanics published the most recent iteration of the ISTVS standards in 1977. Despite the development of new ideas, methods, testing protocols, and technologies over the course of the last 40 years, the document has not been updated since then. Updated from the 1977 ISTVS standards, this work was partially funded by ISTVS and covers a variety of topics related to off-road mobility for vehicles, tires, tracks, soil, wheels, modelling techniques, test methods, and equipment.

M. Kemal et al. (2016). comprehensive study of a new Unmanned Aerial Vehicle (UAV) with Vertical Take-off and Landing (VTOL), hover, and level flight capabilities—combining the characteristics of both multirotor and fixed-wing aircraft on a single platform—covered.

D. Navarro-Tapia et al. (2017) talked about how to improve the resilience and functionality of Autoland control systems, especially when it comes to soft landings on runways within a predetermined touchdown point range. They took into account issues like ground effects, strong wind turbulence, and parametric uncertainties. Notably, the vertical speed controller, which is essential for achieving accurate landings is designed using a structured H_∞ approach in this paper, which is based on the standard H_∞ formulation.

Alatorre et al. (2022), new trajectory design for Unmanned Aerial Vehicles (UAVs) to perform landings on mobile platforms was presented. The trajectory offers a flexible and adaptive approach by seamlessly integrating information about the mobile landing platform into its design. This is the key innovation.

Boris Andrievsky et al. (2022) highlighted a novel strategy with an emphasis on minimizing issues

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resulting from the integral component in control loops, which are typical in aeronautics. The study emphasizes that when actuators controlling the aircraft's surfaces get close to their rate limits, oscillations may occur in both manually and automatically piloted aircraft.

Harsimret Singh Dhami et al. (2022) concentrated on the creation of safe landing techniques for unmanned aerial vehicles. As unmanned aerial systems (UAS) gain greater potential for use in transportation, agriculture, inspection, and rescue operations, they will become more and more dependent on high degrees of autonomy, including the ability to fly beyond visual line of sight (BVLOS).

Xiao-Guang Yang et al. (2019). The fascinating and revolutionary field of electric vertical takeoff and landing (eVTOL) aircraft was covered eVTOL aircraft have the potential to drastically alter transportation systems in the future. Acknowledging the particular operating characteristics of eVTOLs, the study highlights the significant obstacles batteries confront in fulfilling the particular requirements of this technology.

Mihaela Mitici et al. (2023) highlighted is that during take-off and landing, eVTOL batteries experience much higher discharge rates than those needed for automotive applications. The long-term viability of e VTOL batteries is anticipated to be impacted by these special discharge procedures.

A.Kuznetsov et al. (2013) emphasized the innovative algorithmic methods for estimating the current status and forecasting the future movement of aircraft, rooted in an energy-based approach to air vehicle flight control. It discusses the energy balance equation to incorporate runway stages, offering a comprehensive description of how an aircraft's total energy evolves throughout its entire trajectory, including the initial segment

A.A. Pashilkar et al. (2006) described a new neural-aided controller intended to improve high-performance fighter aircraft's fault-tolerant capabilities, especially during the difficult landing phase when confronted with strong winds and potential malfunctions like stuck control surfaces. A neural controller is incorporated into the controller architecture to supplement the conventional controller that is currently in place.

Anna Sibilska-Mroziewicz et al. (2017). The changing role of aircraft, especially unmanned aerial vehicles (UAVs), in contemporary naval warfare and the possibility of a major change in naval operations were covered by Daniel Rohacs et al. (2016) provided demonstrations and validations to support this revolutionary concept, as well as a systematic overview of the methodologies used and an investigation into the viability of integrating Maglev technology into commercial aircraft.

Xinhua Wang et al.'s (2014) discussion of a novel control strategy for Vertical Take Off and Landing (VTOL) aircraft. The control scheme is based on a nonlinear double integrator that corrects for the drift phenomenon and estimates position and velocity from acceleration data.

3. Result and Discussion

Based The main focus of Xinhua Wang et al.'s (2014) discussion of a novel control strategy for vertical take-off and landing (VTOL) aircraft was the use of acceleration measurements to ensure accurate tracking of a specified reference trajectory during take-off and landing. A nonlinear double integrator serves as the foundation of the control scheme, estimating position and velocity from acceleration data while correcting for the drift phenomenon. Innovative advancements like sophisticated runway design, precise landing systems, and the possibility of autonomous take-off and landing were emphasized. These technologies were seen as viable ways to improve safety and operational effectiveness, particularly in inclement weather. It highlighted the constantly changing nature of aviation practices and the industry's commitment to achieving safer, more efficient, and environmentally friendly take-off and landing procedures. It focused on safety, technological advancements, and environmental considerations

4. Conclusion

The potential for autonomous take-off and landing, precise landing systems, and sophisticated runway design were highlighted as examples of innovative breakthroughs. These technologies were thought to be practical means of enhancing operational efficacy and safety, especially during bad weather. It emphasized how aviation practices are ever-evolving and the industry's dedication to attaining safer, more effective, and ecologically friendly take-off and landing procedures.

It was centred on environmental concerns, technological developments, and safety. It also underlined the importance of conducting thorough research and development in this area and the necessity of ongoing advancements in aircraft design and operation. The seminar covered the challenges of design optimization and the implications of these systems in various real-life scenarios as Unmanned Aerial Vehicles (UAVs) gain prominence in both military and civil applications.

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