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Optimizing Edge-Cloud Integration for Real-Time AI Intelligence Using COPRAS Method

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Abstract

Introduction: The rapid growth of data-generating devices powered by the Internet of Things (IoT), 5G, and smart technologies has created an urgent need for faster, more intelligent data processing. Traditional cloud computing, while powerful, often struggles with latency, bandwidth, and real-time responsiveness. Important by processing data closer to its source. When integrated with artificial intelligence (AI), this edge-cloud synergy enables real-time insights, predictive analytics, and autonomous decision-making. This integration not only improves performance and scalability, but also supports mission-critical applications in healthcare, manufacturing, transportation, and beyond. This research paper explores how the convergence of edge, cloud, and AI is reshaping the future of intelligent computing.

Research significance: The integration of edge and cloud computing with artificial intelligence (AI) is transforming how data is processed, analyzed, and acted upon in real time. This research is significant because it addresses the growing need for low-latency, high-performance computing architectures capable of supporting intelligent automation in critical sectors. By exploring the synergy between edge proximity, cloud scalability, and AI-driven intelligence, this study contributes to the development of robust, scalable, and adaptive systems.

These findings have practical implications for industries such as healthcare, smart cities, industrial automation, and transportation, as real-time intelligence is essential for safety, efficiency, and competitiveness. Furthermore, this research supports ongoing advances in sustainable and decentralized digital infrastructure.

Methodology: analytical to explore integration with to enable intelligence. A comprehensive literature review was conducted to examine existing architectures, frameworks, and use cases across various industries. Case studies from healthcare, smart manufacturing, and autonomous systems were analyzed to identify current trends, challenges, and best practices. In addition, a comparative analysis was conducted to evaluate system performance in terms of latency, scalability, and data processing capacity. Key, deep learning, federated were also reviewed understand their role in distributed environments. The aim of the methodology is to provide actionable insights into the development of intelligent, hybrid computing infrastructures.

Alternative: NINJA UAV, NETRA V4 UAV, SWITCH UAV

Evaluation preference: Flight Time, Operational Range, Target Detection Range, Optical Zoom Results: Hash Table It occupies the first place in the table. Graph is getting last place of the table

Keywords: NINJA UAV, NETRA V4 UAV, Flight Time, Operational Range

Introduction

Thanks to advances in semiconductor technologies, especially (MEMS) is being widely used in various industries, including manufacturing, smart factories, water management, smart cities and transportation. According to a paper by Ericsson, a typical smart factory can have a significant number of connected devices per square meter, and even more is possible in high-density areas. The Internet of Things is intricately intertwined into many key sectors, significantly contributing to their increased intelligence and efficiency. [1] Computer science has seen significant changes as a result of the global move towards the Internet of Things (IoT). Capabilities previously reserved for high-performance systems such as servers and data centers are now found in modern embedded devices. Edge computing is a result of this development. By allowing data processing and storage in resource-constrained locations, edge computing improves on current infrastructure and is closely tied to the well-established cloud computing model. This approach can greatly improve the performance of edge-based distributed AI systems. Systems essential to our society have long relied on real-time processing. [2] The Internet of Things (IoT) has completely transformed modern technology by establishing a large ecosystem of connected gadgets that can communicate and interact in real time. Processing, storing, and analyzing the huge amounts of data generated by the growth of IoT poses serious constraints. While traditional cloud computing is still useful in many situations, it often fails to meet the bandwidth and latency requirements of real-time Internet of Things applications.

These constraints are particularly noticeable in cyber-physical systems (CPS), where instant decision-making and rapid reactions are required to maintain the performance and reliability of the system. [3] Rapid advances in artificial intelligence (AI) and edge computing have revolutionized modern networking architectures, more and increased automation. For time-sensitive applications, traditional cloud-centric designs are less

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suitable due to issues including bandwidth constraints, high latency, and security vulnerabilities. By dispersing computational processes closer to the data source, services helps address these issues. AI extends the capabilities of edge-based solutions by facilitating autonomous operations, detecting anomalies, and providing predictive analytics. [4] Artificial Intelligence (AI)-based applications and services have proliferated as a result of the rapid development of AI. In many fields, including facial recognition, (ML) and deep learning (DL) have demonstrated cutting-edge performance. Edge computing helps address key barriers to implementing these applications. A potential solution to these problems is the combination of edge computing and artificial intelligence. This involves exploring distinct edge-based processing and collaborative approaches for model training and inference, servers. We will also explore research on edge caching strategies that store AI models locally to effectively handle dynamic and task-sensitive situations. [5] cloud edge computing causing major upheaval in the telecommunications industry. While each of these technologies has improved service delivery on its own, when combined, they have the potential to drastically change how telecommunications carriers handle real-time data processing and reduce latency. With the increasing demand for reliable, fast communications driven by innovations 5G, mobile broadband, sophisticated data processing solutions are now more important than ever.

To process large amounts of data, telecommunications networks have historically relied on centralized cloud computing infrastructures. [6] From industrial automation to driverless cars, a new generation of intelligent, networked systems has emerged as a result of the explosive growth of gadgets. However, conventional IoT data analytics methods often fail to meet the real-time requirements of these types of applications. Edge computing offers a powerful alternative data processing the point creation. This shift improves data privacy and accelerates real-time decision-making while reducing latency and bandwidth usage. [7] In this era of digital transformation, driving innovation including home automation, healthcare, and transportation, which can improve efficiency and safety. In critical sectors such as healthcare and industrial operations, where instant and accurate decisions are critical, the true value of IoT lies in its ability to deliver immediate and reliable performance. Real-time data processing in healthcare enables rapid, life-saving interventions, while edge computing in industrial settings enables autonomous decision-making and predictive maintenance. However, networks can experience stress, and system responsiveness can decrease due to the massive amounts of real-time data generated by connected devices. The performance of traditional cloud-based models in these situations is sometimes limited by issues related to latency and centralized processing controls. [8] Cloud computing has been the subject of much research in the past 20 years due to advances in distributed systems and networking. As a significant breakthrough in the development of distributed architectures, cloud computing evolved from the basic client-server concept first presented in 1958. Its rapid growth has made it a key technology tool widely used in various sectors, including industry, government, and academia.

To meet the needs of new science, healthcare, agriculture, transportation management, new technologies and paradigms have been made possible by fundamental features such as dynamic scaling and scalable access to shared computing resources. [9] In today's rapidly changing digital environment, cloud computing is the cornerstone of contemporary IT infrastructure. Its remarkable scalability, versatility, and cost-effectiveness have revolutionized the way businesses handle data over the past decade. Organizations across a variety of industries have adopted cloud solutions to drive innovation and stay competitive. Undoubtedly, the cloud the ecosystem, opening door further advancements in technology. However, despite its revolutionary effects, cloud computing still has many drawbacks. [10] The complexity of our energy production and use is growing rapidly, requiring lessons from cutting-edge technologies and other rich sectors. From the gasoline that powers cars and planes to the gas used for cooking to the electricity that lights homes and workplaces, every aspect of everyday life is powered by energy. While commodity markets for electricity, gas, and oil are still well-established, the energy landscape is changing at an unprecedented rate, requiring an equally rapid evolution from the sector. By leveraging model-based reasoning, direct inference, and sending anomalies and discoveries back to the cloud for continuous model improvement and data analysis, edge computing and AI are delivering real-time insights. [11] The cloud platform provides customers with a variety of services, such as software, hardware infrastructure, workspaces, data management, security solutions, and integrated hardware-software platforms. Cloud computing faces challenges such as high bandwidth requirements for data transfer to centralized cloud servers, the need for significant and, as a result, increasing latency systems Internet Things (IoT). integration artificial intelligence, i.e. machine learning, with edge computing technologies has been referred to as edge intelligence or edge AI in recent years. [12] two industrial that could be completely transformed by IoT applications. But the massive amounts of data generated by IoT devices are too much for the traditional centralized cloud computing model, which faces obstacles such as latency, bandwidth constraints, and privacy concerns. Supported by a wealth of research and perspectives, this article explores how edge computing can enhance CRM and SCM by providing scalable solutions and real-time analytics. [13] As information technology continues to evolve, organizations must adapt their digital infrastructure management methods.

Working in an era of rapidly growing data and increasingly complex distributed networks, organizations can no longer rely on traditional IT management architectures. Reactive problem-solving, reliance on manual human involvement, and numerous performance and cost inefficiencies that often lead to significant downtime are three major drawbacks of conventional IT infrastructures. These increasing difficulties have fueled the development of AI-powered computing systems that offer a revolutionary method for automating IT service management. [14] With the use, cloud computing emerged as a major research topic. It offers a wide range of services across multiple applications, offering unparalleled flexibility and scalability. Big data and IoT integration has been fueled by the growth of information and communication technologies (ICT), which has transformed cloud services. Cloud computing is essential to provide effective and scalable big data management solutions in this changing environment. Cloud computing, an emerging technology, is made up of several essential parts that collaborate to create a seamless built on top these gadgets, including sensors, routers, cell phones, and smart devices. [15] Artificial intelligence (AI) powered by machine learning (ML), especially deep learning, has made significant advances in the past decade, revolutionizing fields including medical diagnostics, facial recognition, and natural language processing.

Recently, the amount of data generated at the network edge has expanded dramatically due to the rapid growth of the Web of Things (WoT) and mobile applications. This data is typically transferred to the cloud for centralized machine learning model inference and training, although this method has drawbacks. These issues are addressed by edge computing, a new paradigm that enables machine learning right at the network edge. To facilitate local processing, edge servers with computing capabilities are deployed in base stations or access points in these types of systems. [16] Our daily lives are heavily dependent on the Internet of Things (IoT), which has the power to drastically change things. It significantly increases the potential of the Internet than previously thought. IoT is made up of real internet-connected gadgets that collect and exchange data all the time.

It allows for smooth communication between all smart devices by connecting them to the internet. IoT basically consists of smart sensors, devices, and wearable devices that are interconnected. Thanks to the advancement of powerful supercomputer CPUs and extensive wireless networks, almost everything can now be. Because of this, IoT has emerged as one of the most popular and rapidly expanding technologies in our rapidly changing world. [17] Applications and services powered by artificial intelligence (AI) have grown rapidly advancement have produced results in many fields, including facial recognition. Edge intelligence refers to networked systems and gadgets that use artificial intelligence (AI) methods to collect, store, process, and evaluate data close to its source.

The aim is to improve data processing while protecting user security and data privacy. Access to sufficient high-quality training data is crucial for many machine learning algorithms, especially supervised learning, to achieve good performance. [18] The has grown rapidly, connecting many devices limited resources. The widespread use of sensing devices, including wearable technology, cell phones, and smart home appliances, has generated vast amounts of data. However, most IoT devices have limited storage, connectivity, and processing capabilities. For example, they typically have limited memory and CPUs, so they must rely on cloud services to improve their performance. Cloud computing has also become a new and revolutionary computing paradigm in recent decades. [19] is a with sensors, software, communication capabilities. This has transformed many aspects of everyday life, increasing convenience, efficiency, and connectivity. Traditional cloud computing methods have scalability issues as a result of the vast data generation caused by the explosive growth of the Internet of Things. Additional computing layers, such as fog and edge computing, have been proposed to address these issues. Additionally, in an effort to close the growing gap between developers' ability to keep up with rapid advances in electronics, businesses and industries have begun to offer open source software layers to accelerate development efforts. [20]

Material and Method

Alternative:

NINJA UAV: The NINJA UAV is a lightweight, fully autonomous, fixed-wing drone developed by idea Forge, tailored for surveillance and reconnaissance missions. Its compact design and quick deployment capability make it ideal for tactical operations in challenging terrains. It can be launched by hand and is equipped with high-resolution day and night vision payloads. With a flight endurance of up to 2 hours and a range of about 25 km, NINJA UAV is suitable for short- to mid-range missions. Its ease of use, silent operation, and portability make it a strong choice for paramilitary, disaster response, and internal security roles.

NETRA V4 UAV: The NETRA V4 UAV is an advanced, quadrotor drone jointly developed by idea Forge and DRDO for high-precision surveillance applications. It features vertical takeoff and landing (VTOL) capabilities, making it highly adaptable for urban and rugged environments. NETRA V4 can operate at altitudes up to 4.5 km and offers an endurance of over 60 minutes with HD imaging and thermal sensors. Its real-time video streaming and GPS-enabled autonomous flight capabilities make it a reliable asset for counter-insurgency, border patrol, and crowd monitoring tasks. The modular design and robustness against environmental challenges make it an efficient alternative for intelligence-gathering missions.

SWITCH UAV: The SWITCH UAV, also developed by idea Forge, is a hybrid vertical takeoff and landing (VTOL) drone with long-range and high-endurance capabilities. Unlike traditional multirotor UAVs, SWITCH combines fixed-wing efficiency with VTOL convenience, making it ideal for extended surveillance missions in remote and mountainous regions. It has an endurance of over 2 hours and a range exceeding 15 km, equipped with day and night surveillance payloads. SWITCH is widely adopted by the Indian Armed Forces for its rugged build, autonomous mission execution, and real-time intelligence gathering. Its dual-mode operation and operational versatility make it a premier solution for persistent surveillance and reconnaissance tasks.

Evaluation preference: Flight Time: Flight time is a critical evaluation metric for UAV performance, determining how long the drone can stay airborne during a single mission. Longer flight durations enable broader surveillance coverage, reduced downtime, and fewer redeployments. UAVs with extended endurance are ideal for prolonged operations such as border patrol, forest monitoring, or disaster response. Flight time is influenced by factors like battery capacity, aerodynamics, and payload weight. In tactical scenarios, a UAV with 90 to 120 minutes of flight time offers a significant advantage over shorter-range platforms by enabling sustained observation without frequent interruptions. Operational Range: Operational range refers to the maximum distance a UAV can travel from its ground control station while maintaining communication and control. A longer operational range allows UAVs to reach remote or hostile areas without risking personnel or equipment. This is particularly important for military reconnaissance, pipeline inspection, or large-scale area mapping. UAVs with ranges exceeding 15 to 25 kilometers offer enhanced flexibility, enabling deep-field missions without relocating base stations. Evaluating operational range the UAV mission's spatial requirements effectively. Target Detection Range: Target detection range measures how far a UAV's onboard sensors can accurately identify and track objects or individuals on the ground. A longer detection range enhances early threat identification and increases situational awareness in both military and civilian operations. It depends heavily on the type and quality of sensors, including thermal, infrared, and electro-optical systems. UAVs with detection capabilities beyond 1 to 2 kilometers allow operators to maintain a safe standoff distance while collecting actionable intelligence — a vital factor in surveillance and reconnaissance missions.

Optical Zoom: Optical zoom is the UAV camera's ability to magnify an image without losing resolution, which is crucial for close observation and target identification. High optical zoom capabilities (e.g., 10x to 30x) allow users to capture detailed visuals from a distance, reducing exposure and improving operational security. Unlike digital zoom, which can degrade image quality, optical zoom ensures clarity and precision, which is especially valuable in applications such as law enforcement, intelligence gathering, and infrastructure inspection. Evaluating optical zoom performance is essential for missions requiring fine-detail monitoring.

COPRAS: In industries that rely on adversity has historically been linked to forestry and fisheries. Social sciences, technical sciences, management, and environmental studies are just a few of the disciplines that have developed this concept. The Brundtland Report of the World Commission on Environment and Development has the most widely accepted definition of sustainability, which states that it is the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. Current research on sustainability explores a variety of topics and identifies important new concerns, particularly in industries such as shipping, ports, and maritime enterprises. [1] The assessment of sustainability factors in shipping ports was conducted fuzzy. First, expert a literature review was used to identify these factors. Then, experts used the fuzzy COPRAS technique to assess the importance of each factor. These findings highlighted important sustainability issues such as, excessive use, failures. Sustainability has historically been defined as "the ability to maintain productivity despite challenges" in renewable resource domains including agriculture, ecology, and fisheries, with an emphasis on forestry and fisheries. [2] E-learning, which uses Internet technology to distribute and share educational content, is a revolutionary approach to education brought about by the rapid. According to studies, evaluating approached multiple criterion (MADM), which often involves conflicting selection criteria. The fuzzy matrix design method has been used to evaluate e-learning sites, emphasizing elements that support successful learning and course satisfaction, including interactivity, user interface, personalization, navigation, comprehensive content, security, and clarity of information. [3] Under the pressure of globalization, businesses are forced to increase their competitiveness and productivity. Upgrading industrial facilities by implementing new equipment and production methods is an efficient way to accomplish this. However, careful thought must be given to selecting the best machinery, as the performance of the system – including its accuracy, responsiveness, flexibility and adaptability – can be adversely affected by selecting inappropriate equipment. This decision-making process involves weighing multiple options to choose the best course of action. Businesses must always seek efficient manufacturing solutions as the manufacturing economy grows to meet and exceed customer demands. [4] Hard turning is a machining technique used to machine work pieces with high hardness using a single-point cutting tool. Hardened components are often finished by grinding to provide the required surface quality, however this process is time-consuming and only works with specific geometries. Therefore, machining hardened steels using more sophisticated technology requires higher material removal rates and greater flexibility in shaping different part geometries. Hard turning is now considered a viable alternative to milling due to its improved produce shapes on machine. [5] The basic principle of the scheme is to promote early diagnosis at primary health facilities. While primary health facilities deal with common and chronic diseases, general hospitals are designed to treat acute and chronic diseases. However, many individuals prefer to visit general hospitals rather than primary care centers, no matter how severe or mild their illness.

Due to the rapid progress in the medical field, a comprehensive medical and service system has emerged in recent years. This system has a systematic evaluation system and an evaluation indicator framework. [6] The Information Technology (IT) sector has grown rapidly in recent years, bringing about significant changes in various applications that rely on information. Education, especially teaching and learning, is one of the most popular applications. Within the larger framework of distance education, e-learning knowledge information and is continuous process of innovation. Today's students are looking for more personalized and efficient support to help them achieve their learning objectives. As a result, mobile technology is being incorporated into many learning applications to enhance the educational process. [7] companies adopt strategies to increase. Under many names and methodologies, the Lean Manufacturing (LM) concept and associated technologies are widely used in various industries to enhance resource management. The main goal of Lean principles is to identify and eliminate non-value-added (NVA) activities in order to achieve a more efficient process flow. Seven basic types of waste are identified by the LM philosophy: movement, inventory, waiting, overproduction, over processing, transportation and defects. It is very important for improve their manufacturing facilities. [8] Global challenges are increasing that affect traditional supply chains. Fixed and linear supply chain models struggle to perform well in changing environments. To remain competitive in the face of this unpredictability, businesses must implement new supply chain strategies that emphasize flexibility and scalability, which can be accomplished with digital technologies. The recently popular term "digital supply chains" (DSC) has the potential to drive expansion and facilitate faster response times. DSC promotes technological advances and the development of new products and services. A vague set of membership titles alone is inadequate to address a wide range of complex real-world decision-making problems. [9] Decision-making is one of the most important characteristics that distinguish humans from other animals. This ability has existed since the beginning of humanity and is still essential to management science today. The cognitive process that results in choosing a specific course of action from among various options is called decision-making. A greenhouse is a building with a lightweight frame that is covered with translucent or transparent materials to conserve heat and increase light exposure. These plant-growing structures come in a wide range of sizes, from small sheds to large buildings. [10]

Results and Discussion

Table 1. Edge and Cloud Integration with AI Powering Real				
DATA SET				
	Flight Time	Operational Range	Target Detection Range	Optical Zoom
NINJA UAV	0.35	0.45	0.55	0.6
NETRA V4 UAV	0.25	0.75	0.45	0.95
SWITCH UAV	0.75	0.4	0.05	0.1

The dataset provides normalized performance values for three UAVs – NINJA UAV, NETRA V4 UAV and SWITCH UAV – across four critical evaluation parameters: flight time, operational range, target detection range and optical zoom. The NINJA UAV performs moderately well across all categories, with its highest score in optical zoom (0.6). The NETRA V4 UAV excels in operational range (0.75) and optical zoom (0.95), making it suitable for surveillance-focused missions. In contrast, the SWITCH UAV demonstrates better endurance with maximum flight time (0.75), but performs better in target detection (0.05) and optical zoom (0.1). This dataset provides a comparative basis for evaluating UAVs based on mission-specific requirements, helping decision-makers prioritize between range, endurance, visual capability and situational awareness.

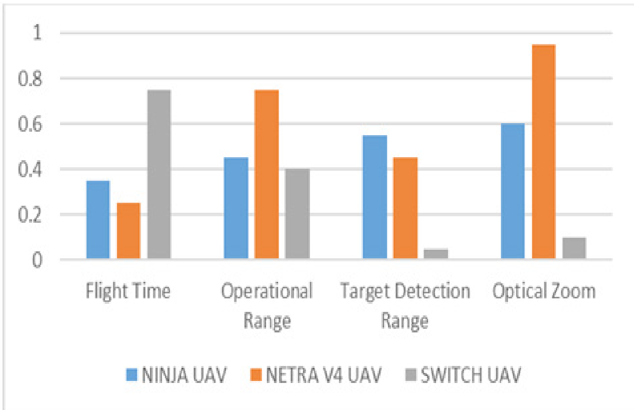

Figure 1: Edge and Cloud Integration with AI Powering Real-Time Intelligence

This bar chart compares the performance of three UAVs – NINJA UAV, NETRA V4 UAV, and SWITCH UAV – across four evaluation options: flight time, operational range, target detection range, and optical zoom. The SWITCH UAV leads in flight time, indicating its suitability for long-duration missions. The NETRA V4 UAV excels in operational range and optical zoom, making it suitable for deep-field reconnaissance and detailed visual surveys. In terms of target detection range, the NINJA UAV performs slightly better than the others, indicating effective surveillance capabilities. The SWITCH UAV lags significantly behind in optical zoom and target detection, which may limit its use in precision surveillance. Overall, each UAV exhibits unique strengths, emphasizing the importance of selecting a drone based on specific mission requirements.

Table 2: The table presents normalized performance metrics for three UAVs—NINJA

Normalized Data

	Flight Time	Operational Range	Target Detection Range	Optical Zoom
NINJA UAV	0.2593	0.2813	0.5238	0.3636
NETRA V4 UAV	0.1852	0.4688	0.4286	0.5758
SWITCH UAV	0.5556	0.2500	0.0476	0.0606

The table presents normalized performance metrics for three UAVs—NINJA, NETRA V4, and SWITCH—across four key parameters: Flight Time, Operational Range, Target Detection Range, and Optical Zoom. Normalization scales values between 0 and 1, enabling direct comparison. The NINJA UAV excels in Target Detection Range (0.5238) and has balanced scores in Flight Time (0.2593) and Optical Zoom (0.3636), though its Operational Range is moderate (0.2813). NETRA V4 UAV leads in Operational Range (0.4688) and Optical Zoom (0.5758), with decent Target Detection (0.4286) but lower Flight Time (0.1852). SWITCH UAV shows the highest Flight Time (0.5556) but significantly lower scores in other categories, especially Target Detection (0.0476) and Optical Zoom (0.0606). This data helps assess UAV suitability for specific mission needs.

Table 3: The table shows the weight distribution assigned to the four performance criteria

Weight

	Flight Time	Operational Range	Target Detection Range	Optical Zoom
NINJA UAV	0.25	0.25	0.25	0.25
NETRA V4 UAV	0.25	0.25	0.25	0.25
SWITCH UAV	0.25	0.25	0.25	0.25

The table shows the weight distribution assigned to the four performance criteria – flight time, operational range, target detection range, and optical zoom – used to evaluate three UAV models: NINJA, NETRA V4, and SWITCH. Each parameter is given an equal weight of 0.25, indicating that all factors are considered equally important in the overall evaluation. This equal weighting approach ensures a balanced evaluation without prioritizing any one attribute over the others. By using these balanced weights, the comparison of UAVs reflects a holistic view, considering endurance, range, detection capability, and zoom performance equally. This method is useful when all performance aspects are critical to mission success and when biases towards specific UAV capabilities are avoided.

Table 4. Weighted normalized decision matrix

Weighted normalized decision matrix

	Flight Time	Operational Range	Target Detection Range	Optical Zoom
NINJA UAV	0.06	0.07	0.13	0.09
NETRA V4 UAV	0.05	0.12	0.11	0.14
SWITCH UAV	0.14	0.06	0.01	0.02

Combines normalized performance values with their respective weights to provide a comprehensive evaluation of UAVs on four criteria: flight time, operational range, target detection range, and optical zoom. Each cell represents a normalized score and the product of its weights, which reflects the weighted contribution of each parameter to overall UAV performance. For example, the SWITCH UAV has the highest weighted flight time value (0.14), while the NETRA V4 leads in operational range (0.12) and optical zoom (0.14). The NINJA UAV scores the highest in target detection range (0.13). This matrix enables a balanced, quantitative comparison to identify which UAV best meets the mission requirements by factoring in both the relative importance and actual performance of each criterion.

Table 5. Bi, Ci, Min(Ci)/Ci

	Bi	Ci	Min(Ci)/Ci
NINJA UAV	0.135	0.222	0.1220
NETRA V4 UAV	0.163	0.251	0.1078
SWITCH UAV	0.201	0.027	1.0000

This table presents three key metrics for UAVs - NINJA, NETRA V4, and SWITCH, which are used in decision analysis. Bi represents the weighted sum of the benefits, which represents the overall performance scores. Ci represents the weighted sum of the costs or drawbacks associated with each UAV. The Min(Ci)/Ci ratio compares the cost of each UAV to the minimum cost of all UAVs, which serves as a measure of relative performance. The SWITCH UAV has the highest cost value (Ci = 0.201) but also the best cost-performance ratio (1.0000), indicating that it has the minimum cost base. NINJA and NETRA V4 show the lowest costs, but the lowest relative performance ratios. This analysis helps identify UAVs that offer the best balance between benefits and costs for optimal selection.

Table 6: This table provides Qi and Ui values for UAVs, which are used to rank their overall performance

	Qi	Ui
NINJA UAV	0.185	30.3809
NETRA V4 UAV	0.207	34.0958
SWITCH UAV	0.608	100.0000

This table provides Qi and Ui values for UAVs, which are used to rank their overall performance. Qi represents the relative indicates UAV best a lower Qi indicates better performance. Ui is the percentage score derived from Qi, which shows the ranking of the UAV as a proportion of the best performance. The SWITCH UAV has the highest Qi value (0.608) and has a Ui of 100%, which indicates that it is the reference or best UAV in this analysis. NINJA and NETRA V4 have lower Qi values (0.185 and 0.207) and correspondingly lower Ui scores (30.38% and 34.10%), which reflects their performance over SWITCH. This helps decision makers select the most suitable UAV.

Table 7. Rank

Rank

NINJA UAV	3
NETRA V4 UAV	2
SWITCH UAV	1

The ranking table summarizes the final evaluation based on the overall performance scores of the three UAVs: NINJA, NETRA V4, and SWITCH. The SWITCH UAV ranks first, indicating that it is the best performing model of the three, likely due to its balanced strengths across key criteria. The NETRA V4 UAV ranks second, showing solid performance but slightly behind the SWITCH. The NINJA UAV ranks third, indicating that it is the most favorable option based on the metrics evaluated. These rankings assist decision makers in selecting the most suitable UAV, clearly highlighting which model performs best overall. Such rankings provide a straightforward comparison, helping to simplify complex data into operational insights for UAV deployment strategies.

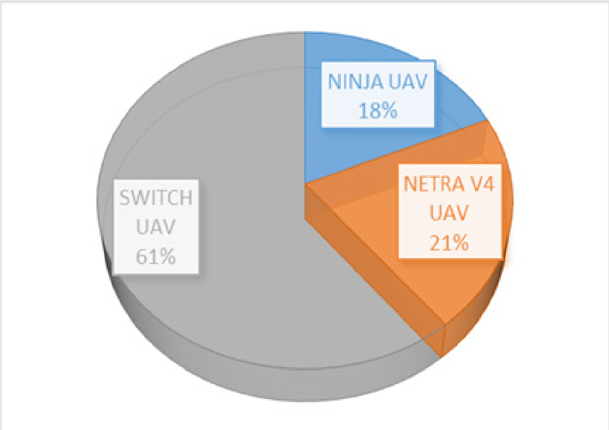

Figure 2: Qi, Ui

The pie chart illustrates the overall preference spread between the three UAVs, SWITCH UAV, NETRA V4 UAV, and NINJA UAV, based on performance metrics. The SWITCH UAV dominates with 61%, indicating its strong fit for the applications evaluated, likely due to its extended flight time and balanced capabilities. The NETRA V4 UAV follows with 21%, reflecting its strength in operational range and optical zoom, making it a reliable choice for precision and long-range missions. The NINJA UAV is at 18%, indicating a more specialized or limited scope of application compared to its peers. This preference spread highlights that while the SWITCH UAV leads in versatility, each UAV offers unique advantages suited to unique mission profiles.

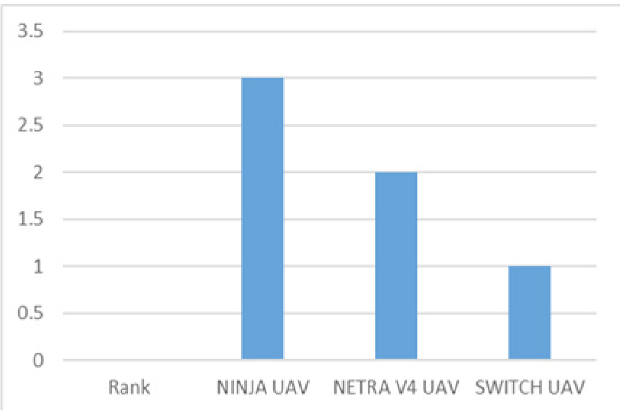

Figure 3: Rank

The bar chart presents the ranking results of three UAVs – NINJA UAV, NETRA V4 UAV, and SWITCH UAV – based on key performance criteria. The SWITCH UAV takes the top spot with a rank of 1, indicating its best overall performance across the parameters assessed. The NETRA V4 UAV receives a rank of 2, reflecting its strong capabilities in operational range and optical zoom, although it lags slightly behind the SWITCH in overall versatility. While competitive in some areas, such as target detection, the NINJA UAV is placed at rank 3, indicating that it may be less suited to a wider range of mission requirements. The ranking highlights the SWITCH UAV as a more balanced and effective option, making it the preferred choice for applications that demand endurance, range, and multi-role functionality.

Conclusion

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