Revolutionizing Military Operations: The Role of Deep Learning with YOLO v7 in the Evolution of Drones

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In this research paper we explores the transformative role of drones in military operations, highlighting the historical evolution and strategic impact of these unmanned systems. Tracing their development from early investigation tools to sophisticated battle instruments, the study highlights significant milestones in drone technology. We are giving special attention to the integration of deep learning techniques and the YOLOv7 object detection framework, to examining their contributions for enhancing drone capabilities. The paper investigates into the technical advancements brought by deep learning, including improved navigation, targeting accuracy, and real-time decision-making. YOLOv7's innovations in object detection and tracking are analysed for their operational benefits in various military scenarios. Through a comprehensive historical and strategic analysis, the study evaluates the effectiveness of deep learning-enhanced drones compared to traditional systems. Additionally, the research addresses the ethical and legal implications of autonomous drone warfare, considering the broader impact on military strategy and global security. In these paper we identifies emerging trends and potential future advancements in drone technology, offering predictive insights into the next generation of military operations. We also examine the past, present, and future of military drones, this study underscores the critical role of AI and advanced algorithms in revolutionizing modern warfare.

Keywords: YOLOv7, Deep learning Drone, Aerial Vehicles, Radio Controlled Model Flying System, Security, Military.

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1 Introduction

Drones, also known as unmanned aerial vehicles (UAVs), have become integral to modern military operations due to their versatility, efficiency, and ability to operate in environments that may be too risky or challenging for manned missions [1]. After reviewing some papers we found some key points highlighting the importance of drones in modern military operations [8]. Drones have revolutionized military operations by providing continuous real-time surveillance over areas of interest for extended periods. Equipped with advanced cameras and sensors, they capture high-resolution imagery and video, offering detailed intelligence. Their infrared and thermal imaging capabilities enable them to conduct operations at night and in adverse weather conditions. Drones excel in identifying and tracking targets with high precision, enhancing strike accuracy and minimizing collateral damage [8]. They can follow moving targets and relay real-time updates to command centers, facilitating dynamic decision-making. Armed drones, equipped with precision-guided munitions, engage targets remotely, minimizing risks to human pilots and ground forces while conducting highly accurate strikes [9].

The deployment of drones eliminates the need to send pilots into hostile environments, thereby reducing the risk of casualties. Drones extend the reach of military forces, enabling operations in otherwise in accessible or dangerous areas. They can be deployed quickly and cost-effectively, enhancing overall operational efficiency. Compared to manned aircraft, drones are generally less expensive to operate and maintain. This affordability allows for the deployment of larger numbers, providing greater coverage and operational flexibility. Drones can be equipped with various payloads, including cameras, sensors, communication relays, and weapons, making them adaptable to a wide range of missions. They can be quickly reconfigured for different tasks, from surveillance to combat, search and rescue, and electronic warfare.

Real-time data and imagery transmission to command centers improve situational awareness and enable better-informed decision-making. Drones integrate seamlessly into network-centric warfare systems, enhancing communication and coordination among different military assets. They are invaluable in search and rescue operations, providing aerial reconnaissance to locate and assist in the recovery of personnel. Additionally, UAVs assist in disaster response by assessing damage, locating survivors, and delivering supplies. The constant presence of drones acts as a deterrent to adversaries, who are aware of being monitored and targeted at any time. Drones can also be used for psychological operations, including leaflet drops and broadcasting messages.

Advances in artificial intelligence and machine learning are enabling drones to perform more autonomous operations, reducing the need for human intervention. Future developments may see the deployment of drone swarms, operating in a coordinated manner to overwhelm adversary defenses. Ongoing advancements aim to improve the stealth and survivability of drones, making them less detectable and more resilient in contested environments. These innovations ensure that drones remain a crucial and evolving asset in modern military operations.

2 Historical Evolution of Military Drones

When we take up the development of the natural and man-made features we find that various stages play vital role in this context. We find that after a lacuna of Time Rivers change their course, mountains become oceans and desert becomes green valley, plains are covered by the multistory buildings, but it cannot be done within a day. If we look at the history of ways, means and techniques offence and defiance time has played a crucial role to find the course of development [10]. Naturally we have to study stone age of gun powder and age of steam further the atomic energy and star war to which we can say age of high-tech in all fields and flights.

At the threshold of civilizations man started become offensive and defensive both. Whenever offensive equipment's came in existence the defensive Measures also appeared simultaneously. Hence we have to take up the study of Radio Control Model Flying System (RCMF) in civil and non-civil duties. The study needs highlighting the periodical development in this aspect [11].

The study of RCMF is correlated with the gesturing and adventurous sports of aeromodelling. Man has always been fascinated by flight, as is evidenced by the mythology of early civilizations and the work of artists through the centuries [20][21]. The remarkable Leonardo-da-Vinci, who is believed to have made successful model helicopter, was the first to leave a record of possible designs for flying machines, one or two of which could well have proved sufficiently successful to have encouraged further development. Other figures of history were less practical, for example Roger Bacon, who wrote a specification in 1250; he was convinced that air had an upper surface on which a sufficiently light vessel would float. The concept developed gradually and the scientists discovered the lifting property of a cambered surface and wind vessel.

2.1 RCMF (Radio Control Flying System)

Presently models are controlled through RCMF system (Radio Control Model Flying Sys- tem). This facilitates full control of the model aircraft from the ground. Such models are fitted with glow plug engine, servos, with various channels as provided in receiver of the set[8][9]. Gradually model aircrafts and aeromodelling had been used as hobby and sports, it became extremely popular amongst the people of all age group. This approach however leads towards the understandings of a highly technical theory that is aerodynamics. Scholar being aero modeler as hobby and profession had curiosity to give a new track in an important field like national defense, civil defense, internal security with special reference to various terrorist groups, Naxalites, Maoists and intruders [12]. I started my approach of study to use my hobby and sports (aeromodelling) for the tactical employment. This needs instant studies and practical on:

a. Aerial photography of no man's land and forward area.
b. Target shooting
c. Raccee.
d. Surveillance

May I bring on records that different RPVs (Remotely Piloted Vehicles) vary in their range of action? The RCMF system was earlier used in sports, now it can be a helping asset to infantry commanders [8]. The infantry commanders/commanders of paramilitary forces/Special Armed Forces can gain live video shooting and moving mapping with the help of modern software's. It may be added that RPVs/UAVs (Unmanned Aerial Vehicles) are a paramount feature in early warning system in tactical resonances and target acquisition to save own casualties of trained man power[10][11][12].(see Figure 1)

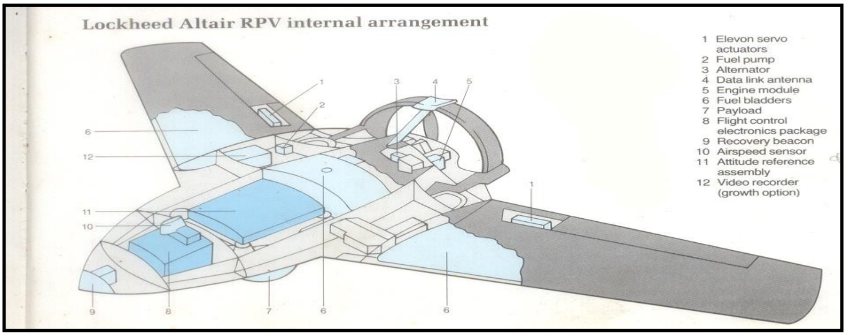

Figure 1. Historical evaluation of Military Drones

It also works as deterrence amongst terrorists, Naxalites armed rebels. Today UAVs are performing various services including tactical intelligence gathering for tactical theater and helping in mechanism of homeland security system [9]. At the strategic level large and costly UAVs are performing these missions with dedicated payloads and short-range surveillance. The smaller RCMF or so-called spy planes can gain the photographic information's, simultaneously denies sending trained personnel in no man's land, forward areas, and dense forest area in homeland security, even if it will be short down it would be cheaper than the loss of the skilled NCO/JCO/or CO (Non Commissioned Officer/Junior Commissioned Officer or Commissioned Officer)[19][20][21].

2.2 Lay Out of the Work

While introducing the realistic approach to the research worthy problem 'TACTICAL EMPLOYMENT OF RADIO CONTROL MODEL FLYING SYSTEM'. I researcher feel as it's my duty to project the effective requirement of the work under the present spectrum. We are living in the state of total war where not only the fighting forces are involved in defense activities, but a major proportion of multi sector of the nation is directed to meet the ends of the war. May be a farmer, engineer, teacher, industries of nation, logistical means TPT, and communication, all economic and natural resources[10][11][12].

They play a vital role in defense of a nation. Naturally they become vulnerable enemy targets. In the present day war, the main target of the enemy is not the fighting forces but the resources of the nation are the major targets, so as to crush the will to defend the nation i.e. demoralization. The Adolf Hitler in WWII practiced this. He said in future, war would be wagged through propagandas, suggestions and other psycho traits. Psychological bombardment will crush the will to fight instead of artillery bombardment[8][9].

Need it I add apart from the importance of tactical targets in present day global countries are facing new virus that is the global terrorism. The terrorist use to merge with civilian population of the country and plays their role mostly from behind the curtain. The activities of the terrorist/insurgents have become a constant headache to military, paramilitary forces and state police. As the man in uniform cannot encounter civil population and it becomes difficult to find actual target, which is happening in Chhattisgarh due to Naxalite activities. Not only in Chhattisgarh but in adjacent states also like, Bihar, Jharkhand, Orissa, Maharashtra, Madhya Pradesh, Andhra Pradesh and Nagaland, Assam, Jammu and Kashmir etc[14][18][23].

2.3 Technical Devices Used

Before going to the depth of the research worthy problem. The technical terminology needs elaboration of working methodology [12][13].

The proposed technical devices and terminology are as under:

RADIO CONTROL SET

1) Receiver	2) Transmitter.
3) Servo and connectors	4) Frequency.
5) Decoder	6) Types of Radio Control Models
7) Down link video camera	8) USB TV Box.
9) Engines (types and functions)	10) Payload system.
11) Auto pilot device	12) Thermal Imaging Devices

13)Infra-Red (IR) camera (importance in surveillance and target locating)
14) PC laptop

The above-mentioned devices will be used for experiments. (Excluding Thermal Imaging, and Infra-Red camera) [15][16][17].

3 Deep Learning in Military Drone Operations

The integration of deep learning in military drone operations represents a transformative shift in how these aerial vehicles are utilized. Deep learning, a subset of artificial intelligence (AI), influences neural networks to analyses and interpret large amounts of data.[3] This capability significantly enhances the performance and capabilities of drones in various military applications. After reviewing some paper we conclude that there are so many advantages of deep learning in military drones like enhanced object detection and recognition, autonomous navigation and decision-making, enhanced surveillance and reconnaissance and enhanced surveillance and reconnaissance. Deep learning algorithms like YOLO (You Only Look Once) v7 can process visual data in real-time, enabling drones to detect and recognize objects, people, and vehicles with high accuracy. Improved precision in identifying targets reduces the likelihood of errors, minimizing collateral damage and increasing mission success rates. Deep learning enables drones to autonomously plan and adjust their flight paths based on real-time data, avoiding obstacles and adapting to dynamic environments. AI-powered drones can assess their surroundings and make decisions without human intervention, enhancing operational efficiency and response times [4]. Deep learning allows for continuous monitoring and analysis of vast areas, providing real-time intelligence and situational awareness. Drones can identify and track patterns of movement, detect anomalies, and gather valuable intelligence for strategic planning. Deep learning models can predict potential hardware failures by analyzing operational data, allowing for proactive maintenance and reducing downtime. AI systems can adapt to new data and evolving threats, maintaining high performance and reliability in diverse conditions [4].

3.1 Applications of Deep Learning in Military Drones

Border Patrol: Deep learning-enhanced drones can monitor borders for unauthorized crossings, providing real-time alerts to security forces.
Urban Warfare: In urban environments, drones can navigate complex terrain, identify potential threats, and relay critical information to ground troops [22].
Precision Strikes: AI-powered drones can identify and engage high-value targets with precision, reducing the risk to human operators and minimizing collateral damage.
Combat Support: Drones can provide close air support to ground troops by identifying enemy positions and providing real-time intelligence.
Autonomous Resupply: Drones can autonomously deliver supplies to remote or hazardous locations, ensuring troops have the necessary resources without risking human lives.
Inventory Management: AI can optimize logistics operations, ensuring efficient use of resources and timely delivery of essential supplies.

From above we have face some challenges to use deep learning in Military Drones i.e. autonomous weapons, privacy concerns, data requirements, computational resources, cybersecurity threats and adversarial attacks[23][24]. The use of AI in autonomous weapon systems raises ethical concerns regarding accountability and the potential for misuse. The extensive surveillance capabilities of AI-powered drones pose significant privacy risks, requiring robust legal and regulatory frameworks. Deep learning models require vast amounts of data for training, which can be challenging to obtain in military contexts. High-performance computing hardware is necessary to run complex deep learning algorithms, potentially increasing costs and logistical challenges. AI systems are vulnerable to cyber attacks, necessitating robust security measures to protect sensitive data and ensure operational integrity. Deep learning models can be susceptible to adversarial attacks, where malicious actors manipulate data to deceive AI systems.

The integration of deep learning into military drone operations offers substantial benefits, including enhanced accuracy, autonomous decision-making, and improved reliability. While there are significant challenges and ethical considerations, the potential for increased operational efficiency and effectiveness makes deep learning a valuable asset in modern military strategies. As technology continues to advance, the role of AI in military drones will likely expand, shaping the future of military operations.

4 YOLO v7: Technical Features and Military Applications

YOLO v7, the latest iteration of the "You Only Look Once" family of object detection algorithms, brings significant advancements in real-time object detection and recognition. It processes images and videos swiftly by predicting bounding boxes and class probabilities simultaneously, enabling real-time analysis. Enhancements in accuracy are achieved through advanced anchor box generation, feature pyramid networks, and robust loss functions, which together improve the precision of detection. YOLO v7's optimized neural network architecture reduces computational requirements, resulting in lower latency and faster inference, even on hardware with limited processing power. Its ability to perform multi-scale detection enhances the model's performance across varied object sizes. Dynamic routing allows YOLO v7 to allocate computational resources based on the complexity of the input, optimizing both resource usage and processing speed. Improved training techniques, such as advanced data augmentation, better optimization algorithms, and regularization techniques, further boost the model's robustness and accuracy by preventing overfitting.

In military applications, YOLO v7 significantly enhances the capabilities of drone operations. Its real-time object detection enables drones to monitor and track multiple objects simultaneously, providing continuous surveillance over vast areas and quickly detecting changes or anomalies [6]. The high precision of YOLO v7 in target detection and identification allows military drones to accurately identify and prioritize high-value targets, reducing the risk of collateral damage and enhancing mission effectiveness. Autonomous navigation and real-time obstacle avoidance are bolstered by dynamic path planning, allowing drones to navigate complex environments without human intervention and optimize flight paths based on terrain analysis. In logistics and supply chain support, YOLO v7 enables drones to autonomously conduct resupply missions with pinpoint accuracy, efficiently manage inventory, and minimize risks to human operators. For threat detection and countermeasures, YOLO v7 offers advanced intruder detection capabilities, providing early warnings and enabling effective counter-drone measures to enhance perimeter security and neutralize potential threats. Overall, YOLO v7's technical features and applications significantly enhance the operational efficiency, precision, and reliability of military drone operations.

5 Proposed Methodology with Comparative Analysis

This table1 provides a clear comparison between traditional drone operations and those enhanced with deep learning, specifically focusing on the improvements brought by YOLO v7 in various military applications.

Table1. Comparative Analysis of Traditional vs. Deep Learning-Enhanced Drone Operations

Aspect	Traditional Drone Operations	Deep Learning-Enhanced Drone Operations (YOLO v7)
Accuracy	Relies on GPS, IMUs, and other on-board sensors. Manual control can intro- duce human error[23][24].	Real-time object detection and recognition. Enhanced target identification with YOLO v7. Reduced false positives and improved precision.

Reliability	Dependent on hardware quality. Prone to environmental interference.	Adaptive algorithms improve over time. Predictive maintenance and fault tolerance. Less prone to environmental factors due to advanced sensing and processing.
Cost-Effectiveness	Lower initial costs. High operational and maintenance costs due to manual control.	Higher initial costs for advanced sensors and computing hardware. Long-term savings through reduced need for manual intervention and improved efficiency.
Surveillance and Reconnaissance	Limited to basic monitoring capabilities. Dependent on operator vigilance [23][24].	Continuous monitoring and real-time analysis. Enhanced pattern recognition and anomaly detection. Increased situational awareness.
Target Acquisition and Engagement	Manual targeting with higher risk of errors. Less precise target identification.	- Precise target identification and prioritization. Reduced collateral damage. Real-time battlefield analysis and decision support.
Autonomous Navigation	Limited to pre-programmed paths and basic obstacle avoidance.	Dynamic path planning and obstacle avoidance in real-time. Autonomous decision-making in complex environments. Improved terrain analysis for optimized flight paths.
Logistics and Supply Chain	Manual resupply missions with higher risk and logistical challenges.	Autonomous resupply missions with accurate delivery. Efficient inventory management and optimal resource allocation. Reduced risk to human operators.
Threat Detection	Basic intruder detection, often manual. Limited counter-drone capabilities.	Advanced intruder detection with early warnings. Effective counter-drone measures. Enhanced perimeter security and threat neutralization.
Challenges	Dependent on hardware robustness. Limited adaptability and scalability. High operational costs[23][24]..	Requires high-quality training data and computational resources. Needs robust security against adversarial attacks. Validation across diverse conditions for consistent performance.

5.1 Proposed Work

The drone captures high-resolution images or video frames from its environment using advanced on-board cameras. These images form the raw data input for further processing. The captured images are pre-processed to meet the input requirements of the YOLO v7 model. This involves resizing the images to a standard dimension and normalizing pixel values. This step ensures that the images are in a consistent format that the model can efficiently process. The pre-processed images are fed into the YOLO v7 deep learning model. YOLO v7 is designed for real-time object detection, making it highly suitable for dynamic and time-sensitive military operations. These layers use ReLU (Rectified Linear Unit) activation functions to extract meaningful features from the input images[1]. These features include edges, textures, and patterns that help in identifying objects. The model predicts bounding boxes around potential objects in the image. These predictions include the coordinates of the boxes and are generated using linear activation functions. Bounding boxes localize the objects within the frame. Each bounding box is assigned an Objectness score using sigmoid activation. This score represents the confidence level that the box contains an object of interest, distinguishing between background and actual objects. For each bounding box, the model predicts the probability of the object belonging to each class using the SoftMax activation function. This results in a probability distribution over predefined classes, such as vehicles, people, weapons, etc. The raw output from the YOLO v7 model undergoes post- processing to refine the detection results. This technique filters out redundant and overlapping bounding boxes to retain only the most relevant ones. NMS ensures that each detected object is represented by a single, precise bounding box. A confidence threshold is applied to Objectness scores to eliminate Low confidence detections. Only bounding boxes with high confidence scores are considered for fur- ther analysis [6].

The processed image now contains bounding boxes with class labels and confidence scores for each detected object. This output is critical for the drone's situational awareness and decision-making capabilities. Based on the detection output, the drone makes informed decisions to carry out its mission objectives. The drone identifies specific objects of interest, such as enemy vehicles, personnel, or strategic installations, based on the class probabilities [8]. The drone plans actions in response to the detected objects. For instance, it may track a moving target, avoid detected obstacles, or initiate surveillance on identified objects. The drone adjusts its flight path based on the location and movement of detected objects. This capability is crucial for safe navigation and efficient mission execution in dynamic environments. The drone communicates detection results and decisions to the command centre or other units in the field. This real-time data sharing facilitates coordinated actions and informed decision-making across the operation.

The drone executes the planned actions, such as moving to a new location, engaging a target, or avoiding an obstacle. The seamless integration of detection, decision-making, and execution enhances the drone's operational effectiveness.

5.2 Revolutionizing Military Operations

Drones equipped with YOLO v7 can conduct continuous, real-time surveillance, identifying and tracking objects of interest with high accuracy. This capability enhances situational awareness and enables proactive responses to emerging threats. Drones can gather detailed intelligence by accurately detecting and classifying objects in the field. This information is vital for strategic planning and tactical decision-making. The ability to quickly and accurately identify and track targets, such as enemy vehicles or personnel, significantly improves the efficiency of target acquisition and engagement processes. Advanced object detection and classification enable drones to navigate complex environments safely and avoid obstacles. This capability reduces the risk of collisions and enhances the drone's operational longevity[1][2].

5.3 Objectives of the Study

We are analyzing the historical development of military drones from early manual systems to advanced autonomous platforms, examining technological advancements over time.

1 We use deep learning and YOLOv7 for our proposed work and development in military drone technology and deep learning applications to address current limitations and explore new capabilities.
2 Analysing the strategic advantages and operational roles of modern drones based on their recent utilization in military engagements worldwide.
3 We explore how deep learning techniques enhance drone capabilities in navigation, targeting, and real-time decision-making processes.
4 We are using YOLO v7 for object detection framework to improving the operational effectiveness and accuracy of military drones.
5 Assess the operational efficiency and effectiveness of deep learning enhanced drones compared to traditional systems in various operational scenarios.
6 We conduct a comparative analysis of traditional versus deep learning -enhanced drone operations, focusing on key performance metrics such as accuracy, reliability, and cost-effectiveness.
7 Identify emerging trends and potential future advancements in drone technology and deep learning integration that could influence military applications.

8 In future we do trajectories and capabilities of military drones, considering technological advancements, strategic requirements, and geopolitical implications.
9 Provide recommendations for policymakers and military strategists on the effective and ethical use of autonomous drones in warfare, emphasizing responsible deployment and regulation.
10 Highlight the importance of international cooperation and the development of regulatory frame- works to ensure safe and ethical deployment of autonomous military system.

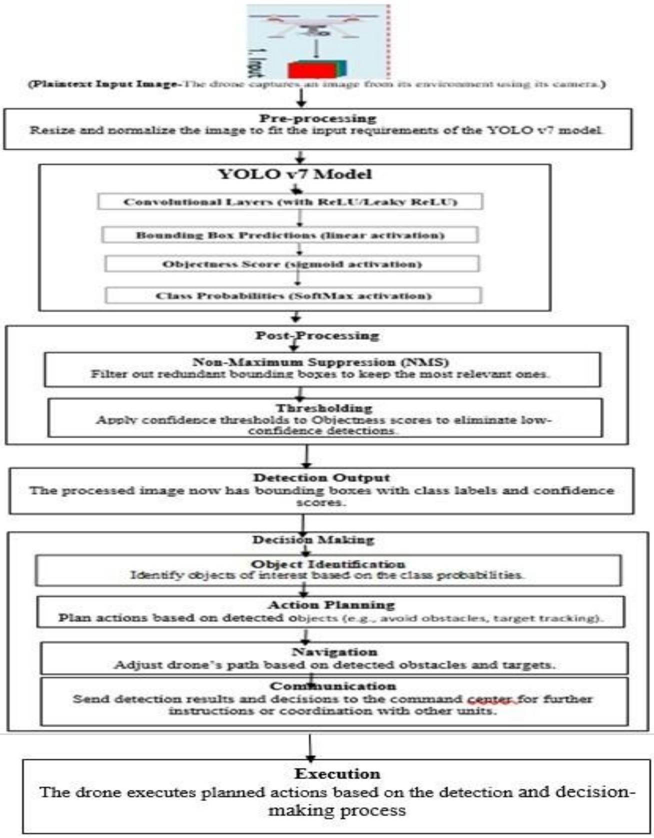

Figure 2. Flow Diagram of Proposed work

This flow diagram demonstrates how the YOLO v7 model, incorporating the SoftMax activation function for class probabilities, is integrated into the drone's operation system to enhance military operations. The Combination of efficient object detection, accurate classification, and real-time decision-making contribute significantly to the evolution and effectiveness of drones in military applications. This flowchart figure 2 provides a detailed explanation of how a drone uses a YOLOv7 model for object detection and decision-making. Her we analysis of the process is-

1 Input and Pre-Processing: This stage contains input image and pre-processing.
  - Input Image: The drone captures an image from its environment using its camera. This raw image serves as the primary input for further processing.

- Pre-Processing:
  - The captured image is resized and normalized to fit the specific input requirements of the YOLOv7 model.
  - Normalization ensures the image data is scaled appropriately for efficient model processing.

2 YOLOv7 Model-The YOLOv7 architecture is employed for object detection. It consists of the following stages:
- Convolutional Layers: These layers, utilizing activation functions like ReLU or Leaky ReLU, extract important features from the image, such as edges, textures, and patterns.
- Bounding Box Predictions: Linear activation functions are used to predict potential object locations within the image.
- Objectness Score: A sigmoid activation function estimates the likelihood of an object being present in each bounding box.
- Class Probabilities: Using a SoftMax activation function, the model assigns probabilities to each detected object's possible categories.

3 Post-Processing –It contains
- Non-Maximum Suppression (NMS): This step eliminates redundant or overlapping bounding boxes, retaining only the most relevant ones with the highest confidence scores.
- Thresholding: A confidence threshold is applied to filter out low-confidence detections, ensuring only reliable results are forwarded.

4 Detection Output
- The post-processed image is enhanced with bounding boxes, class labels, and confidence scores. This information highlights the identified objects and their probabilities.

5 Decision-Making
- Object Identification: The system identifies objects of interest based on their class probabilities, such as obstacles or targets.
- Action Planning: The drone plans appropriate actions based on detected objects, such as avoiding obstacles or tracking specific targets.
- Navigation: Adjustments are made to the drone's flight path to align with the planned actions, ensuring smooth and safe operation.
- Communication: The processed results and decisions are sent to a command center for additional instructions or collaboration with other systems.

6 Execution
- The drone executes the planned actions based on the decisions made during the previous steps. This may include navigating through the environment, avoiding obstacles, or completing a designated task.

This entire pipeline ensures the drone can detect, analyze, and act on its surroundings autonomously using the YOLOv7 model for real-time object detection and decision-making.

6 Conclusion

Military drones have evolved significantly from their early manual forms to advanced autonomous systems, driven by rapid advancements in technology, particularly in AI and deep learning. These advancements have transformed military operations by enhancing capabilities in surveillance, reconnaissance, and target acquisition, while also presenting new challenges and considerations. In proposed work we use YOLO v7 object detection framework, promises further improvements in operational effectiveness and accuracy. However, this advancement also raises ethical, legal, and strategic concerns regarding the use of autonomous systems in warfare. It is imperative for policymakers, military strategists, and researchers to collaborate on establishing robust regulatory frameworks and ethical guidelines to ensure the responsible development and deployment of autonomous military technologies. Finally, the future of military drones lies in continued innovation and the strategic adaptation of emerging technologies. As these technologies evolve, they will continue to shape military strategies and global security dynamics, influencing how nations defend their interests and respond to evolving threats in the 21st century.

References

[1] L. Tan, X. Lv, X. Lian, and G. Wang, “YOLOv4_Drone: UAV image target detection based on an improved YOLOv4 algorithm,” Computers and Electrical Engineering, vol. 93, Jul. 2021, doi: 10.1016/j.compeleceng.2021.107261.

[2] O. Sahin and S. Ozer, “YOLODrone: Improved YOLO Architecture for Object Detection in Drone Images.”

[3] Z. Zhang, X. Lu, G. Cao, Y. Yang, L. Jiao, and F. Liu, “ViT-YOLO:Transformer-Based YOLO for Object Detection.”

[4] F. Yang, X. Zhang, and B. Liu, “Video object tracking based on YOLOv7 and DeepSORT,” Jul. 2022, [Online]. Available: http://arxiv.org/abs/2207.12202

[5] U. Nepal and H. Eslamiat, “Comparing YOLOv3, YOLOv4 and YOLOv5 for Autonomous Landing Spot Detection in Faulty UAVs,” Sensors, vol. 22, no. 2, Jan. 2022, doi: 10.3390/s22020464.

[6] Nwankwo Constance Obiuto, Igberaese Clinton Festus-Ikhuoria, Oladiran Kayode Olajiga, and Riliwan Adekola Adebayo, “REVIEWING THE ROLE OF AI IN DRONE TECHNOLOGY AND APPLICATIONS,” Computer Science & IT Research Journal, vol. 5, no. 4, pp. 741–756, Apr. 2024, doi: 10.51594/csitrj.v5i4.1019.

[7] M. Lee et al., “A Study on the Advancement of Intelligent Military Drones: Focusing on Reconnaissance Operations,” IEEE Access, vol. 12, pp. 55964-55975, 2024, doi: 10.1109/ACCESS.2024.3390035.

[8] C. Chen et al., “YOLO-Based UAV Technology: A Review of the Research and Its Applications,” Drones, vol. 7, no. 3. MDPI, Mar. 01, 2023. doi: 10.3390/drones7030190.

[9] L. F. Gonzalez, G. A. Montes, E. Puig, S. Johnson, K. Mengersen, and K. J. Gaston, “Unmanned aerial vehicles (UAVs) and artificial intelligence revolutionizing wildlife monitoring and conservation,” Sensors (Switzerland), vol. 16, no. 1, Jan. 2016, doi: 10.3390/s16010097.

[10] BILL GUNSTON (1981), The Encyclopedia of World Air Power

[11] DAVID MILLER (1987), Christopher F Foss Modern Land Combat

[12] BILL GUNSTON (1986), James Aerospace Dictionary

[13] JOHN WR TAYLOR (1973), Jane’s Pocket Book Major Combat Aircrafts

[14] WILLIUM J WINTER (1988), Model Aviation Official Publication of the Academy of Model Aeronautics

[15] M ANJI REDDY (2001), Remote Sensing and Geographical Information System

[16] AIR COMMODORE (2003), Future Defense Challenges (Dr G N GHOSH)

[17] LRA NARAYAN (1999), Remote Sensing and Its Application

[18] CHAITANYA AGRAWAL (2000), Text Book on Remote Sensing in Natural

[19] AND PRADEEP GARG, Resources Monitoring and Management

[20] JOURNAL OF USI (2003), the Journal of the United Service Institution of India Oct-Dec

[21] WILIAM J WINTER (1966), Aeromodeller

[22] WALTERLSCHRODER (1979), Encyclopaedia of Model Aircraft

[23] Y. Turk, A. Aydin, and R. Eker, “Comparison of Autonomous and Manual UAV Flights in Determining Forest Road Surface Deformations,” European Journal of Forest Engineering, vol. 8, no. 2, pp. 77– 84, 2022, doi: 10.33904/ejfe.1206846.

[24] Yurtseven, H., Demir, M., Akgul, M., Akay, A.O. 2016. Comparison of Drone Based Photogrammetry and Terrestrial Laser Scanning for Forest Road Surface Modelling, 1st International Symposium of Forest Engineering and Technologies (FETEC 2016), Bursa, Turkey, vol.1, pp.22-22.