IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Survey In Ai Applications Of Drone: Environmental Monitoring, Disaster Management, Agriculture, Logistics

[1]Heman Gowda K S, [1]Jai Gupta, [1]Jiya Duseja, [1]Kumar Aditya, [1]Shreya Upadhyaya, [2]Shobana T S
[1]Student, [2]Assistant Professor
[1]Information Science and Engineering,
[1]B.M.S. College of Engineering, Bangalore, India

Abstract: Artificial intelligence integrated with drones has created new opportunities for many industries, making processes automated, enhancing remote data capturing and decision making. UAV (Unmanned Aerial Vehicles) also known as drones was originally used for military and surveillance but now integrates technologies like agriculture, supply chain, emergency management and ecological sensing. The background on this research relates to the enhancement of capability of drones through machine learning and computer vision algorithms permitting them to work autonomously without much human input. The methods that have been discussed in this paper are CNN as an object detection technique, Reinforce Learning for efficient routes, and NLP for Voice Command Control Systems. Such technologies make it possible for the drones to discover features of the environment, identify objects and even interact better with the operators. Speaking of the outcomes, AI drones have shown a considerable advance in terms of effectiveness and precision during their operation. However, numerous industries such as precision agriculture involve the use of drones with AI in multispectral imaging to determine the state of crops to achieve better results from resource utilization. Likewise, in disaster management situations, exceptional agility is possible by using drones that have artificial intelligence for purposes of assessing the destruction, finding victims and delivering supplies. Such advancements support a view on how AI can improve the performance of drones in dynamic environments with related uncertainties. Nevertheless, some limitations still exist in some issues including the model regulation, ethical issues, and the structures for handling variability in actual usage of AI models. Copied from the main text The research therefore concludes that AI applications in drones are growing progressively, further development of these technologies is needed for improved breakthroughs. With superior technological enhancement, drones are expected to be more relevant to sectors that need precision, efficiency, and decentralization to function optimally while guaranteeing regulatory compliance and safety concerns will be the critical parameters that will drive the improvement of drones' functionality.

***Index Terms* -** Artificial Intelligence, Drones, Unmanned Aerial Vehicles, Machine Learning, Computer Vision, Autonomous Systems, Precision Agriculture, Disaster Management, Object Detection, Route Optimization, Reinforcement Learning, Natural Language Processing, Environmental Monitoring, Real-time Data Processing, Ethical Considerations in AI

I. INTRODUCTION

Artificial Intelligence (AI) is a field of organizing unbelievably systems or pros able to translate their circumstances and make cardinal choices to accomplish exact points successfully. Consistent progressions are being made in AI, and numerous endeavors are underway to coordinate AI into different arrangements to move forward organizational proficiency toward coming to these and other destinations. Unmanned Ethereal Vehicles (UAVs) have too encountered huge advancements in afterward a long time credited to progress it in Fake Insights additionally to machine learning. Specialists are utilizing a number of AI approaches to progress the usefulness and flexibility achievable with UAVs. Worldwide advertisement for the standalone UAVs is anticipated to develop essentially and is anticipated to reach the showcase esteem of USD 15.63 billion in 2023 and may conceivably cross USD 91.3 billion by 2033. Organizational UAV headways have suddenly affected segments like transportation and perception, where impelled sensors and AI-based computations let these UAVs go standalone. Autonomous UAVs with incredible stature complexity and cautious coordination are capable of creating circumstance mindfulness, securing data and fulfilling complicated missions. This development is related in zones such as movement checking, ethereal overviews, and bundle conveyance. In cultivating, UAVs help in alter watching, sprinkling, and promoting noteworthy encounters to ranchers. In catastrophe organizations they are utilized in assessing the effect, looking for casualties and conveying offer assistance in emergency zones.

A few applications coordinated UAVs with AI computations, secured as developing in Area III. It incorporates utilizing case planning and basic utilizing cases for way organizing, control frameworks and swarm coordination for UAVs. Why organizing is vital for secure and productive UAV movement control and how Machine Learning (ML) procedures counting Post Learning (RL) are utilized to instruct UAVs to discover perfect courses utilizing standard clues and uncommon mission targets. The control frameworks utilized to oversee UAVs depend on AI to keep up quality and permit legitimate development; PID controllers help in modifying enhancements by diminishing the disparity of required and real states. Customary ML computations such as Noteworthy Learning Neural Systems (DLNNs) upgrade control frameworks by examining flight arrangement and energetic strategies. In expansion, AI computations empower what is called different UAV administration, utilizing satisfying operations through swarm computations such as Underground frightening crawly Colony Optimization (ACO) and Molecule Swarm Optimization (PSO), to where UAVs can communicate, collaborate, and make bunch choices proficiently.

Subsystems of driving edge UAVs have been well created, with way better batteries to upgrade flight times. High-resolution cameras and sensors orchestrated on these UAVs make it conceivable to capture real-time information that advise how decision-making shapes and improved situational mindfulness happen.

II. AI ALGORITHM BASED CLASSIFICATION

2.1. Reinforcement Learning (RL)

Reinforcement learning (RL) is a popular AI computation in unmanned ethereal vehicle (UAV) frameworks, especially for tasks that involve decision making within real time in an energetic climate. In RL, an operator (the UAV) learns by rote and error to interface with its surroundings to accomplish activities that optimize a reward sign.

This approach is especially well-suited for UAV applications because:

- UAVs frequently work in eccentric situations: The elements such as wind, obstacles, and other airships need time sensitive tuning, which RL does flawlessly.
- Numerous UAV errands include successive decision-making: As with way arranging, collision shirking, and asset allotting, long-term results are desirable, a characteristic of RL.
- RL permits for learning complex behaviors without unequivocal programming: This is advantageous to UAVs whereby conventional computer programming methodology pose a challenge more so due to energy exertion during flying.

The sources conceptually primarily concern the FQ-model, which represents a method (policy, a mapping from states to actions) or a value function (evaluating the expected cumulative reward) of the environment’s constituent without necessarily identifying the latter. Inside model-free RL, there are two fundamental categories:

- Policy-based calculations: These calculations are especially made to determine the Re from the most efficient perspective of the approach’s anticipated remunerate. Policies include Profound Deterministic Approach Angle (DDPG) and Proximal Arrangement Optimization (PPO) which have been used efficiently for UAV demeanor control.
- Value-based calculations: They achieve esteem work that estimates the expected total pay for per state or per state-action pair. It is at this point that the operator decides on the activities based on these esteem measures. Q-learning is a frequently applied value-based computation in UAV way finding and resource management.

The sources too differentiate model-based RL, which uses a learned depiction of the environment to predict the outcomes of actions. This can be very useful when in real life conducting experiments is costly or dangerous. Nevertheless, model-based RL may require high computation and potentially does not generalize in the modern context. The sources present examples of model-based RL using impersonation learning and reverse support learning for UAV control and direction tracing.

The sources highlight the taking after key applications of RL in UAVs:

- Way Arranging: RL also enables UAVs to discover perfect strategies where constituents encompass repellents, wind status, and mission objectives. DRL and Q-learning are also used in the illustrations and in deterrence avoidance and route selection.
- UAV Control: Of RL, it can be used to train autopilot frameworks to replace or enhance conventional PID controllers where situations are complicated.
- UAV Systems: RL enables grouping of numerous UAVs in tasks such as communication transferring, detecting and performing numerous coordinated assignments.
- Collision Shirking: RL enables UAVs to learn around obstacles and other deterrents, airplane types and enhance flight safety.
- Prescient Upkeep: In Reference to RL, they can be used to predict mechanical problems of UAVs with data from the sensors and history of flights to enhance on the maintenance schedule.

The sources too mention hybrid RL equations that contain aspects of both the model-free and the model-based RL. A case is the use of show gatherings to prepare a multitude of models and fuse their expectations to enhance wheat abdicate forecast by UAVs.

In total, the sources prove that RL is a rather auspicious and efficient tool to develop the UAV advancement and enhance independent flight. However, challenges remain in areas such as flexibility, asset constraints, information access, and strength, which warrant assist study and implementation.

2.2. Convolutional Neural Systems (CNNs)

Particularly, they make it clear that Convolutional neural frameworks (CNNs), a specific shape of manufactured neural organize (ANN), have come to be irreplaceable for upgrade of acknowledgment and choice making in UAVs. They are especially profitable in giving examination of visual information, which is one of the key viewpoints of numerous UAV schemes.

CNNs work by taking a course of action of convolutional channels through input pictures and highlights refinement at distinctive levels of deliberation. The return of these channels is at that point encouraged by non-linear activation capacities and pooling layers which diminishes the profundity of the information as well as protecting basic data.

This different leveled incorporate extraction licenses CNNs to learn complex plans and representations from rough picture data, engaging them to perform errands like:

- Dissent Area: Recognizable proof and isolation of certain objects of interest which are inspiring intrigued in ramble pictures like individuals, cars or buildings.
- Picture Classification: Putting pictures in classes agreeing to the subject matter, like separating between distinctive sorts of scene or distinguishing zones of intrigued mostly.
- Semantic Division: To put to each pixel in a picture, a title, subsequently giving a nitty gritty understanding of the substance of the scene.

The sources categorize CNNs into two types:

- Shallow CNNs: These systems have a moderately little number of layers and are regularly utilized for easier picture acknowledgment assignments.
  Illustrations include:
  LeNet: One of the most punctual CNN models, still utilized for fundamental assignments like transcribed digit acknowledgment and person on foot checking in UAVs.

AlexNet: A more complex shallow CNN that accomplished critical breakthroughs in picture classification. It has been effectively connected to wind turbine edge harm discovery utilizing UAV symbolism.

- Profound CNNs: These systems have numerous layers, permitting them to learn more complex and theoretical highlights.

A few prevalent profound CNN models utilized in UAV applications include:

- ResNet (Profound Leftover Learning Organize): Addresses the vanishing angle issue in exceptionally profound systems, empowering more compelling preparation and execution. It has been utilized for real-time UAV distinguishing proof utilizing micro-Doppler marks from radar spectrograms.
- InceptionNet: Utilizes parallel convolutional channels of distinctive sizes to capture highlights at different scales, upgrading exactness in protest location and picture classification errands. It has been connected to inconsistency discovery in UAV observation videos.

The sources highlight a few cases of CNNs being utilized in AI-integrated UAV systems:

- Protest Location and Following: CNNs are utilized to identify and track objects in genuine time, empowering UAVs to take after moving targets or screen particular ranges.
- Collision Shirking: CNNs can handle visual information to distinguish impediments and help in collision evasion maneuvers.
- Peculiarity Discovery: CNNs can be prepared to identify unordinary occasions or designs in UAV symbolism, such as recognizing fires or security breaches.
- Exactness Horticulture: CNNs are utilized to analyze trim wellbeing, foresee yields, and optimize input application in horticulture.
- Bridge Assessment: CNNs analyze high-resolution pictures and warm information to distinguish basic absconds in bridges.

The sources additionally talk around the centrality of data openness and quality for planning fruitful CNN models. High-quality, varying, and absolutely labeled data is crucial for making solid and strong AI calculations for UAV applications.

Overall, the sources outline the essential portion of CNNs in advancing free UAV capabilities, particularly in zones requiring visual acknowledgment and examination. As examination continues, we can expect undoubtedly more cutting-edge CNN-based courses of action to create, energize updating the capabilities of UAVs over diverse spaces.

III. Survey of AI Applications in Drones by Sector

3.1. Environmental Monitoring

In recent years, unmanned aerial vehicles (UAVs) combined with artificial intelligence (artificial intelligence) have emerged as powerful tools for monitoring environmental parameters. This integration is transforming how data is collected, analyzed, and used for managing natural resources, monitoring ecosystems, and detecting environmental hazards. Drones equipped with artificial intelligence algorithms provide real-time insights, accurate data collection, and efficient solutions for several environmental challenges. Below, we delve into some prominent applications of unmanned aerial vehicles (UAVs) in monitoring of environmental parameters, the artificial intelligence techniques involved, the challenges faced, and future directions in the field.

3.1.1. Air and Water Quality Monitoring

Drones equipped with sensors are increasingly being used for monitoring air and water quality. In air quality monitoring, unmanned aerial vehicles (UAVs) are deployed to collect data from difficult-to-reach or hazardous areas, offering advantages over traditional ground-based monitoring systems. These unmanned aerial vehicles (UAVs) can detect pollutants such as particulate matter (PM), carbon dioxide (CO_2), nitrogen dioxide (NO_2), and ozone (O_3) using specialized sensors.

In water quality monitoring, unmanned aerial vehicles (UAVs) equipped with sensors are used to sample water bodies for parameters like pH levels, temperature, turbidity, salinity, and contamination. For example, unmanned aerial vehicles (UAVs) equipped with multispectral imaging can detect pollutants like oil spills, hazardous chemicals, or algal blooms in water bodies, thus helping in the early detection of environmental hazards.

Techniques:
- Image Segmentation: In water quality monitoring, unmanned aerial vehicles (UAVs) can capture high-resolution images of water bodies, and artificial intelligence-driven image segmentation techniques can help identify areas with high pollutant concentration, distinguishing between contaminated and non-contaminated areas.
- Anomaly Detection: artificial intelligence algorithms like anomaly detection can analyze sensor data from unmanned aerial vehicles (UAVs) to identify deviations from normal environmental parameters, indicating pollution or other environmental hazards.
- Environmental Data Analytics: artificial intelligence models are trained to process large volumes of environmental data collected from unmanned aerial vehicles (UAVs). These models can analyze air and water quality data, providing insights into pollution patterns and predicting future contamination levels.

Challenges:
- Environmental Factors Impacting Sensors: Environmental conditions like humidity, temperature fluctuations, and dust can affect sensor accuracy, leading to errors in data collection.
- Legal Restrictions on Data Collection: Regulatory frameworks in various countries impose restrictions on drone operations in certain areas, which can limit their effectiveness in monitoring environmental parameters.

3.1.2. Wildlife Tracking

Drones have revolutionized wildlife tracking by offering a non-invasive, cost-effective method for monitoring animals in their natural habitats. Using high-resolution cameras and GPS systems, unmanned aerial vehicles (UAVs) can track animal movement patterns, observe wildlife behaviors, and monitor endangered species in remote locations. Drones are particularly useful for tracking large mammals, bird migration, and other wildlife movements in areas that are difficult to access by humans.

Techniques:
- Image Segmentation: In wildlife tracking, artificial intelligence-powered image segmentation is used to identify and segment animals in drone-captured images or videos. This is especially useful for identifying individual animals, monitoring population density, and detecting changes in behavior or movement.
- Anomaly Detection: artificial intelligence models can be used to detect unusual behaviors in wildlife, such as sudden changes in movement patterns, which may indicate danger or distress, helping wildlife conservationists take action in a timely manner.
- Environmental Data Analytics: By combining environmental data (weather, habitat conditions) with wildlife tracking data, artificial intelligence models can analyze how various environmental factors affect wildlife movement and survival, contributing to effective conservation strategies.

3.1.3. Deforestation Mapping

Deforestation monitoring is critical for managing forests and preventing illegal logging. Drones have been widely used to monitor forest cover, identify deforestation hotspots, and map out changes in vegetation cover over time. By capturing high-resolution images and using multispectral cameras, unmanned aerial vehicles (UAVs) can help detect subtle changes in the forest environment that may not be visible to the naked eye.

Techniques:
- Image Segmentation: artificial intelligence-driven image segmentation techniques are applied to satellite and drone imagery to classify land cover types and detect changes in vegetation. This helps in identifying deforestation or forest degradation caused by logging or environmental changes.
- Anomaly Detection: artificial intelligence models are used to analyze long-term satellite and drone imagery, detecting unusual patterns that may indicate illegal logging activities, land clearing, or forest fires.
- Environmental Data Analytics: artificial intelligence models can predict future deforestation patterns by analyzing historical deforestation data, climate conditions, and land use patterns. This predictive capability can help policymakers in forest conservation and management efforts.

Challenges:

- Environmental Factors Impacting Sensors: Drones equipped with imaging sensors can be affected by weather conditions (e.g., heavy rain, cloud cover) and natural obstructions (e.g., dense tree canopies), limiting the quality of data collected for deforestation monitoring.
- Legal Restrictions on Data Collection: Governments often impose regulations on unmanned aerial vehicles (UAVs) flying over forest areas, particularly in sensitive regions. These restrictions can limit the ability to gather sufficient data for deforestation analysis.

Future Directions:

- Renewable-Powered Drones: There is a growing interest in developing unmanned aerial vehicles (UAVs) powered by renewable energy sources such as solar power or hydrogen fuel cells. These renewable-powered unmanned aerial vehicles (UAVs) would have the potential for longer flight times, enabling continuous monitoring of environmental conditions over large areas without the limitations of battery life. This innovation will be particularly valuable in monitoring remote or inaccessible locations where frequent drone deployments are necessary.
- Artificial Intelligence Models for More Accurate Forecasting: As artificial intelligence models continue to advance, there is a strong emphasis on improving the accuracy of environmental forecasts using drone-collected data. Machine learning algorithms will become more adept at predicting environmental trends such as pollution levels, wildlife migration patterns, or deforestation rates. These artificial intelligence models will provide better decision-making tools for environmental policy and resource management.
- Integration with IoT and 5G Technology: The integration of unmanned aerial vehicles (UAVs) with Internet of Things (IoT) devices and 5G networks will allow real-time communication between unmanned aerial vehicles (UAVs) and other monitoring equipment. This will enhance data transfer rates and enable more sophisticated monitoring of environmental parameters systems, providing instant feedback on environmental conditions and allowing for rapid responses to environmental hazards.

3.2. Disaster Management

Environmental control and the assessment of the prospective emergency situations is to begin with the level of the population safeguard from possible tectonic and anthropogenic threats. Thus, we are able to identify the sources of dangers quickly and effectively, as well as predict a probable cessation in the region, also decide on threats in development, which let us take every possible measure to avert them indeed prior to the onset of crisis situations. It may mean a lot to people if the extent of possible risk from climate conditions, natural disasters or man-made failures is estimated precisely.

For better understanding of these issues, it is possible to distinguish various approaches to how the information is to be observed, analyzed and prepared. The higher level of crisis observation and definition is awaiting for observation, control and forecast of the dangerous climate phenomena and forms occurring in nature, innovative circles, and the elements of their formation. Crisis determining allows you to choose the severity to which disasters exist in your environment, as well as implement effective prevention strategies against them.

With the help of UAVs, we will be able to search for people lost in forest, estimate territories difficult to access and perform other basic functions. In any case, rambles have one noteworthy disadvantage – their flight time. To cover vast areas and collect more information needed for modeling and estimating various crisis situations, we will solve this problem with the help of several UAVs instead of one.

- Checking: This is our first task, which will be completed with the help of a reconnaissance camera mounted on a ramble. Thanks to the Arducam IMX477 camera assistance, we will always learn about the current situation and be able to track even the smallest change. Great to the warm camera "Seek", occasions happening at night shall not be a hindrance to visibility.
- Determining: This organization will be executed right after receiving the data (information?) collected by the cameras. It will send the data to the microcontroller Jetson Nano, which controls picture handling by the means of profound learning systems. Jetson Nano microcontroller is one of the most effective on the market, and unlike Raspberry Pi – it calculates fake insights much better. By the end of the calculation we will know whether there is a fiasco, and if so how likely it is.
- Early caution: This is an imperative point for which mon- itoring was carried out and without which the meaning of landscape inquiry about and estimating is misplaced. As long as we get the likelihood of the figure we contrast it with our edge esteem and if that outcome surpasses it then we quickly create the occasion and send it to the significant specialists without squandering a minute. The occasion will contain the following:

- Time of the recognized catastrophe (day/month/year : hour/minute/second)
- Exact identifies, extent and degree of the fire
- Heading toward which the fire is spreading
- The frequency at which the fire is extending

The abovementioned things comprise all the necessary data for the corresponding specialists. When persons are informed of the scale and the line of the occurrence, people will manage to work extremely swiftly and efficiently to prevent the fire occurrence and put out the fire occurrence. The agents of checking and estimating as to the crisis situations have a decisive influence upon the feasibility of regulating the danger of their occurrence, their expansion and the expulsion of a novel disaster which is still in the making.

Situational Mindfulness (SA) is the awareness of parts and conditions of the environment in relation to time or space, their consequences and the probable state in the future. The lowest level of Situational Mindfulness is simply Knowledge of the state of affairs outside and in the environment, its impact on the display and the future. Despite the fact that this might appear self-confined in an enduring and reasonable environment, this might turn into a real ordeal in a volatile and intricate situation. This makes Situational Mindfulness a concept that fits and/or holds elevated importance for situations with a tall level of changeability, instability, complexity and equivocalness. The identification of bank and self-generated mistakes, and the prevention of such oversights, is one of the main tasks of situational mindfulness.

The formal definition of SA is partitioned into three sections: analysis of the elements in the environment and evaluation of the situation, and probable assessment of the future state. The central focuses for investigation were three viewpoints of SA: structures of state SA, structures of frameworks of SA and structures of forms of SA. In Circumstances SA there are hints at real concern of the circumstance. Frameworks SA mentions spreading of SA between objects in the environment, also formation of SA exchange between components of the given framework. SA in its Forms addresses the enhancement of SA states and to what determines the time SA changes. Many models of situational mindfulness were produced. Of all the Endsley shows this three level show is the most familiar and, in our opinion, the most realistic.

3.2.1. State-Of-The-Art Technologies Using Uav To Localize People In Emergency Situations

- Sensors Accelerometer, magnetometer, gyroscope, barometer
  An element perceives and responds to natural stimuli such as light warmth motion tackiness or mass falling in the gap between the physical and cyclic worlds sensors can also be active or passive depending on its operation dynamic sensors must receive power from a source outside the environment in question whereas detached sensors draw power from the said environment some cases include meteorological sensors as the dynamic attachment while others include a mercury thermometer as a detached attachment sensors can moreover be analog or advanced sensors also can be of two types namely analog or advanced moreover sensors can also be analog or advanced whereas the analog sensors are relaying steady though fluctuating data the computerized sensors generate binary data or 1s and 0s at a time.

- Video Camera/RGB depth camera
  RGB is a color system where colors are produced with the aid of red green and blue lights sources this kind of camera is an rgb which records color pictures by sensing light in these wavelengths 400-700 nm an rgb camera is just a color camera and also a depth camera working at the same time real-time 3d depth sensor such as stereo and time of flight the possibility to combine color and depth data makes it easier to perform object identification and scene understanding that’s why rgb cameras are useful in such fields as face recognition anti-spoofing and people counting in the present research we employed the arducam imx477 simultaneous stereo camera module that has been developed for the NVidia jetson nano and features two 12mp imx477 chips for depth range perception.
- Audio/Microphone Array
  Recording sound converging with nearby clamor can ruin the recording and fixing the sound requires computational power to enhance it and expel undesirable clamor to exclude the unwanted sound recordings from various sections of the area are taken and multiple are made or a mouthpiece cluster as it were of two or more mouthpieces helps make a difference between which is producing each sound this is similar to how ones ears choose a specific clamor to follow using the sound related system to determine where to focus microphones mimic this ear-like acknowledgment by picking up sound as pressure waves that induce a stomach sound inside the mic then generate a signal flag in the case of a

mouthpiece cluster each microphones flag is stored and aligned because amplifiers are located at different distances from the sound source they correlate sounds with different time shifts these time delays allow the framework to estimate the area of the sound source software in the mouthpiece cluster measure the time delay between the main mouthpiece and the others by shifting auxiliary recordings also the differences in case the disparity of the recordings is minimal the signals are synchronized in time and allows the framework to determine the time delay for each microphone employing these delays and the time of flight of sound between the separate and each receiver the distance is determined after which geometry is used to estimate the sound sources region this prepare enables mouthpiece cluster to discern sounds and their beginning points in detail hence fruitful clamor control and enhanced sound study.

3.2.2. Advantages And Disadvantages of Each

- Arducam imx477 strengths and weaknesses of focal points.

  Advantages:

  1. Enhances 12mp still pictures in 4056 x 3040 jpeg.
  2. Does record in full determination at 60fps 4k2k at 60fps and 1080p at 240fps
  3. Includes a motor aided center eliminating the need for a focal point shift
  4. Enhances autofocus for additional functionality and not so critical focusing
  5. Prominently demonstrates a mechanically switchable ir channel for applications that segregate obvious and infrared light

  Disadvantages:

  1. Determined the position of camera and the object of focus no more adjustment for direction or lens
  2. In other words, the camera module cannot function independently instead it needs something called a camarray cap to interface with jetson
  3. In fact, supports jetson nano and Xavier nx others are not suitable for jetson sheets

- Microphone Cluster

  Advantages:

  Choosing the form of headings of sound sources can distinguish between different kinds of sound source enhances the possibility to evacuate unwanted sound to improve the speed and accuracy in sound management.

  Limitations:

  Because of the conflict of clamor mistake presence mouthpieces constitute potential mistake since the management of the flag comparison handle is complex and prone to mistakes the complexity of sound analysis leads to the expanding of the preparing time in real time sound handling also can be moderate for commonsense utilize if it involves numerous little operations to compare recordings and calculate time delay those involves numerous amplifiers.

3.2.3. Handling UAV failures

UAV disappointments are continuously being attributed to motor control flight control frameworks and human related factors which contributes to about 80 of the difficulties thus advancing UAV reliability lateral includes changing imposed charge safety and efficiency two primary approaches are utilized blame resistance and disappointments avoiding blame resilience represents triple or fourfold repetition nevertheless it add weight been costly and increases control utilization therefore crash avoidance is often chosen as one since it is an important parameter that often stands out in parliament pre-encounter methods for UAVs such as fat blame tree examination fmea disappointment modes and impacts investigation along with ca criticality investigation guarantee that disappoint menace are identified and alleviated fta looks into disappointments whereas fmea looks at the impact of disappointment of each component these strategies unified previously in the plan stage advance the readiness of frameworks such as flight control and correspondence for progressively secure UAV operation.

3.3. Agriculture

3.3.1. Precise Farming

Through managing field-based variability, precision farming improves on production as well as efficient use of inputs. Remote sensors of fidelity on the aerial platforms including multispectral as well as hyperspectral sensors provides systematic detail on issues to do with land ownership, image density as well as the condition of the ground as well as plant life. It has been shown that this data goes through systems with AI to help farmers using useful solutions. Places that need such treatments, for instance, alterations in nutrient contents, correction of pH levels or targeted water application, are underlined on these maps created by AI. It's exciting how with UAVs enhancing accuracy through photogrammetry, this very use case minimizes input waste, cuts costs, and promotes sustainable agriculture.

3.3.2. Crop Health Monitoring

It is really important to observe crops on a regular basis so as to prevent big losses. Self-flying drones are necessary because they help in capturing detailed pictures of crops as well as videotaping the fields in search of any signs of trouble. Computer vision and deep learning models detect signs that may be inert to a human being, such as disease, bugs or drought. CNNs are very effective in analyzing drone captured photos for the purpose of identifying blight and other plant diseases, studies show. In these ways, the models help to differentiate the health status of the plants and are very accurate to determine the extent to which crops are affected. Reducing reliance on extensive chemical applications through early targeted improvements to crop care and efficiency of resources used in farming is another way in which this strategy encourages sustainable agriculture by reducing further chemical usage.

3.3.3. Pest Detection

Crops are at hazard from bother brushing, which causes expansive misfortunes all through the developing season. Most customary bug administration strategies utilize wide-exposure pesticides, which are hurtful to both individuals and the environment. Mapping and distinguishing creepy crawly populaces is more productive when done utilizing rambles that have AI built in.

To survey the degree of bugs and perversions, ramblers take pictures, which are at that point handled by calculations for protest acknowledgment and categorization. These days, CNNs can precisely separate between a number of bug species and clarify patterns in the conveyance of bugs. When utilized, these procedures offer assistance ranchers find ailing locales, dodge overusing pesticides, and empower biologically neighborly Coordinates Bother Management.

3.3.4. Techniques

- Computer Vision: Computer vision is central to how rural observing is conducted utilizing rambles. It empowers rambles to analyze visual data and envelop it into important information. Whereas picture division permits districts of intrigued in the field to be extricated and inspected, question discovery connected to plants, bugs, and diseases. For occasion, on a field, pictures can be taken by rambles, and at that point utilizing computer vision models, each picture with the crops can be apportioned into those in great conditions and those in focused conditions. The integration of CNNs with computer vision has made this specific field much more encouraging and superior. It implies that with the offered assistance of this innovation, observation can be done with less concentration and the labor component of cultivated administration can be altogether diminished.
- Deep Learning Models: CNNs are among the most connected approaches for preparing and analyzing perplexing information of agrarian areas. These models are created utilizing an expansive number of pictures of solid and contaminated crops, are able to observe little contrasts and decide conditions of plant wellbeing. RNNs demonstrate value when utilized with CNNs and coordinates to edit wellbeing observing to perform information examination in a consecutive shape and anticipate the designs of malady dissemination.

  For occurrence, a thought appeared about how the demonstration might be prepared to identify early signs of contagious diseases in crops by utilizing a picture that was captured through a ramble. The natural and exceptional capabilities of AI models to prepare complex models decide that indeed the slightest self-evident changes, which human creatures are likely to ignore, can be adjusted on time to avoid trim losses.

- Data Analytics Tools: A major challenge that advocates of rambles confront is the truth that they persistently assemble huge sums of information, and the progressed information analytics apparatuses are required to decode it. Application of information analytics innovations in the improvement of AI models conveys nitty gritty data about conditions in areas, wellbeing of crops and utilization of assets. These think about offering assistance ranchers to arrange for and in this manner, superior oversee challenges which may be confronted by their crops.
  Such instruments can utilize real-time and authentic natural information complemented with current field conditions to create models. For occurrence, counterfeit cleverly can precisely appraise the probability of a dry season from climate data and dampness substance accumulated by remotely worked quadcopters. This progress in water system planning and water utilization thus expanding agriculturists efficiency as well as water asset utilization.

3.3.5. Challenges

- Methods of Data collection when weather is different: Basically, one of the biggest obstacles to the deployment of drones and data collection in agriculture is weather. Both the flights and the data being received may become unstable due to factors like wind, rain, or temperature changes. These environmental factors may result in data inconsistencies, visual distortion, or transmission disruptions. Drones need more advanced algorithms that can make its operation more flexible in response to changing conditions and better hardware features that make it more resilient in order to solve these issues.
- High Resolution Imaging needs: Higher determination imaging is fundamental for progressed information handling and more prominent precision, but it can be costly and time-consuming. The cout qualities of the rambles, such as their unparalleled sensor for capturing pictures, essentially increment the cost of carrying out a ramble operation. Besides, analyzing and putting away tall definitions and crude information requires a noteworthy sum of computing control. At that point, in order to boost accessibility inside little agrarian operations, information compression optimization and in general imaging costs ought to proceed to decrease.
- Legal Reforms and Privacy Initialize: Software operating for the purpose of data collection through drones is surrounded by legal and privacy concerns. Drone flights have certain rules and restrictions depending on the country they are flown in, several of them are height restrictions and no fly zones. Still, it sometimes may be difficult to follow these rules and at the same time collect and manage data properly. Besides, identifying visual data sources raises concerns of privacy, for instance, taking pictures or shooting a video may be a breach of someone's privacy or private property. To this end, sound data use policies incorporated with observance of the data protection laws are compulsory. To ensure that its operations are in line with these regulations, privacy is safeguarded and the general population is able to trust the utilization of drone technology in agriculture and many other fields.

3.3.6. Emerging AI models

More sophisticated AI models have recently been brought to the industry, with benefits for a variety of industries, including agriculture. When it comes to assessing the richness seen in agricultural data, deep learning models—such as GANs and transformer models—also perform well. These models can improve the accuracy of crop health assessment, pest detection, and disease diagnosis.
In the future, the ideas may be expanded to incorporate AI models intended for real-time learning. In addition, drone analysis might be modified in reaction to field circumstances and input. The drone's usefulness as a tool for agricultural surveillance will also be enhanced by other developments.

3.3.7. Autonomous Pesticide Delivery

Some of these strategies include automated methods of pest control by developing self-controlled pest controlling chemicals or pesticides. The use of drones with Artificial intelligence, it's possible to survey fields, detect pest infestation zones, and spray pesticide with high accuracy that will ensure that environmental impact is reduced. These selective methods lower the amount of chemicals being used and ensure that the environment remains balanced. This area is being investigated for solutions that can use machine learning techniques to generate more efficient flight and spraying patterns within the drones.

3.3.8. IoT and Farming system compatibility

The use of drones with IoT and smart farming systems has new capabilities for the monitoring and control of different activities. Through IoT sensors placed in fields the drones are able to get updates on soil status, weather and crop growth in the fields. It allows the integration mentioned to improve field understanding and automate responses to change in conditions and situations. For instance, drones could be allowed to create automatic control systems to alter irrigation, using information from the soil moisture sensors.

3.4 Logistics

With the coming of the web and the ensuing e-commerce it changed the whole world of work for companies and the exceptionally handle of utilization for clients. The conventional retail appearance that is utilized to take out physically, in physical buildings, has been impedance with the consolation and convenience that numerous commerce organizations trumpet approximately their online shopping stages. As buyer inclinations, As the showcasing communications move towards computerized channels, firms have been constrained to adjust to their policies and prerequisites of coordination and supply chain to address the rising requests of e-commerce. The worldwide e-commerce showcase has really experienced quick development for a few years. last few a long time, with income anticipated to develop up to $5.7 trillion by 2022 (Statista). Such increase on the web shopping stages has put gigantic weight on coordination. For the suppliers and the retailers to fine-tune their components; and to profit merchandise regularly, with less compromising or time expending techniques and less result. The flow in e-commerce coordination have essentially turned into a crucial assessment in impacting the triumphs and disappointment of substances in the progressed age. The effect of e-commerce on coordination is for example, the nature and degree of issues, the roots and causes, and the approaches and arrangements are distinctive in many-fold. As supply chain organization, transportation, that comprises warehousing, last-mile transport, and alter coordination. Coordination models, as defined already, are customarily centered primarily for business-to-business (B2B) transactions, have uncovered a need in going to the one-of-a-kind issues made by the commerce to shopper (B2C) e-commerce landscape. One of the key issues that exist in the setting of the company relates to, that is why one of the major challenges of e-commerce coordination is the capacity to oversee the planning handle of huge sums of individual orders and convey the information promptly to clients. Presently totally diverse from the conventional retailing concept, where huge volumes are conveyed specifically to grocery stores, online sales that request administration and transport of immeasurable particular to the client entryway steps. This has called for upgrading of technology, the hypothetical and connected perspectives of the arrange fulfillment systems and the arrange fulfillment optimization. Mobility arrangements to guarantee that individuals have to get to transportation administrations for transport that is cheap and convenient, effective delivery.

Another important view of e-commerce coordination is the need for solid consolidation of distinct types of information architecture, suppliers, retailers, and coordination, verifying stakeholders that is to involve ANA members and leaders, acute care hospitals, providers, and development stages. Successful interactions and basically the sharing of data between these substances are crucial for maintaining end to end perceptive awareness, facilitating real-time taking after, and equipping communication in ways that empowers successful decision making throughout the whole supply chain. E-commerce has also led to new unused commerce models and innovative logistics courses of action. Cases join the expansion of third-party coordination providers (3PLs) contractors in the area of e commerce fulfillment the decision as to what constitutes progress some areas like automatization and mechanical technology in the relationship between warehousing operations and the study other last mile transport methods such as rambles and autonomous vehicles.

3.4.1. Global Implementations in E-Commerce Logistics

- Walmart: It was also involved in providing it and selling it directly as one of the principal players in the brick industry, bricks-and-mortar and online business, Walmart has used an extent of coordination techniques to further enhance its omnichannel endeavor. The company has played a big part in progressing stockroom management processes, automation, and automated control to order contented offer streamline arrangement. Walmart's adoption of micro-fulfilment centers, small automated distribution centers located in populated ranges, has bolstered prompt and efficient establishment, especially in the advancement of new ranges, better last mile transportation. Furthermore, the company has worked with other coordinated deliveries together with delivery providers, including FedEx as well as Postmates, to expand. It examines the conveyance capabilities of the company and looks at its innovative last mile arrangements.
- DHL: With DHL being a worldwide coordination pioneer it has substantial undertakings in its e-commerce coordination capabilities in Europe. The company has set up specialty online order fulfillment warehouses and carried out progressed distribution center administration. The Evaluation

on the systems and computerization advance to improve efficiency and speed. DHL's usage of the Parcel Metro arrangement, an organization of urban micro charging stations, and electric car fleets, has enabled eco better and more friendly and efficient last mile transports in large concentrations of people in the European city. Moreover, the company has partnered with few online retailers, such as ASOS and Zalando to provide personalized Internet business coordination arrangements.

- JD.com: Another important contender in the field of e-commerce in China, JD.com has brought into reality exceptionally. The involvement and commitment of customers on products and delivering mechanisms. The company operates an extremely computerized kind of organization, fulfillment centers using mechanical-technological, artificial intelligence. Technologies to enhance arrange handling and inventory administration. JD.com's execution of ramble conveyance and independent ground vehicles has enabled innovative First Mile delivery solutions, especially in regions deeper and remote areas in the country. The company has moreover practiced in the areas of cold chain coordination strengths to support the emerging requirement for new and perishable goods in the e-commerce advertise.

IV. Challenges and Future direction

4.1. Autonomous Navigation

The improvement of AI calculations for empowering autonomous
route and way arranging presents one of the greatest challenges that the industry is attempting to address. UAVs are required to work and move successfully in complicated and ever-changing situations, avoid deterrents, and expeditiously react to sensor information by making real-time choices to empower autonomous routes. Too, most of the current thinking in this area recommends path-planning conventions by expecting completely and homogeneously associated systems without discontinuities in the joins. Future works may incorporate the advancement of light computation-based calculations for accomplishing course prediction in the three-dimensional space on a real-time premise.

4.2. Sensor Integration

UAVs cause reactions to the boosts gotten from onboard eyes, or more accurately, other types of measured instruments including cameras, radar, GPS and so on. Integrating information gathered from various sensors in order to do outside natural mindfulness is an elaborate task. Hajiyev et al. suggested Strong Kalman Filter (RAKF). The concerns include areas such as: proposal to enhance the privacy of its operation, and addressing the limitations of detectors in UAVs. RAKF acclimatizes itself in the nearness of deficiencies, guaranteeing exact information elucidation indeed in the nearness of sensor disappointment. Deep learning frameworks such as Convolutional neural systems (CNNs) or Repetitive neural systems (RNNs) can be used with a view of preparing as well as process information coming from other sensors.

4.3. Mission Planning and Decision Making

One of the most significant perspectives of an independent flight is a UAVs capacity to make real-time choices whereas on a mission. In any case, tending to components such as climate conditions, genuine time data, and mission parameters whereas designing calculation is a major challenge. UAVs too require adjusting to changing circumstances and startling occasions. As a part of future work, we propose the business of hereditary calculations, which includes moving forward the fitness and precision of conceivable arrangements to approach a specific decision-making issue, in this manner moving forward the proficiency of the mission as well.

4.4. Communication and Networking

UAVs working in swarms need a proficient and quick social interface infrastructure minimally devoid of idle for teaming and to exchange the data to complete the intricate tasks. It is possible to continue the building up such organizing capacity among UAVs while maintaining a good network in vibrant contexts is challenging. The communication joins are too extremely powerless to disappoint because of cyber-interference situations as well as natural elements. Machine Learning techniques which can be integrated enrich the connect and way lifetime as an important factor in
Another example would be in the application of computing flight ways, thus advancing the lifetime of a link. and decreasing the misfortune of the network, reducing sort of mobile telephone.

4.5. Scalability and Resource Constraints

UAVs are challenged with barriers on computational command and tools. UAVs are opposed to interference on computational management and memory because of gauge, weight, and control limits. These calculations and hardware are needed to allow the UAVs to operate inside these constraints and to build AI solutions reasonably on UAV stages. High AI computations are obviously needed for an overwhelming number of instances. prevent occurrences or dissatisfactions and to differentiate and calm ghastly mistakes, to deal with shocking situations and maintain system keenness. We as well need to replace the current computationally burdening situations with overwhelming task specific calculations with their optimized counterpart parts and manufacture high-performance as well as lightweight UAV memory chips.

4.6. Energy Efficiency

UAV Batteries are also faced with challenges in estimate and concerns since the other reduction is often a result of operations-related factors. This limits the coverage time and payload-carrying capabilities of the UAVs, and hence thus making them incapable of being used as full scale the products conveyance industry, for example, the specialists are closed associates. The thought of a hydrogen fuel cell battery with lithium-ion batteries which is good for the next after the earlier one has exhausted its power supply income could be used to meet the mission needs in order to continue. We too believe that it is possible to integrate ML and DL algorithms that can calculate certain energy-efficient measures for flying using elements that are considered natural; for example, winds that have a staggering impact on the ease of UAV and the fuel request of the UAV propellers.

4.7. Cybersecurity

UAV communications are vulnerable to cybersecurity dangers, such as unauthorized access(man-in-the-middle), information breaches, and potential capturing of control systems. Xiao et al. recommended an anomalous-behavior detection framework for UAV systems utilizing Repetitive Neural Network. We propose the acceptance of physical security keys as an industry standard for encouraging UAV confirmation. Also, ML procedures require to be utilized to calculate secure and ideal flight ways, which minimize the hazard of issues like sticking assaults.

4.8. Multi-modal perception

Joining significant information from different outside sensors, counting radar, cameras, and infrared sensors, for the apprehension of the UAVs operational environment presents a complicated issue for the industry and analysts alike. Samaras et al. have expounded different deep-learning methods for understanding this issue. The improvement of effective calculations for the legitimate implantation of information into the computations for making precise situational mindfulness is required and presents a positive zone for future work.

4.9. Availability of Reliable and High-Quality Data

The computational spine of all machine learning calculations employs broad information to prepare scientific models. Sourcing high-quality and differentiated precise information is still risky. All preparing datasets utilized in the industry should be upgraded and labeled routinely and tried frequently to filter out spurious information. This will in the long run offer assistance to accomplish better capacities in the UAVs in terms of superior question discovery, acknowledgment of pictures, and irregularity location.

4.10. Legal and Ethical Concerns

The overpowering utilization of AI in UAVs has cleared the way for unprecedented applications of UAVs in our lives, particularly or by suggestion. In any case, this has drawn decided responses in terms of infringements on security, data security, and accountability. Solid calculations require to be made to address each of these concerns, and educator mindfulness should be spread with regard to the inventive impels being made in this zone to diminish the concerns potential UAV clients and clients might be having.

4.11. Application of Edge Computing

Accomplishing ideal execution in UAVs inside the bounds of accessible assets has been a major issue in the way of the advancement of UAVs. Edge computing presents a conceivable arrangement to address these issues by empowering real-time preparation of the collected information whereas at the same time reducing the requirement to exchange information to cloud servers persistently. It too guarantees the transmission of as it were the important information within the UAV network to decrease the wastage of organized bandwidth and too increments the security and security of touchy information. This can empower the arrangement of UAV swarms and be utilized for purposes like look and protect missions.

4.12. Application of Cognitive Learning

One of the most imperative angles of choice making in independent organizations is making quick, or genuine time, and reliable choices almost shifts in exterior jolts. UAV flights. Still, the handle of creating UAVs like those Milo and Olly are a few highlights inborn in humans. In the case of human cognition capacity is inexpedient. Utilizing cognitive learning about how to overcome this challenge can advance organizing, resource allocation, and reaction to as of now perceivability circumstances for the UAVs as, since of a distant more prominent capacity to obtain more knowledge, free for all approaches of advertisement lib strategies and set up how the execution is upgraded slowly.

V. Conclusion

In this study, we investigated the transformative effect of AI-powered rambles over four basic segments: gardening, organization, disaster management and ecological monitoring. Our examination appears that with mutual responsiveness and AI invention the flexibility of rambles has provided to perform the complex errands independently, flexibly and efficiently. AI strolls in horticulture have rediscovered the perfect region of trim observing and hassle for the upkeep of absolute implant developing the right biggest organization of exactness plowing. These co-ordinations are independent rambles which are redesigning last-mile conveyance; advancing proficiency in course setting; and supporting stock administration frameworks. For fiasco administration, rambles made with AI are helpful and give simple information scrutiny, and a fast goal for look and safeguard and devastation assessment and asset designation in emergency situations. Therefore, in natural checking, rambles are invaluable tools as regards following natural life, assessing the quality of discussion, and investigating the changes in biological species toward conserving the world. However, challenges persist, including administrative constraints, power limitations, security risks that apply different weights to each segment of rambles boosted by AI applications. However, these confinements are expected to be resolved due to new advances in artificial intelligence algorithms, efficient roam models that require power, using new forms of control resources, and renewable power.

As may be expected, as AI continues its progression, the future of AI assisted with rambles, seems to possess higher potential for improved performance, modularity and accessibility. Subsequent interest investigation and advancement will be pivotal to addressing present difficulties and optimizing the saved chances of pro-AI rambles in distinct sectors.

References

[1] 'Environmental Monitoring Using Drone-based Remote Sensing and Convolutional Neural Networks' by Zhang et al., MDPI
[2] 'artificial intelligence-Based Monitoring of Water Quality Using Drones' by Xie et al., Elsevier
[3] 'artificial intelligence-Enhanced Drones for Pollution Detection and Environmental Protection' by Chen et al., MDPI
[4] 'artificial intelligence for Monitoring Air Quality Using Drones in Smart Cities' by Gupta et al., Elsevier
[5] 'A Review of UAVs for Environmental Monitoring' by Khusainov et al., ScienceDirect
[6] 'Drone-Assisted Ecosystem Monitoring: A Hybrid artificial intelligence Approach' by Fischer et al., ResearchGate
[7] 'Using Drones to Monitor and Manage Wildlife Populations' by Lonsdale et al., SpringerLink
[8] 'Using Drones for Wildlife Monitoring and Conservation' by Ropert-Coudert et al., MDPI
[9] 'Real-Time Animal Tracking Using artificial intelligence and Drones' by Kumar et al., IEEE Xplore
[10] 'Monitoring Wildlife Behavior with artificial intelligence and Drones' by Taylor et al., SpringerLink
[11] 'Deforestation Monitoring with UAVs and artificial intelligence' by Li et al., SpringerLink
[12] 'Monitoring Forests with UAVs and artificial intelligence' by Lee et al., IEEE Xplore
[13] 'artificial intelligence-Based Deforestation Detection Using Drones' by Zhang et al., MDPI
[14] 'artificial intelligence and Drones in Forest Management' by Kumar et al., SpringerLink
[15] 'Challenges in Drone-Based Deforestation Mapping' by Gupta et al., Elsevier
[16] 'UAV-Based Forest Monitoring and Legal Restrictions' by Schmidt et al., MDPI
[17] 'Renewable-Powered Drones for Environmental Monitoring' by Liu et al., Elsevier
[18] 'artificial intelligence-Powered Forecasting for Environmental Trends' by Zhang et al., SpringerLink
[19] 'IoT and 5G for Environmental Monitoring with Drones' by Roy et al., MDPI
[20] Zhang, C., & Kovacs, J. M. (2012). "The application of small unmanned aerial systems for precision agriculture: a review." Precision Agriculture, 13(6), 693-712.

[21] Bendre, M., et al. (2018). "Application of machine learning in precision agriculture and allied fields." Journal of Computer Science, 14(6), 759-770.
[22] Mogili, U. R., & Deepak, B. B. V. L. (2018). "Review on application of drone systems in precision agriculture." Procedia Computer Science, 133, 502-509.
[23] Liakos, K. G., et al. (2018). "Machine learning in agriculture: A review." Sensors, 18(8), 2674.
[24] Jin, X., et al. (2021). "Deep learning: Identification of crops, pests, and diseases." Agronomy, 11(10), 1977.
[25] Mohanty, S. P., Hughes, D. P., & Salathé, M. (2016). "Using deep learning for image-based plant disease detection." Frontiers in Plant Science, 7, 1419.
[26] Kamilaris, A., & Prenafeta-Boldú, F. X. (2018). "A review of the use of convolutional neural networks in agriculture." The Journal of Agricultural Information, 13(3), 57-80.
[27] Gao, J., et al. (2020). "Plant diseases detection and classification by deep learning: A review." IEEE Access, 8, 102065-102085.
[28] Tsouros, D. C., et al. (2019). "A review on UAV-based applications for precision agriculture." Information, 10(11), 349.
[29] Malik, N., et al. (2021). "Challenges of drone usage in agriculture under various environmental conditions." Journal of Agricultural Research, 5(4), 215-229.
[30] Jawad, H. M., et al. (2020). "Internet of things and agriculture: The development of wireless sensor networks for smart farming." IEEE Access, 8, 145530-145554.
[31] Wolfert, S., et al. (2017). "Big data in smart farming–a review." Agricultural Systems, 153, 69-80.
[32] AI-Based Drone Assisted Human Rescue in Disaster: Challenges and Opportunities
[33] Aguezzoul, Aicha. "Third-Party Logistics Selection Problem: A Literature Review on Criteria and Methods." Omega, vol. 49, 2014, pp. 69-78.
[34] Barreto, L., et al. "Industry 4.0 Implications in Logistics: An Overview." Procedia Manufacturing, vol. 13, 2017.
[35] Gevaers, Roel, et al. "Characteristics and Typology of Last-Mile Logistics from an Innovation Perspective in an Urban Context." City Distribution and Urban Freight Transport, Edward Elgar Publishing, 2011.
[36] Ivanov, Dmitry, et al. "The Impact of Digital Technology and Industry 4.0 on the Ripple Effect and Supply Chain Risk Analytics." International Journal of Production Research, vol. 57, no. 3, 2019, pp. 829-46.
[37] Lieb, Robert C., and Kristin J. Lieb. "3PL CEO Perspectives on the Current Status and Future Prospects of the Third-party Logistics Industry in North America: The 2014 Survey." Transportation Journal, vol. 55, no. 1, 2016, pp. 78-92.
[38] Lim, Stanley Frederick, et al. "Consumer-driven e-commerce: A Literature Review, Design Framework, and Research Agenda on Last Mile Logistics Models." International Journal of Physical Distribution & Logistics Management, vol. 48, no. 3, 2018, pp. 308-32.
[39] Mangiaracina, Riccardo, et al. "A Review of the Environmental Implications of B2C e-commerce: A Logistics Perspective." International Journal of Physical Distribution & Logistics, vol. 45, no. 6, 2015, pp. 565-91.
[40] Melacini, Marco, et al. "E-fulfilment and Distribution in Omni-Channel Retailing: A Systematic Literature Review." International Journal of Physical Distribution & Logistics, vol. 48, no. 4, 2018, pp. 391-414.
[41] Savelsbergh, Martin, and T. van Woensel. "City Logistics: Challenges and Opportunities." Transportation Science, vol. 50, no. 2, 2016, pp. 579-90.
[42] Statista. "E-commerce Worldwide - Statistics & Facts." Statista, https://www.statista.com/topics/871/online-shopping
[43] P. S. Bithas, E. T. Michailidis, N. Nomikos, D. Vouyioukas, and A. G. Kanatas, “A survey on machine-learning techniques for UAV-based communications,” Sensors, vol. 19, no. 23, 2019, Art. no. 5170.
[44] S. Rezwan and W. Choi, “Artificial intelligence approaches for UAV navigation: Recent advances and future challenges,” IEEE Access, vol. 10, pp. 26320–26339, 2022.
[45] S. Fu, M. Zhang, M. Liu, C. Chen, and F. R. Yu, “Toward energy efficient UAV-assisted wireless networks using an artificial intelligence approach,” IEEE Wireless Commun., vol. 29, no. 5, pp. 77–83, Oct. 2022.
[46] A. Puente-Castro, D. Rivero, A. Pazos, and E. Fernandez-Blanco, “A review of artificial intelligence applied to path planning in UAV swarms,” Neural Comput. Appl., vol. 34, pp. 1–18, 2022.

[47] A. N. Wilson, A. Kumar, A. Jha, and L. R. Cenkeramaddi, "Embedded sensors, communication technologies, computing platforms and machine learning for UAVs: A review," IEEE Sensors J., vol. 22, no. 3, pp. 1807–1826, Feb. 2022.
[48] N. Cheng et al., "AI for UAV-assisted IoT applications: A comprehensive review," IEEE Internet Things J., vol. 10, no. 16, pp. 14438–14461, Aug. 2023.
[49] J. Tang, H. Duan, and S. Lao, "Swarm intelligence algorithms for multiple unmanned aerial vehicles collaboration: A comprehensive review," Artif. Intell. Rev., vol. 56, no. 5, pp. 4295–4327, 2023.
[50] N. Thakur, P. Nagrath, R. Jain, D. Saini, N. Sharma, and D. J. He manth, "Artificial intelligence techniques in smart cities surveillance using UAVs: A survey,"Mach.Intell. Data Anal. Sustain. Future Smart Cities, vol. 971, pp. 329–353, 2021.