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A
Major Project Report

On

"ASSESSING THE IMPACT OF AUTONOMOUS DRONE FLEETS IN MISSING CHILD SEARCH AND RESCUE OPERATIONS"

Submitted in partial fulfillment of the

Requirements for the award of the degree of

Bachelor of Technology

In

Computer Science & Engineering –
Artificial Intelligence & Machine Learning

By

Mohammed Owais	**20R21A6639**
Veerannagari Sravan Kumar	**20R21A6654**
Ramaram Sandeep Reddy	**20R21A6645**
Kalyanam Tharuni Dixitha	**20R21A6623**
Ellelvula Venkat sai	**20R21A6615**

Under the guidance of

J. Vijay Gopal
Associate Professor

Department of Computer Science & Engineering –

Artificial Intelligence & Machine Learning

2024

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CERTIFICATE

This is to certify that the project entitled **“Assessing the Impact of Autonomous Drone Fleets in Missing Child Search and Rescue Operations”** has been submitted by **Mohammed Owais (20R21A6639), Veerannagari Sravan Kumar (20R21A6654), Ramaram Sandeep Reddy (20R21A6645), Kalyanam Tharuni Dixitha (20R21A6623), Ellelvula Venkat sai** (**20R21A6615**)in partial fulfillment of the requirements for the award of degree of Bachelor of Technology in Computer Science and Engineering – Artificial Intelligence & Machine Learning from Jawaharlal Nehru Technological University, Hyderabad. The results embodied in this project have not been submitted to any other University or Institution for the award of any degree or diploma.

Internal Guide **Head of the Department**

Project coordinator **External Examiner**

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DECLARATION

We hereby declare that the project entitled **"Assessing the Impact of Autonomous Drone Fleets in Missing Child Search and Rescue Operations"** is the work done during the period from **January 2024 to April 2024** and is submitted in partial fulfillment of the requirements for the award of degree of Bachelor of Technology in Computer Science and Engineering – Artificial Intelligence & Machine Learning from Jawaharlal Nehru Technology University, Hyderabad. The results embodied in this project have not been submitted to any other university or Institution for the award of any degree or diploma.

Mohammed Owais	**20R21A6639**
Veerannagari Sravan Kumar	**20R21A6654**
Ramaram Sandeep Reddy	**20R21A6645**
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Laxman Reddy Avenue, Dundigal, Hyderabad-500 043, Telangana, India

Department of Computer Science & Engineering-Artificial Intelligence & Machine Learning

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Mohammed Owais	**20R21A6639**
Veerannagari Sravan Kumar	**20R21A6654**
Ramaram Sandeep Reddy	**20R21A6645**
Kalyanam Tharuni Dixitha	**20R21A6623**
Ellelvula Venkat sai	**20R21A6615**

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Department of Computer Science & Engineering-Artificial Intelligence & Machine Learning

ABSTRACT

Children lost amidst vast forests – definitely that scenery most feared by any parent. Our drone project innovation aims to transmute the dark fears of disaster into a rapid save. Picture a group of intelligent "guardian drones" armed with thermal cameras sensitive to heat in any weather, as well as night vision for traversing through thick forests, and GPS for exact locationing. Such devices can easily localize a missing child with a prompt response over a wide range, and send relevant information to the search team intermittently. The rapid reaction system is of utter importance during those first critical hours, transforming fear into comfort, and thus wows return for children who got lost.

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LIST OF ABBREVIATIONS

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ABBREVIATIONS

UAV	Unnamed Aerial Vehicle
MAVLink	Micro Air Vehicle Link
CNN	Convolutional Neural Network
YOLO	You Only Look Once

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APPENDIX-3

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Picture a child, desperately lost in the midst of a vast woodland. As the sun slips below the horizon, shadows deepen, and panic grips the heart. Search and rescue teams mobilize, but their efforts are hindered by the dense forest and limited visibility. With each passing moment, hope dwindles. This distressing scenario is all too common in forested regions worldwide. Children love twists and turns in forests, but those paths become dangerous if lost. Regular searches don't work well in big, thick forests. Hope fades quickly. Then drones appear, their propellers whirring! Drones have awesome sensors and smart code. They fly over trees, seeing all. Sensors pierce the forest roof. Drones scan huge areas, guided by great systems mapping search routes. We set aside conventional drone applications, instead tackling the unique challenges posed by these critical missions. Envision a fleet of aerial sentinels equipped with high-tech sensors, scouring the forest floor, their cameras trained on the telltale signs of a lost child—a brightly colored jacket, the glint of sunlight reflecting off tears.

1.2 PURPOSE OF THE PROJECT

The purpose of this project is to build a new technology that offers creative solutions for search and rescue missions will be introduced. Using AI algorithms, real-time data transfer, a potent camera, and a drone fleet in situations involving lost children, drones might scan wide areas in such endeavors, discover people in steep places, and provide the rescue crews with vital information. The employment of autonomous drones could expedite and improve the search operation's accuracy while also raising the likelihood of a successful outcome.

1.3 MOTIVATION

Traditional search and rescue methods in forests face significant challenges. Reliance on human crews is hampered by limited manpower and difficult terrain, slowing searches and reducing the chance of finding missing children quickly. Dense foliage and uneven ground make navigation hard, potentially causing crews to miss crucial areas. Time is critical, but traditional methods might not fully utilize the golden hours after a disappearance. Communication between emergency responders, volunteers, and families can be complex, leading to delays and a lack of real-time information. Finally, bad weather conditions like rain, fog, and snow further hinder search efforts and limit the effectiveness of some technologies. These issues not only impact the success of the search but also create immense psychological stress for families waiting for news about their loved ones.

Figure 0 : Top-view of Pixhawk drone

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CHAPTER 2

LITERATURE SURVEY

An extensive literature survey has been conducted by studying existing systems of Drone integration and object detection. A good number of research papers, journals, and publications have also been referred before formulating this survey.

2.1EXISTING SYSTEMS

1		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org /document/9348925	ZHIJUN MENG LIFENG WANG HAOCHEN LI KAIPENG WANG KAIPENG WANG	Reinforcement learning,UAV (Unmanned Aerial Vehicle) Obstacle avoidance,A* algorithm,Artificial potential field method Genetic algorithm,Ant colony algorithm,Particle swarm optimization,Q learning,Convolutional Neural Network (CNN) Recurrent Neural Network (RNN),Markov Decision Process (MDP)
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
Unmanned Aerial Vehicle Path Planning	the aim is to create a smart drone that can fly by itself,	Construction of the Algorithmfor effective path planning Stability

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Algorithm Based on Deep Reinforcement Learning in Large-Scale and Dynamic Environments	learn from its surroundings, and make decisions to navigate safely through different environments	and Convergence obsatcle avoidence

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process

	Process Steps	Advantage	Disadvantage (Limitation)
1	The algorithm establishes the state and action spaces for addressing UAV path planning. It frames the problem as a Partially Observable Markov Decision Process (POMDP) and employs a three-dimensional topographic map for algorithm evaluation	Clearly defining the state space and action space provides a structured representation of the problem.	Depending on the complexity the environment a three-dimensional map could lead to increased computational demands
2.	The algorithm is constructed on the foundation of deep reinforcement learning, incorporating a network structure featuring Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN). To tackle partial observability, a recurrent neural network with temporal memory is employed to extract vital information	Deep reinforcement learning with CNNs and RNNs enables the algorithm to learn complex patterns and temporal dependencies.	Training deep networks might face challenges like overfitting.

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	from historical state-action sequences		
3.	The algorithm proposes a new action selection strategy that combines the current reward value and the state-action value. This strategy reduces meaningless exploration and improves the learning efficiency of the algorithm.	The integration of current reward and state-action value can lead to more informed and efficient decision-making.	In certain situations, the combined strategy might struggle to adapt effectively across diverse environments.
4.	The algorithm constructs two memory pools based on the average reward value per round. It uses an adaptive sampling mechanism to take samples from the important memory pool according to the frequency of task failure. This approach improves the learning efficiency and convergence stability of the algorithm with low computational cost	The approach minimizes computational costs by focusing on important memory.	Adaptive mechanisms may introduce additional complexity to the algorithm.
5.	The algorithm conducts simulation experiments to evaluate its performance. It compares the algorithm with other path planning algorithms and analyzes the results. The experimental results show that the proposed algorithm has	The approach minimizes computational costs by focusing on important memory.	Adaptive mechanisms may introduce additional complexity to the algorithm.

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	significant improvements in terms of stability and learning compared to other algorithms.		

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
The effectiveness of the UAV path planning algorithm can be assessed by evaluating its capacity to identify optimal routes and its success rate across diverse environments	The independent variable could be the various design choices and parameters of the UAV path planning algorithm	The type or complexity of the environment in which the UAV operates	the use of deep reinforcement learning with CNNs and RNNs

Input and Output	Feature of This Solution	Contribution & The Value of This Work
<table><tr><th>Input</th><th>Output</th></tr><tr><td>Input from different sensers about</td><td>Path to follow by UAV</td></tr></table>	This UAV path planning algorithm stands out for its ability to navigate in three dimensions, considering both horizontal and vertical actions. It formulates the problem as a	Good to have this knowledge from this paper as we want to work on UAVs

the environment		Partially Observable Markov Decision Process, making decisions with incomplete information. The algorithm incorporates a probabilistic safety measure, evaluates performance in diverse environments, and introduces adaptive mechanisms for efficient learning. Its effectiveness in obstacle avoidance and applicability to limited sensor scenarios make it a robust solution for dynamic UAV navigation.	

Positive Impact of this Solution in This Project Domain	**Negative Impact of this Solution in This Project Domain**
The algorithm enhances UAV path planning by improving efficiency, learning, stability, and adaptability. It addresses partial observability, performs well in diverse environments, and does so with low computational cost, making it a valuable solution for UAV projects.	The algorithm's potential drawbacks in the UAV project domain include computational intensity, implementation complexity, reliance on simulation, sensitivity to environmental changes, risk of overfitting, limited robustness, and a learning curve for implementation**.**

Analyse This Work By Critical Thinking	**The Tools That Assessed this Work**	**What is the Structure of this Paper**
This work is good, as they used Deep Reinforcement Learning for effective path planning	Deep Learning	Abstract I. Introduction II. Construction of the Algorithm III. Approaches to Speed Up

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		Algorithm IV. Experimental Results and Analysis I. Conclusion and Future Work

2	

Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://link.springer.com/chapter/10.1007/978-3-030-33950-0_16	Kevin Pluckter Sebastian Scherer	Precision landing Unstructured environments Helipad design Visual Teach and Repeat (VTR) Visual servoing Fisheye lens camera Pinhole camera lens Rigid body transform
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
Precision UAV Landing in Unstructured Environments	The goal or objective of this solution is to enable autonomous precision landing of unmanned aerial vehicles (UAVs) in unstructured and unknown	Take-off and Landing Localization Pose Estimation and Control Safety Measures

	environments, specifically at the UAV's starting position. The problem that needs to be solved is the reliance on GPS or odometry-based landing systems, which can be inaccurate and unreliable, especially in GPS-denied environments. The proposed solution aims to address this issue by using a downward-facing fisheye lens camera to accurately guide the drone back to its initial position without the need for a specific landing pattern	

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process

	Process Steps	Advantage	Disadvantage (Limitation)
1	Take-off: The drone takes off from its initial position while recording a set of images at regular intervals using a fisheye lens camera	Starting with a recorded set of images provides a baseline for comparison during landing.	Sensitivity to lighting conditions and potential false matches.
2	Image Processing: Key points and ORB descriptors are extracted from the recorded images during take-off. These features will	Extracting key points and ORB descriptors enables efficient feature matching.	Limited to the features present in the initial take-off image, may struggle with drastic scene changes.

	be used for localization during the landing phase.		
3	Localization: During the landing phase, the drone compares the current image captured by the fisheye lens camera with the image taken at a lower altitude during take-off. By matching the ORB descriptors, the drone can estimate its relative position to the take-off image.	Relatively quick and accurate localization using feature matching.	Assumption of planar projection might not hold in complex environments.
4	Pose Estimation:After finding similar features in the images, the drone adjusts these points based on how it's tilted (roll and pitch). Then, it imagines these adjusted points in a 3D space using the assumption that the environment is mostly flat. Considering the height and camera details, this helps the drone figure out where it is compared to the starting image	Correcting position based on roll and pitch improves accuracy.	Susceptible to errors if the initial localization is incorrect.
5	Control and Descent: With the estimated pose, the drone commands itself towards the position of the take-off image. As the drone approaches the position, it	Continuous descent toward the take-off position enhances precision.	Temporary loss of localization during ascension may impact efficiency.

	continuously descends. If the drone goes below the height of the current take-off image being compared to, the next closest image is used for localization.		
6	Safety Measures: If the RANSAC algorithm fails to determine a consensus on the rigid body transform, indicating a potential scene change, the drone ascends to increase its field of view until it can match with the take-off image again. This ensures safe landing even in challenging environments.	Proactive ascension in case of potential scene changes ensures safety.	

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
The accuracy of the drone landing	The method using a downward facing fisheye lens camera and the associated algorithm	A moderating variable could be environmental conditions	The correction of drift errors in state estimation

Relationship Among the Above 4 Variables in This article
The relationship involves the algorithm impacting both the correction of drift errors and the accuracy of the drone landing. The correction of drift errors serves as an important mediating variable, explaining how the algorithm's influence translates into improved accuracy during the landing process.

<table>
<tr><th colspan="2">Input and Output</th><th>Feature of This Solution</th><th>Contribution & The Value of This Work</th></tr>
<tr><th>Input</th><th>Output</th><td rowspan="2">This solution features efficient feature extraction, precise localization, and 3D pose estimation during drone landing. It incorporates safety measures, such as proactive ascension in case of scene changes. The system undergoes rigorous evaluation in diverse environments, comparing the performance of fisheye and pinhole lens cameras.</td><td rowspan="2">Good to have this knowledge from this paper as it provides a knowledge provides a fail safe mechanismUAVs</td></tr>
<tr><td>Drone takes off and records images using a fisheye lens camera.</td><td>During landing, the drone compares the current image with the take-off image using the extracted features.</td></tr>
</table>

Positive Impact of this Solution in This Project Domain	Negative Impact of this Solution in This Project Domain
This solution significantly improves drone precision and reliability in localization and landing, ensures safety through proactive measures, and offers versatility across diverse environments. The rigorous evaluation and camera comparison enhance its effectiveness in UAV projects.	This solution has potential drawbacks, including dependence on initial conditions, sensitivity to lighting, limitations in complex environments, risks of false matches, and temporary loss of localization during safety measures. Addressing these challenges is essential for optimal performance in UAV projects.

Analyse This Work by Critical Thinking	The Tools That Assessed this Work	What is the Structure of this Paper

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The work presents a thorough approach to drone localization and landing. Critical analysis highlights strengths in feature extraction and safety measures but prompts consideration of limitations like the planar assumption and sensitivity to conditions. Rigorous evaluation is commendable, though addressing dependencies on initial conditions and temporary localization loss is crucial for real-world effectiveness.	Fisheye Lens Camera ORB Descriptors 3D Pose Estimation Algorithm Pinhole Lens Camera	Abstract I. Introduction II. RelatedWorks III. ProposedMethod IV. ExperimentalSetup V. ExperimentalResultsandEvaluation VI. Conclusion I. Futurework
Diagram/Flowchart		

3		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://www.hindawi.com/journals/wcmc/2021/5565589/	Xin Liu Zhanyue Zhang	UAV (Unmanned Aerial Vehicle) YOLO v4 (You Only Look Once version 4) DeepSORT (Deep Simple Online and Realtime Tracking) Cascade matching Occlusions Mahalanobis distance matching

The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	The Goal (Objective) of this Solution & What is the problem that need to be solved	What are the components of it?
A Vision-Based Target Detection, Tracking, and Positioning Algorithm for Unmanned Aerial Vehicle	The goal of this solution is to use a UAV to automatically detect, track, and accurately position a moving target. The problem to be solved is the state estimation of the target in a nonlinear system.	Vehicle Detection Multitarget Tracking Trajectory Processing and State Estimation Cascade Matching

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process

	Process Steps	Advantage	Disadvantage (Limitation)
1	Vehicle Detection: The "You Only Look Once version 4" (YOLO v4) algorithm is used for vehicle detection. This algorithm is known for its robustness and generalization capabilities, allowing it to accurately detect vehicles in urban environments	The YOLO v4 algorithm is known for its robustness and generalization capabilities, allowing it to accurately detect vehicles in urban environments.	The performance of the algorithm may be affected by factors such as weather conditions, lighting conditions, and occlusions.
2	Multitarget Tracking: The DeepSORT algorithm, which combines target	The DeepSORT algorithm combines target detection with multitarget tracking,	The algorithm's performance may be affected by occlusions and complex motion

	detection with multitarget tracking, is employed. DeepSORT uses the detections from YOLO v4 to track multiple vehicles over time, maintaining their identities and estimating their trajectories.	allowing for the tracking of multiple vehicles over time.	patterns.
3	Trajectory Processing and State Estimation: The algorithm processes the tracked trajectories and estimates the state of the target, including its position and velocity. The Mahalanobis distance matching method is used to associate detected positions with the average tracking position. Additionally, target appearance information is utilized to improve tracking performance	The algorithm processes the tracked trajectories and estimates the state of the target, including its position and velocity.	The algorithm's performance may degrade in situations where the target's motion is highly nonlinear or unpredictable.
4	Cascade Matching: When a target is occluded for a long time, the algorithm	Cascade matching helps handle occlusions and maintain accurate	It may not be effective in situations where occlusions are frequent

	employs cascade matching to handle the increased uncertainty in filtering predictions. This step helps maintain accurate tracking even in challenging scenarios.	tracking even when targets are occluded for a long time. -	or prolonged.

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
the independent variable could be the characteristics or settings related to the UAV and the sensors input.	The accuracy of the target detection and tracking	The UAV system's performance is affected differently based on whether it's a sunny day or a rainy day	The efficiency of the signal processing algorithm

Relationship Among The Above 4 Variables in This article

The UAV characteristics influence target detection accuracy, with environmental conditions moderating this relationship, and the efficiency of the signal processing algorithm mediating the impact of UAV characteristics on accuracy.

Input and Output	Feature of This Solution	Contribution & The Value of This Work

<table>
<tr>
<td>
<table>
<tr><th>Input</th><th>Output</th></tr>
<tr><td>video or image data containing urban scenes</td><td>set of bounding boxes and class labels that indicate the location and type of vehicles in the input data</td></tr>
</table>
</td>
<td colspan="2">This solution combines the YOLO v4 algorithm for accurate vehicle detection, DeepSORT for multitarget tracking, the Mahalanobis distance matching method for precise state estimation, and cascade matching to handle occlusions. Its objective is to achieve real-time and accurate detection, tracking, and positioning of vehicles using UAVs in urban environments.</td>
<td>Good to have this knowledge from this paper as we want to work on UAVs</td>
</tr>
<tr>
<th colspan="2">Positive Impact of this Solution in This Project Domain</th>
<th colspan="2">Negative Impact of this Solution in This Project Domain</th>
</tr>
<tr>
<td colspan="2">positive impacts such as enhanced search capabilities, real-time monitoring, improved efficiency, data-driven decision making, and better collaboration among stakeholders. These benefits increase the chances of locating the missing child and contribute to the success of the project.</td>
<td colspan="2">It may raise concerns regarding privacy, ethics, technical limitations, costs, and legal compliance.</td>
</tr>
<tr>
<th>Analyse This Work By Critical Thinking</th>
<th colspan="2">The Tools That Assessed this Work</th>
<th>What is the Structure of this Paper</th>
</tr>
<tr>
<td>This work is good, as they tried improve the target detection by vision based.</td>
<td colspan="2">Deeplearning</td>
<td>Abstract
I. Introduction
II. RelatedWorks
III. ProposedMethod
IV. ExperimentalSetup
V. ExperimentalR</td>
</tr>
</table>

		esultsandEvaluation VI. Conclusion Futurework

4		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org/document/9878336	MUHAMMAD ARIF ARSHAD SADDAM HUSSAIN KHAN1, SULEMAN QAMAR MUHAMMAD WALEED KHAN IQBAL MURTZA JEONGHWAN GWAK ASIFULLAH KHAN	Drone navigation Region and edge exploitation Deep CNN Convolutional neural network Perception and autonomy Drone split transform merge Reinforcement learning Machine learning Deep learning Object identification Object detection Visual navigation Collision probability
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**

Drone Navigation Using Region and Edge Exploitation-Based Deep CNN	The goal or objective of the proposed solution is to develop a deep Convolutional Neural Network (CNN) based strategy for drone navigation in complex and dynamic environments. The problem that needs to be solved is the safe and reliable navigation of unmanned aerial vehicles (UAVs) in challenging and unpredictable environments	Drone-STM-RENet STM-based CNN blocks Regression CNN Deep learning techniques

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process
Creating a drone navigation system requires the incorporation of machine learning, computer vision, GPS, and optical sensors, along with the implementation of SLAM for navigating urban environments. The steps involve gathering a varied dataset, labeling it for training, and designing a tailored Drone-STM-RENet neural network equipped with STM to enhance obstacle detection efficiency. Training and validation processes are crucial for ensuring the system's capability to navigate effectively in intricate surroundings.

	Process Steps	**Advantage**	**Disadvantage (Limitation)**
1	Detection Methods: Utilize machine learning algorithms or computer vision techniques to detect obstacles using GPS range and optical sensors. These methods assess the device	Machine learning and computer vision techniques provide accurate obstacle detection.	Dependence on sensor accuracy; errors in GPS or sensor data may lead to navigation issues.

	status, detect obstacles, and determine the flight route.		
2	SLAM Approach: Overcome the challenges in urban areas by employing Simultaneous Localization and Mapping (SLAM) as a typical approach. SLAM allows the UAV to develop a map of the environment while simultaneously self-locating within it. This approach is beneficial for global navigation.	Effective in urban areas where GPS signals may be obstructed.	Computational complexity may be high, impacting real-time performance.
3	Dataset Collection: Collect a dataset consisting of images from three cameras and data from GPS, IMU, brake, steering angles, throttle, gear, and speed. The dataset should include images from various city areas with different obstacles and surroundings	Including various city areas and obstacles enhances system adaptability.	Time-consuming and resource-intensive to collect a comprehensive dataset
4	Dataset Labeling: Label the dataset based on the presence or absence of obstacles. Frames with no obstacles are labeled as 0 (no collision), while frames with obstacles are labeled as 1 (collision). This labeled	Binary labeling simplifies the training process.	Manual labeling can be time-consuming and prone to human error.

	dataset is used for training, validation, and testing.		
5	Architecture Design: Design the Drone-STM-RENet architecture, which consists of branched CNN blocks. These blocks utilize the Split-Transform-Merge (STM) concept to efficiently process the input data and extract relevant features.In STM we use region and edge operation	The region operations help in understanding the broader context of the scene, while edge operations enhance the network's ability to detect finer details and boundaries.	Complexity may require significant computational resources.
6	Training and Validation: Divide the dataset into training and validation sets. Use a portion of the dataset for training the drone navigation system with the Drone-STM-RENet architecture and another portion for validation to assess the system's performance	Training on a diverse dataset enhances model robustness.	Overfitting or underfitting may occur if not carefully managed.
Major Impact Factors in this Work			

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
The performance of the drone navigation system	Sensors data	The type and complexity of urban environments	Dataset quality and diversity could serve

Relationship Among The Above 4 Variables in This article
The performance of the drone navigation system is influenced by the effectiveness of machine learning algorithms, the adaptability of the architecture, the complexity of urban environments, and the quality of the training dataset. Understanding and optimizing these relationships are crucial for developing a robust and versatile drone navigation system.

Input and Output	Feature of This Solution	Contribution in This Work

<table>
<tr>
<td>
<table>
<tr><th>Input</th><th>Output</th></tr>
<tr><td>Sensor data and Images captured by multiple cameras</td><td>A navigation system that processes input data to detect obstacles and determine an optimal flight route.</td></tr>
</table>
</td>
<td>Key features include the use of SLAM for robust urban navigation, a diverse dataset for training, and a specialized Drone-STM-RENet neural network with STM for efficient obstacle detection. The system is designed to process GPS, optical sensor, and camera data, providing a comprehensive and adaptable solution for navigating complex environments.</td>
<td>Good to have this knowledge from this paper as we want to work on UAVs and it is very important to know about how the pathplanning works</td>
</tr>
</table>

<table>
<tr><th>Positive Impact of this Solution in This Project Domain</th><th>Negative Impact of this Solution in This Project Domain</th></tr>
<tr><td>This drone navigation solution positively impacts UAV projects by improving accuracy in urban environments through machine learning, computer vision, and SLAM. It ensures effective obstacle detection and avoidance, global navigation capability, adaptability to complex settings, real-time decision-making, and comprehensive sensor integration for a reliable and versatile system.</td><td>Potential drawbacks of this drone navigation solution include computational complexity, resource intensiveness in dataset collection, dependency on sensor accuracy, the risk of overfitting during training, challenges in dynamic environments, and considerations regarding data privacy.</td></tr>
</table>

<table>
<tr><th>Analyse This Work By Critical Thinking</th><th>The Tools That Assessed this Work</th><th>What is the Structure of this Paper</th></tr>
<tr><td>This drone navigation system shows innovation in addressing urban UAV challenges with machine learning and SLAM. Strengths include diverse dataset use and</td><td>Machine Learning Frameworks
Computer Vision Libraries
Neural Network Design Tools
Statistical Analysis Tools</td><td>Abstract
VII. Introduction
VIII. RelatedWorks
IX. ProposedMethod
X. Experimental Setup
XI. Experimental</td></tr>
</table>

a specialized neural network. However, potential concerns include computational complexity, resource intensity, and sensor dependencies. Ongoing testing and privacy considerations are crucial for practical implementation. Overall, the solution demonstrates promise but requires careful consideration of real-world challenges.		ResultsandEvaluation XII. Conclusion I. Futurework
Diagram/Flowchart		

5		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
S1084804520302137	Abhishek Sharma Pankhuri Vanjani Nikhil Paliwal M. Wijerathna Basnayaka Dushantha Nalin K. Jayakody Hwang-Cheng Wang	Wireless networks Communication systems UAVs (Unmanned Aerial Vehicles) Mesh network Wireless Sensor Network (WSN) Point-to-point (P2P) protocols Cyber-physical security Air-to-ground channel measurements Channel model Machine learning Artificial intelligence Internet of Things (IoT) Aerial base stations Channel modeling UAV regulation

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The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	The Goal (Objective) of this Solution & What is the problem that need to be solved	What are the components of it?
Communication and Networking Technologies for UAVs	The goal of the solution presented in the document is to improve the communication and networking capabilities of Unmanned Aerial Vehicles (UAVs). The problem that needs to be solved is the limited and inefficient communication infrastructure for UAVs, which hinders their ability to transmit data, receive control signals, and coordinate with ground operators	Communication Modules Resource Handling Platforms Networking Technologies

The Process (Mechanism) of this Work; Means How the problem has Solved & Advantage & Disadvantage of Each Step in This Process

The author said UAV communication process involves initializing network parameters, discovering nearby devices, establishing communication links through signal exchange and parameter negotiation, and finally transmitting data once a reliable link is established. Each step comes with its own advantages and challenges in building an efficient and robust UAV network.

	Process Steps	Advantage	Disadvantage (Limitation)
1	Before connections can be established, the UAV communication network must undergo initialization. This process includes setting	Configuring network parameters in advance allows for a more controlled and organized setup. It helps in avoiding conflicts	It might take time and resources to initialize the network, and if not done correctly, it could lead to

	up network parameters like network ID, channel selection, and synchronization.	and ensures that UAVs operate on a designated network.	connectivity issues or vulnerabilities
2	network discovery phase: UAVs must locate and recognize other devices or nodes within their communication range. This can be achieved through activities such as scanning and listening for available networks or exchanging network information with neighboring UAVs.	Enables UAVs to find and connect with each other efficiently. It's a crucial step for creating a network in dynamic and changing environments.	Depending on the method used, there might be delays in the discovery process, and there's a potential for information leakage to unauthorized entities.
3	Link Establishment: Once UAVs recognize each other, they can begin the process of establishing a link. This involves exchanging control signals, negotiating communication parameters, and creating a reliable communication link.	Once established, a reliable communication link ensures efficient data exchange and coordination between UAVs.	Establishing links can take time, and there's a risk of link failures or disruptions, especially in challenging environmental conditions.
4	Channel Allocation: In a multi-UAV scenario, where multiple UAVs are operating in the same area, channel allocation is necessary to avoid interference and ensure efficient use of available communication resources. This can be done	Optimizes the use of available communication resources, minimizing interference in multi-UAV scenarios.	Centralized control might introduce a single point of failure, while distributed algorithms could lead to suboptimal channel allocation in certain situations

	through centralized control or distributed algorithms.		
5	Data Transmission: Once the connection is established, UAVs can start transmitting data between each other or with the ground control station. This can include sensor data, control commands, or other relevant information	Enables the actual exchange of information between UAVs or with ground control, supporting mission-critical tasks	Data transmission might be affected by latency, packet loss, or interference, impacting the reliability of communication

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
It could be the overall efficiency, reliability, or performance of the communication network	network parameters (e.g., network ID, channel selection	environmental conditions	The synchronization process

Relationship Among the Above 4 Variables in This article

It the relationship among these variables in the UAV communication network establishmen process involves configuring network parameters (independent variable), which influences th overall efficiency and reliability of UAV communication (dependent variable). Thi relationship can be moderated by environmental conditions, and the synchronizatio mechanism acts as a mediating variable, explaining the process by which configured parameter impact communication outcomes

<table>
<tr><th>Input and Output</th><th>Feature of This Solution</th><th>Contribution & The Value of This Work</th></tr>
<tr><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>Identify devices or nodes within communication range through scanning or exchanging information</td><td>Successfully established communication links with neighboring UAVs.</td></tr></table></td><td>Efficient UAV communication solution featuring precise initialization, dynamic network discovery, reliable link establishment, optimized channel allocation, and seamless data transmission.</td><td>Good to have this knowledge from this paper as we want to work on UAVs and it is very important to know about how the how communication takes place</td></tr>
</table>

<table>
<tr><th>Positive Impact of this Solution in This Project Domain</th><th>Negative Impact of this Solution in This Project Domain</th></tr>
<tr><td>This solution enhances overall UAV project efficiency by optimizing communication, ensuring flexibility, and improving coordination, reliability, and resource utilization</td><td>This UAV communication solution, while beneficial, may pose challenges such as complexity in implementation, resource intensiveness, susceptibility to interference, high initial costs, and security concerns in the UAV project domain.</td></tr>
</table>

<table>
<tr><th>Analyse This Work By Critical Thinking</th><th>The Tools That Assessed this Work</th><th>What is the Structure of this Paper</th></tr>
<tr><td>The UAV communication solution shows promise with its focus on efficiency, coordination, and resource optimization. However, challenges like complexity, resource demands, vulnerability to interference, high initial costs, and security</td><td>Wireless Communication Protocols Analyzers
UAV Ground Control Software
Signal Propagation Modeling Tools</td><td>Abstract
XIII. Introduction
XIV. RelatedWorks
XV. ProposedMethod
XVI. ExperimentalSetup
XVII. ExperimentalResultsandEvaluation
XVIII. Conclusion
Futurework</td></tr>
</table>

need careful consideration for successful implementation.		
Diagram/Flowchart		

6		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org/document/9249585	Peter Harington Wai Pang Richard Binns	Predefined flight plan, single autonomous drone, flight command codes, receiving drone, autonomous drone control, Wi-Fi network, quadcopter drone, military drones, commercial applications, flight time, drone mission, multiple drone network, NodeMCU, signal processing algorithms, digital signal processing, hardware, wireless fidelity, drones, aerospace control.
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**

Autonomous drone control within a Wi-Fi network	Goal (Objective): Create a network of multiple drones from commercially available ones. Problem to Solve: Enable coordination among autonomous drones to follow predefined flight plans and communicate using flight command codes for collaborative and controlled missions.	The system's building blocks involve the Parrot AR2 drone, which is essentially a common drone you can control via Wi-Fi and has built-in navigation cameras. Wi-Fi is the tech glue that allows these drones to chat and share flight commands and data. Then, there are these NodeMCU Wi-Fi modules - they're like the middlemen, linking the drones and offering some handy programmable stuff. To control the drones using a laptop, you've got this software toolkit (SDK) for writing flight programs and managing Wi-Fi connections.

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process

	Process Steps	Advantage	Disadvantage (Limitation)
1	Start by selecting the Parrot AR2 drone, a commercially available drone with navigation cameras. Set up a Wi-Fi network for communication, allowing drones to share flight	Drones can be programmed to follow predefined flight plans and execute commands, reducing the need for continuous manual control.	The use of Wi-Fi and NodeMCU modules allows for wireless communication and reduces the need for physical connections.

	commands and navigation data.		
2	Configure the NodeMCU Wi-Fi modules.To control the drones via a laptop, install the software development kit (SDK) provided by Parrot, allowing users to write flight control programs in 'C' and handle Wi-Fi connections.	The SDK and AT commands provide the flexibility to customize drone behaviors to suit specific applications.	While using commercially available drones is cost-effective, there can still be an initial investment in hardware components and software development.
3	Implement flight control functions using AT commands in the NodeMCU modules.	The constant transmission of navigation data through the network enables real-time monitoring and control, improving mission accuracy.	
4	As a result of the above steps, a network of autonomous drones is created. These drones can operate independently, follow predefined flight plans, communicate via Wi-Fi, and execute specific flight commands.	The use of Wi-Fi and NodeMCU modules allows for wireless communication and reduces the need for physical connections.	The configuration of multiple components, including hardware and software, can be complex and may require technical expertise.

Major Impact Factors in this Work

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Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
Performance of Autonomous Drone Network	Parrot AR2 Drone, Implementation of NodeMCU Wi-Fi Modules, Application of SDK for Laptop Control, Flight Control Functions.	Wi-Fi Network Stability	Real-time Data Exchange (continuous transmission of navigation data)

Relationship Among The Above 4 Variables in This article

Input and Output	Feature of This Solution	Contribution & The Value of this Work
Input: Flight Plan Commands **Output**: Controlled Flight of Autonomous Drones	Users can easily program various flight parameters, enabling direction and distance control. The solution allows the creation of drone networks for collaborative missions, thanks to Wi-Fi communication. Real-time data exchange ensures accurate monitoring. Future work includes expanding the network through a discovery algorithm, facilitating the inclusion of more drones for enhanced capabilities.	Good to have this knowledge from this paper. As it inclined more on controlling the drone autonomously. We know that drones are cost effective making sure of its security is essential.

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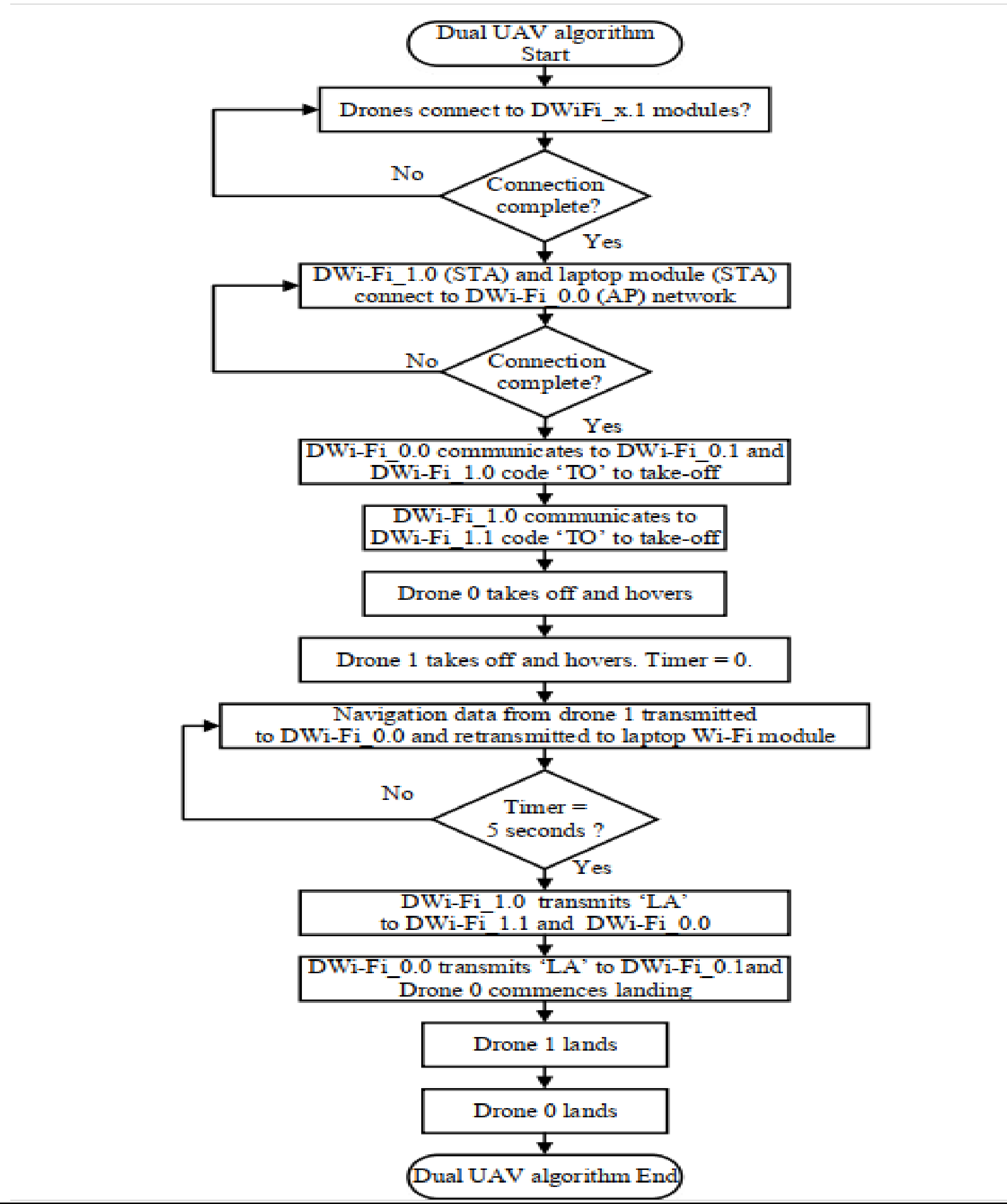
Positive Impact of this Solution in This Project Domain	Negative Impact of this Solution in This Project Domain
Good to have this knowledge from this paper. As it inclined more on controlling the drone autonomously. We know that drones are cost effective making sure of its security is essential.	The use of autonomous drones with networked capabilities, especially in surveillance or data collection applications, may raise privacy issues if not properly regulated.

Analyse This Work By Critical Thinking	The Tools That Assessed this Work	What is the Structure of this Paper
This work is good, as they tried improving the performance by nodemcu wifi modules. Even if any drone lose the connectivity alternate module is activated. One critical point to consider is the potential security vulnerabilities associated with using Wi-Fi networks for drone communication.		Abstract I. Introduction II. Methodology III. Results and Analysis Conclusion
Diagram/Flowchart		



7		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org/document/9032876	Sankula Likhith Krishna Guduru Sai Rama Chaitanya Abbasani Sree Hari Reddy Arasada Manoj Naidu S.S. Poorna K. Anuraj	Cameras, Telemetry, Sensors, Drones, Conferences, Trajectory, INSPEC: Controlled Indexing,

		autonomous aerial vehicles, disasters, emergency management, intelligent robots, object detection, rescue robots, robot vision, Unmanned Aerial Vehicle (UAV)
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
Human detection system methodology	The goal is to create a drone-based automated human detection system for Search and Rescue (SAR) missions, with the primary problem being the swift localization of disaster victims.	The paper describes the development of an autonomous drone system for human detection in disaster situations. It outlines the key hardware components used in the system, integration of these components into the drone, and a human detection algorithm employing motion detection. The algorithm provides confidence scores for detected humans. This technology aims to expedite Search and Rescue operations in natural disasters by swiftly identifying survivors.

The Process (mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process			
	Process Steps	**Advantage**	**Disadvantage (Limitation)**
1	The drone is equipped with key hardware components, including the Pixhawk Flight Controller, SiK Telemetry Radio, Camera, and Radio Receiver and Transmitter System.	The integration of advanced hardware components, such as the Pixhawk Flight Controller, SiK Telemetry Radio, and a high-quality camera, equips the drone with the capability for efficient data collection and communication. These components provide precision and reliability in capturing critical information during Search and Rescue operations.	The setup and integration of these hardware components can be complex and may require specialized technical expertise.
2	The drone operates autonomously by following predefined flight trajectories, leveraging the Ardupilot mission planning software to navigate the route and capture video.	Autonomous flight minimizes the need for manual piloting, making data collection more efficient and reducing the risk associated with human error. Predefined flight trajectories and mission planning software enable precise and repeatable flight paths, enhancing the drone's ability to cover specific areas of interest.	While the system performs well with pre-recorded datasets, its reliance on such data may pose challenges when faced with diverse and dynamic real-world scenarios.

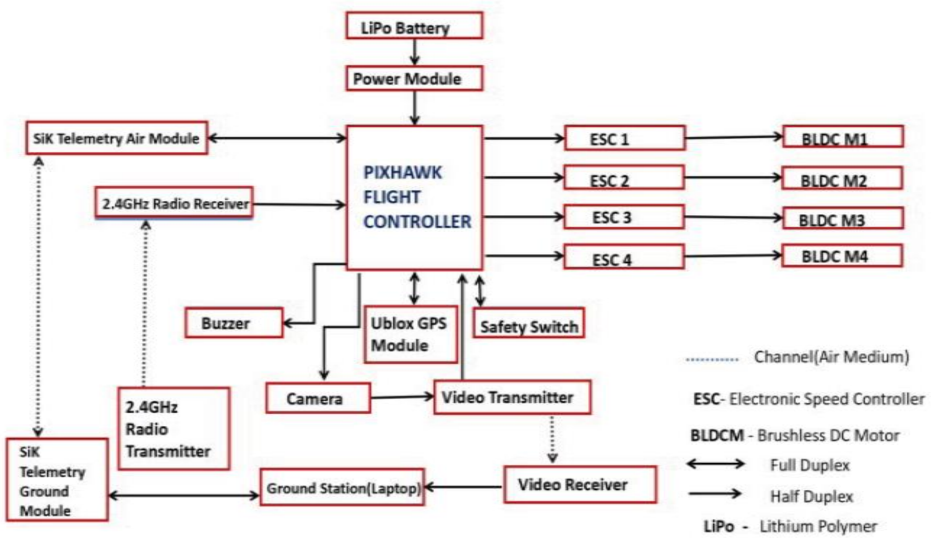
3	An algorithm utilizing motion detection processes the captured video, employing Kalman filtering to identify moving human centroids, tracking their movements and assigning confidence scores to detected individuals.	The human detection algorithm, particularly using motion detection and Kalman filtering, allows for efficient identification of individuals from the captured video. It offers the ability to track moving subjects and assign confidence scores to human detections, aiding in rescue prioritization.	
4	The system aids Search and Rescue operations by swiftly locating survivors, providing rescuers with vital data for effective action plans, potentially elevating the survival rate in disaster-stricken areas.	The system's primary advantage lies in its ability to swiftly locate survivors in disaster scenarios, which can significantly increase their chances of survival. Additionally, the system's provision of confidence scores for human detections can assist rescue teams in making informed decisions and prioritizing their efforts.	

Major Impact Factors in this Work

Dependent Variable	**Independent Variable**	**Moderating variable**	**Mediating (Intervening) variable**

<table>
<tr><th colspan="3">Relationship Among The Above 4 Variables in This article</th></tr>
<tr><td colspan="3">This study explores the connection between stuttering severity and the automation of stuttering recognition , with age serving as a moderating factor. The workload of Speech Language Pathologists acts as a mediating variable, influencing the relationship between automation and stuttering severity. The study aims to discern how automated recognition, moderated by age and mediated by workload, correlates with the severity of stuttering.</td></tr>
<tr><th>Input and Output</th><th>Feature of This Solution</th><th>Contribution in This Work</th></tr>
<tr><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>Visual data from the UAV's camera</td><td>Localization and identification of survivors, confidence scores for detected humans</td></tr></table></td><td>It takes advantage of various sensors, including GPS and cameras, to gather comprehensive environmental data. This data informs the system's core function: generating precise flight paths for the Unmanned Aerial Vehicle (UAV). The output provides the UAV with a predefined trajectory, ensuring safe and efficient operation during Search and Rescue missions. Real-time updates on the UAV's progress and the detection of survivors are also offered. This input-output setup equips the system with the critical ability to navigate complex environments and swiftly</td><td>Good to have this knowledge from this paper as we want to work on UAVs . As it focus more on the detecting the person which will impact the insights for child rescue as well.</td></tr>
</table>

	locate and aid disaster survivors.	
Positive Impact of this Solution in This Project Domain		**Negative Impact of this Solution in This Project Domain**
The major impact of this solution in the project domain is the substantial improvement in disaster response. It accelerates the identification and localization of survivors, streamlining Search and Rescue (SAR) operations. This leads to quicker and more effective rescue missions, potentially saving more lives in disaster scenarios.		A negative impact of this solution is its vulnerability to technical issues and weather-related challenges, which could impede its performance during critical Search and Rescue (SAR) operations
Analyze This Work By Critical Thinking	**The Tools That Assessed this Work**	**What is the Structure of this Paper**
It addresses a critical real-world problem, but its technical complexity and sensitivity to adverse weather conditions present practical challenges. Additionally, privacy concerns related to surveillance technology require careful consideration. The reliability of the human detection algorithm in diverse scenarios warrants further investigation.	MATLAB, OpenCV, Ardupilot, Pixhawk Flight Controller, cameras, GPS modules, and telemetry radios	Abstract I. Introduction II. Related Works III. Proposed Method IV. System Description V. Experimental Results and Evaluation VI. Conclusion VII. Future work References

Diagram/Flowchart


8		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org /document/9243257	Kadi Shiza nehwaz	Payload capacity, cruise speed, drone, video transmission, communication module, autonomous flight control, waypoints, altitude, firmware, telemetry unit, transmission power, receiver sensitivity, remote controllervideo transmitter, mean aerodynamic chord, center of gravity, MAC line, wing span, root chord, tip chord

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The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	The Goal (Objective) of this Solution & What is the problem that need to be solved	What are the components of it?
Development of an Aircraft Type Portable Autonomous Drone for Agricultural Applications	The objective of this solution is to design and develop a portable agricultural drone that can be used for various agricultural applications. The agricultural drone provides a solution by offering a faster and more precise way to perform these tasks. It helps in improving productivity, reducing manual labor, and optimizing resource utilization in agriculture.	Mechanical Module: The mechanical module of the drone consists of the airframe, which is constructed using composite glass fibers, foam pad, plywood, and aluminum pipe. Electrical and Electronics Module The communication module facilitates autonomous and manual control of the drone. It comprises a ground control station (GCS) for path programming, a telemetry unit transmitting data at 64kbps, for the autopilot (PixHawk 2)
The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process		

	Process Steps	Advantage	Disadvantage (Limitation)
1	The drone's sturdy airframe was crafted from composite glass fibers, foam padding, plywood, and aluminum pipe. Components were strategically placed—GPS	Precision Agriculture: Drones enable precision agriculture by providing real-time data on crop health, nutrient levels, and pest infestations. This allows farmers to make informed	Drones have limited battery life and flight time, which can be a constraint in covering large areas of farmland. Frequent recharging or battery replacement may be

	and telemetry units on top, while the power unit, autopilot, and electronics were housed inside. Weighing around 2 kilograms without payload, featuring two 8"×4.5" propellers, it could carry up to 1.4 kilograms.	decisions and optimize their farming practices.	required, leading to interruptions in operations.
2	Two brushless motors with electronic speed controllers powered the drone's propulsion system. It utilized a high-precision GPS and a lithium-polymer battery. Additionally, an HD camera with a 3-axis gimbal and a bottom-mounted loudspeaker were incorporated.	Efficient Monitoring: Agricultural drones can cover large areas of farmland quickly and efficiently, providing farmers with a comprehensive view of their crops. This helps in early detection of diseases, pests, and other problems, allowing for timely intervention.	
3	The drone's flight path was programmed using Mission Planner software from the Ground Control Station. Test flights followed a set course of five waypoints with specific radii. Autonomous navigation relied on a telemetry unit with a 4-kilometer range, while manual control was possible via a 2.4 GHz long-range remote controller.	Increased Productivity: Drones can automate tasks such as crop spraying, seed sowing, and mapping, reducing the time and effort required by farmers. This leads to increased productivity and improved crop yields.	The use of drones in agriculture is subject to regulatory restrictions and guidelines. Farmers need to comply with airspace regulations, obtain necessary permits, and ensure safe operation of drones, which can be time-consuming and complex.

4	Precise calculations established the Mean Aerodynamic Chord (MAC) and Center of Gravity. The MAC, derived from averaging root and tip chord lengths, crucially impacted aerodynamic stability. To ensure stability, the estimated center of gravity was positioned at 22.5% of the MAC from the wing's leading edge.	Cost-Effective: Drones offer cost-effective solutions for monitoring and managing agricultural fields. They eliminate the need for manual labor and reduce the use of pesticides and fertilizers, resulting in cost savings for farmers.	

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
Flight Performance Metrics, Ease of Installation and Portability	Modules and Design Components, Cruise Speed, Modules and Design Components		

Relationship Among The Above 4 Variables in This article

Input and Output		Feature of This Solution	Contribution & The Value of This Work
Input	**Output**	The Altitude Range, from 10 to 200 meters, fundamentally shapes the drone's performance metrics. It directly affects	Good to have this knowledge from this paper. As it inclined more on efficiency the drone autonomously. We know that

Altitude Range	Flight Performance Metrics	speed, endurance, stability, and power usage. Higher altitudes reduce air density, impacting speed and endurance while posing stability challenges due to altered air pressure and wind conditions. Altitude changes also influence power consumption, affecting the drone's endurance and operational range. Ultimately, the Altitude Range plays a crucial role in defining the drone's capabilities and behavior during flights.	drones are cost effective making sure of its security is essential.

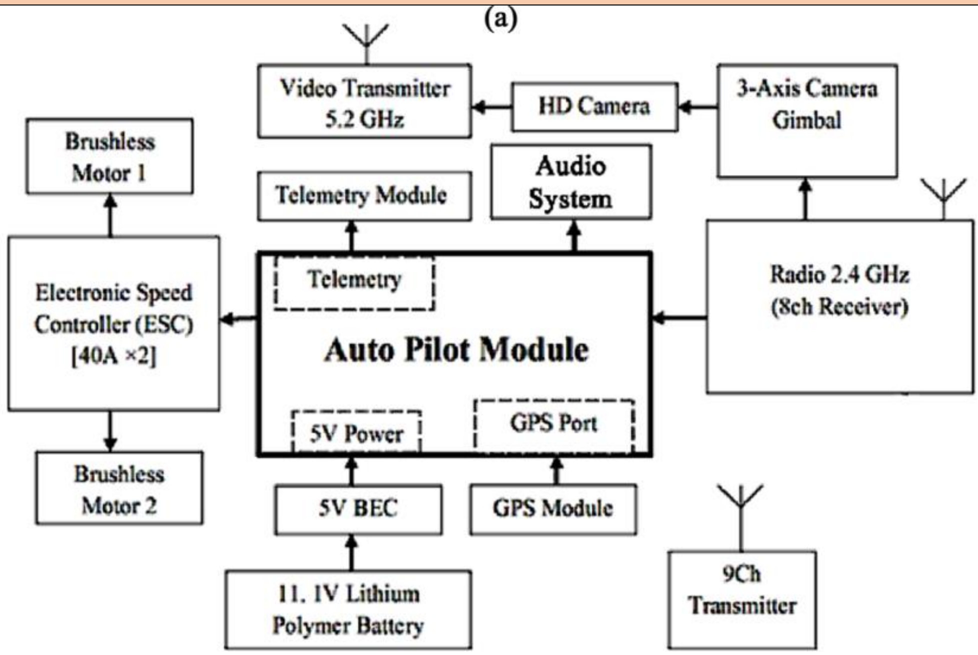
Positive Impact of this Solution in This Project Domain	**Negative Impact of this Solution in This Project Domain**
The drone, meticulously designed, showcases exceptional capabilities. Its design parameters exceed requirements with a payload capacity of 1 kilogram, a maximum speed of 60 kilometers/hour, and wings engineered for stability. Computational Fluid Dynamics analysis validated optimal airflow at high wind speeds, ensuring efficiency. Post-installation, it weighs 2 kilograms, achieves 200 meters altitude and a 4-kilometer range, with a development cost below $800.	Environmental Concerns: The use of agricultural drones for spraying pesticides and fertilizers can lead to environmental pollution. The chemicals used in these applications can contaminate soil, water sources, and harm beneficial insects and wildlife.

Analyse This Work By Critical Thinking	**The Tools That Assessed this Work**	**What is the Structure of this Paper**

This work demonstrates detailed design and analysis, highlighting the drone's strengths in speed, payload, and stability. However, critical assessment questions the $800 development cost's impact on accessibility and urges deeper exploration of sustainability and scalability for broader agricultural adoption.	The tools used to assess this work include Python and its libraries (such as PyDub and Librosa) for audio processing and feature extraction, scikit-learn for training the SVM model, Keras with TensorFlow backend for developing and training the GRCNN models, and various deep learning models such as CNN and RNN.	Abstract I. Introduction II. Methodology III. Results and Analysis IV. Conclusion

Diagram/Flowchart

(a)



(b)

9	
Reference in APA format	

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URL of the Reference	Authors Names and Emails	Keywords in this Reference
https://ieeexplore.ieee.org /document/9332518	Seema Barda	Anand Ashok Athul midhur
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
Short Range Telemetry Communication for Autonomous Drone Navigatin	This study aims to innovate wireless telemetry for autonomous drone navigation by interfacing a Raspberry Pi with a Pixhawk Mini 3DR using Python and Ardupilot. It targets short-range Bluetooth communication for low-latency benefits, addressing the need for cost-effective, user-friendly drone systems. Successful implementation can advance intelligent, autonomous drones.	The experimental setup comprises a 250mm carbon fiber frame drone with PM3DR, ESCs, BLDC motors, HC-05 Bluetooth, LiPo battery, and GPS. A Raspberry Pi interfaces with the Pixhawk Mini 3DR using Python. HC-05 modules enable short-range telemetry, and baud rate set at 57600 establishes MAVLink communication. The setup also includes image processing code for target detection and hardware connections established between the RPi and HC-05 Bluetooth modules. Fig. 1 visually represents these components and connections.
The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process		

	Process Steps	Advantage	Disadvantage (Limitation)
1	Interface Setup: The study aimed to interface a companion PC (Raspberry Pi) with an autopilot system (Pixhawk Mini 3DR) using Python programming and Ardupilot software.	The interface setup allowed for the successful communication between the Raspberry Pi and the Pixhawk Mini 3DR, enabling control of the drone operations using commands sent by the Raspberry Pi.	This can restrict the operational range of the drone and limit its capabilities in certain scenarios.
2	Bluetooth Telemetry: The use of Bluetooth telemetry was chosen over radio telemetry due to its lower latency (up to 100ms) compared to radio telemetry (up to 250ms). Bluetooth telemetry allowed for successful communication between the Raspberry Pi and the PM3DR	Bluetooth telemetry offered low latency, making it advantageous for short-range communication between the Raspberry Pi and the flight controller.	
3	Bluetooth Telemetry: The use of Bluetooth telemetry was chosen over radio telemetry due to its lower latency (up to 100ms) compared to radio telemetry (up to 250ms). Bluetooth telemetry allowed for successful communication between the Raspberry Pi and the PM3DR	The analysis of flight data provided insights into various parameters that govern the quality and manner of drone flight, allowing for further improvements and optimizations.	
4	Flight Data Analysis: The flight data logged in the SD	The vibration analysis ensured that the vibration	

	card storage of the PM3DR was extracted using Mission Planner software.	levels during autonomous flight were within the permissible range, ensuring smooth flight and avoiding malfunction of the aircraft.	

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
Flight Data Analysis, experimental setup	performance	bluetooth Network Stability	Real-time Data Exchange (continuous transmission of navigation data)

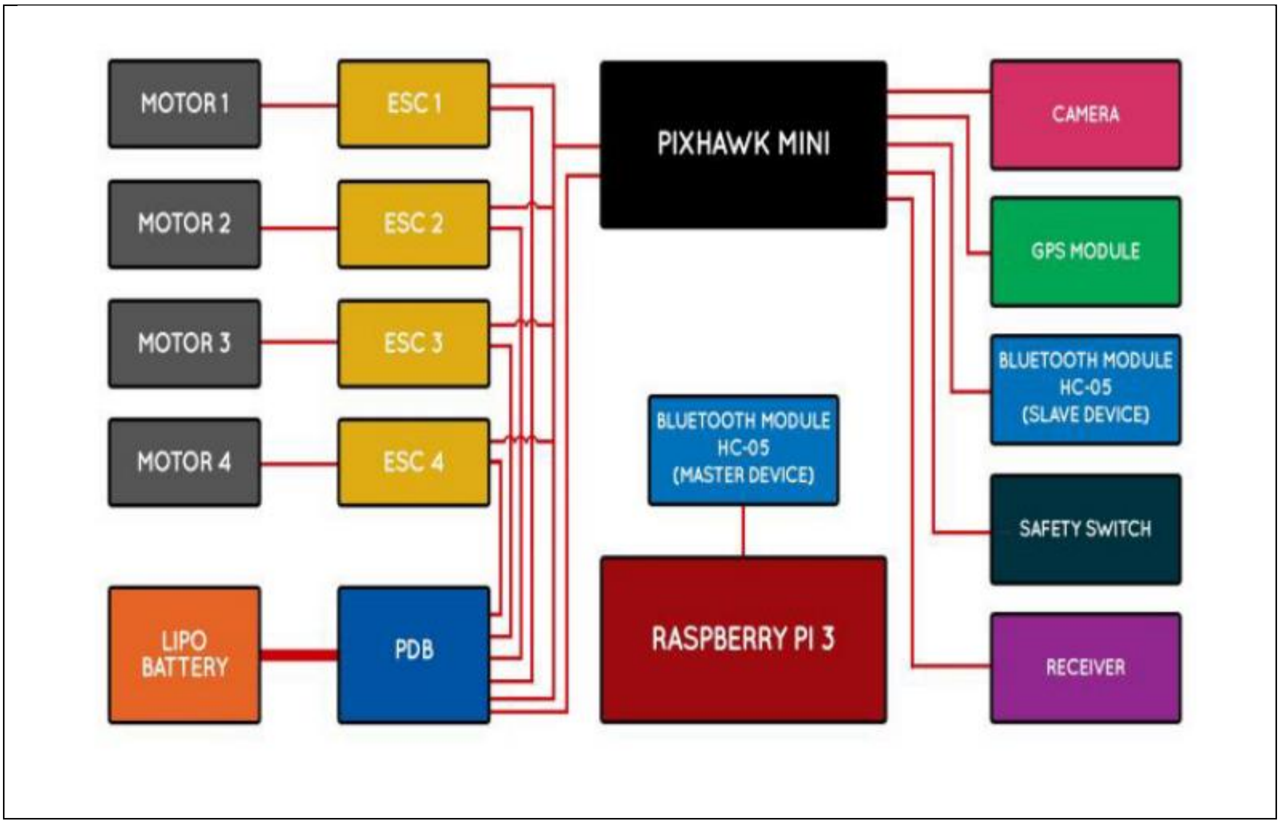
Relationship Among The Above 4 Variables in This article

Input and Output	Feature of This Solution	Contribution & The Value of This Work
Input: Bluetooth modules for telemetry **Output**: Short-range telemetry communication establishment	Bluetooth modules serve as the enabling technology for establishing short-range telemetry communication within this solution. Their utilization facilitates direct, low-latency communication between the Raspberry Pi and Pixhawk, ensuring effective and efficient data exchange	Good to have this knowledge from this paper. It helps us to first test on the smaller platform which has low damage. And can be easily controlled.

	crucial for drone control and navigation.	

Positive Impact of this Solution in This Project Domain	Negative Impact of this Solution in This Project Domain
Enhancing drone control, the solution streamlines communication between Raspberry Pi and Pixhawk, fostering efficient data exchange. This improves operational precision, enabling seamless control and navigation, thereby augmenting the autonomy and efficacy of unmanned aerial vehicles in various applications.	Insufficient telemetry range due to the short-range nature of Bluetooth modules can limit operational distances

Analyse This Work By Critical Thinking	The Tools That Assessed this Work	What is the Structure of this Paper
Critical thinking seems implicit in the document through systematic analysis of parameters like vibration levels, flight path, and power draw to assess drone performance. Use of Mission Planner software for flight log analysis and comparison of vibration levels with limits highlights a methodical approach toward ensuring smooth drone operation.		Abstract IV. Introduction V. Methodology VI. Experimental setup VII. Conclusion I. References
Diagram/Flowchart		



10		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org /document/8491889	Emad Arne poramate	Propellers, Signal processing algorithms, Navigation, Laser radar, System recovery, Collision avoidance, Simulation, Autonomous drone system
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**

Short Range Telemetry Communication for Autonomous Drone Navigation	Develop an adaptive obstacle avoidance algorithm for drones to navigate complex environments, preventing deadlock and collisions. This solution is vital for real-world applications like infrastructure inspection and search operations. It must be efficient, ensuring safety without endangering lives or property while navigating obstacles autonomously.	The drone, a quadcopter using a carbon fiber frame and 14" carbon propellers, hosts a PIXHAWK 2 flight controller with LIDAR obstacle sensors. Controlled by a neural network, these sensors enable adaptive obstacle avoidance, ensuring safe navigation through complex terrains. The paper details the system's design, mechanics, and neural control for efficient obstacle evasion.

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process

	Process Steps	Advantage	Disadvantage (Limitation)
1	Requirement Identification: Define objectives—creating an adaptive obstacle avoidance drone for real-world scenarios, prioritizing safety, prolonged flight, and simple control strategies.	Drones can be programmed to follow predefined flight plans and execute commands, reducing the need for continuous manual control.	Frameworks can be expensive
2	Choose components aligning with requirements—a Tarot 650 Sport frame, suitable motors and propellers for necessary thrust, Pixhawk	The advantage is that the design requirements ensure the drone meets the necessary criteria for safety and performance.	all the requirements may add complexity and weight to the drone.

	controller, LIDAR sensors for obstacle detection, and a neural-based control system.		
3	Assemble the drone, integrating selected components, configuring the control system based on LIDAR inputs, and developing the neural network for obstacle avoidance.	The constant transmission of navigation data through the network enables real-time monitoring and control, improving mission accuracy.	.
4	Validate the system through simulations, ensuring efficient obstacle navigation. Implement the algorithm on a physical platform for infrastructure inspection, confirming its capability to navigate complex environments safely.	software tool like eCalc is that it provides a quick estimation of the drone's performance.	

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
Successful navigation of the drone through environments	Implementation of adaptive obstacle avoidance control system	Environmental factors (e.g., weather, terrain)	Utilization of short-term memory within the neural network control system

Relationship Among The Above 4 Variables in This article

This study examines the link between dysarthria severity and the accuracy of diagnosis using a Convolutional Neural Network . Speech features like zero crossing rates and MFCCs serve as mediating variables, explaining how dysarthria severity affects diagnosis accuracy. Age is considered as a potential moderating variable, suggesting its influence on this relationship. Overall, the study showcases the CNN's effectiveness in early dysarthria diagnosis, considering severity levels and potential moderating factors.

<table>
<tr><th>Input and Output</th><th>Feature of This Solution</th><th>Contribution & The Value of This Work</th></tr>
<tr><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>LIDAR Sensor Data</td><td>Yaw Command for Steering</td></tr></table></td><td>This adaptive obstacle avoidance system integrates LiDAR sensors to detect obstacles, employing a neural network for continuous navigation adjustments. It ensures drone safety by converting real-time sensor data into precise steering commands, enabling efficient and collision-free autonomous flight in diverse environments.</td><td>This work pioneers an adaptive obstacle avoidance system, utilizing LiDAR sensors and a neural network for drone navigation. Its contribution lies in enabling safe autonomous flight, crucial for diverse applications like infrastructure inspection and crisis response. The value lies in real-world implementation, enhancing safety and efficiency in complex environments.</td></tr>
</table>

Positive Impact of this Solution in This Project Domain	Negative Impact of this Solution in This Project Domain
This solution revolutionizes drone autonomy, ensuring safe navigation in diverse terrains. It empowers applications such as infrastructure inspection and search operations, enhancing efficiency and safety. By enabling obstacle-free flight, it elevates the reliability and effectiveness of drone-	**Complex implementation might entail high costs or require specialized expertise, limiting accessibility and widespread adoption in certain contexts.**

based tasks in challenging environments, revolutionizing their capabilities.	

Analyse This Work By Critical Thinking	The Tools That Assessed this Work	What is the Structure of this Paper
This work introduces an innovative approach to drone navigation, employing advanced technology for autonomous obstacle avoidance. It exhibits strong potential in enhancing safety and efficiency in various applications. However, critical analysis could delve into factors like scalability, real-world adaptability, and potential limitations in highly dynamic or unpredictable environments. Assessing the feasibility, scalability, and adaptability of this approach across diverse scenarios would be crucial for a comprehensive evaluation. Additionally, exploring the need for redundancy or fail-safes in the control system could enhance its robustness in unpredictable conditions.		Abstract VIII. Introduction IX. Obstacle avoidance control X. Results and Analysis Conclusion

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Reference in APA format	

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URL of the Reference	Authors Names and Emails	Keywords in this Reference
https://ieeexplore.ieee.org/document/9080597	Chenchen Xu Xiaohan Liao Junming Tan Huping Ye Haiying Lu	Low-altitude airspace, RS and GIS for UAV regulation, UAV regulation technology and policy, Urban region, UAV low-altitude air routes.
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
Geographic Information System (GIS) technology	Aim is to incorporate the rapidly increasing number of UAVs into an already crowded airspace, as well as to ensure civilian aviation safety, countries or regions commonly segregate UAV activities from civil aviation in airspace by several measures.	Author used bionic intelligence optimization algorithm and GIS, Ant Colony Optimization (ACO) algorithm for path planning which helps UAV to find the optimal path in crowded, low altitude areas.

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process

The author emphasizes the role of technology, particularly urban remote sensing and GIS, in advancing the field of UAV regulation in urban regions and the technologies used for real-time data processing, object detection and optimal path searching.

	Process Steps	Advantage	Disadvantage (Limitation)
1	The information of USS1 is collected by UAV cloud-based control system.	Describes bionic intelligence optimization algorithm and GIS, Ant Colony Optimization (ACO) algorithm for path planning which helps UAV to find the optimal path and easily pass the information.	Ensemble based techniques should preferably use to develop automated dynamic filter generation which is not fulfilled in this paper.
2	The UAV gathers the information to find the optimal path in low-altitude areas and crowded places.		Data confidentiality and release issue. It is difficult for data updating without the support of geographic

			information and fast data acquisition.
3	UAV service system and the data exchange platform	The USS and the data exchange platform are core components of UTM, providing real-time operation and manufacture data of UAVs from different operators to the UAV cloud-based control system.	

Major Impact Factors in this Work

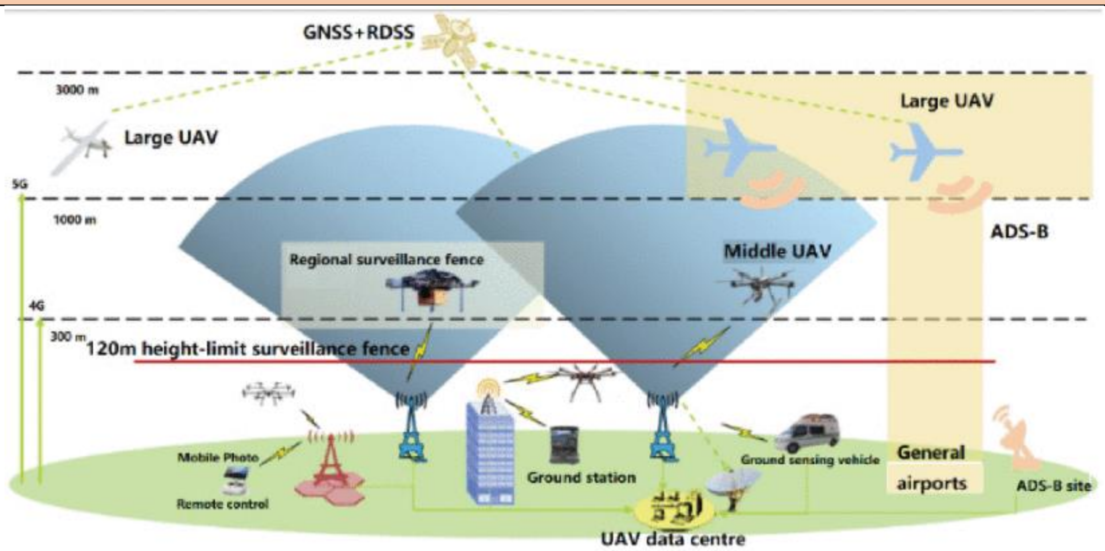
Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
Low altitude areas	Path detection	Environmental conditions	ACO, GIS

Relationship Among The Above 4 Variables in This article

Input and Output	Feature of This Solution	Contribution & The Value of This Work
Input: Data about low altitude areas and crowded places, possible paths. **Output**: Detecting possible air-routes, object detection.	Developing possible air-routes while sending the information to the cloud-based systems. Ensuring the safe and legal operation of UAVs at low-altitudes in urban areas through surveying and mapping technology in RS, GIS and geographical grid technology.	Good to have this knowledge from this paper as we reviewing of all the basic algorithms under data mining filter designing rules.

Positive Impact of this Solution in This Project Domain	**Negative Impact of this Solution in This Project Domain**
Path searching algorithms are big challenging in the current research. Restricting UAV flight by imposing a maximum height and spatial range (geofence) can distinguish civil aviation.	**Since this is a performance evaluation of various algorithms, not much to project on negative side as all the things used are defined in advance.**

Analyse This Work By Critical Thinking	**The Tools That Assessed this Work**	**What is the Structure of this Paper**
This work is good, as they tried improving the latest policies and key technologies to ensure the safe flight of UAVs at low-altitude over cities.	Path searching algorithms	Abstract I. Introduction II. Machine Learning Techniques III. Benchmark spam datasets IV. Design environments and Evaluation Metrics V. Experimental evaluation VI. Conclusion Future work

Diagram/Flowchart


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Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9164987	André Farinha Raphael Zufferey Peter Zheng Sophie F. Armanini Mirko Kovac	Aerial systems, applications, robotics in hazardous fields, sensor networks.
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
micro SMA-based trigger, WSN	Aerial sensor placement through impulsive launching with application to Wireless Sensor Network deployment in hazardous environments.	demonstrates a new aerial sensor placement method based on impulsive launching. Since direct physical interaction is not required, sensor deployment can be achieved in cluttered environments where the target location cannot be safely approached by the UAV.
The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process		

	Process Steps	Advantage	Disadvantage (Limitation)
1	Direct placement	usage of manipulators is a viable method for sensor delivery.	Accurate state estimation is required to ensure stability of the platform
2	Sensor dropping		
3	Impulsive launching		
4	Sensor attachment and trajectory		
5	Energy storage		

Major Impact Factors in this Work

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Dependent Variable	Independent Variable	Moderating variable	Mediatin (Intervening) v

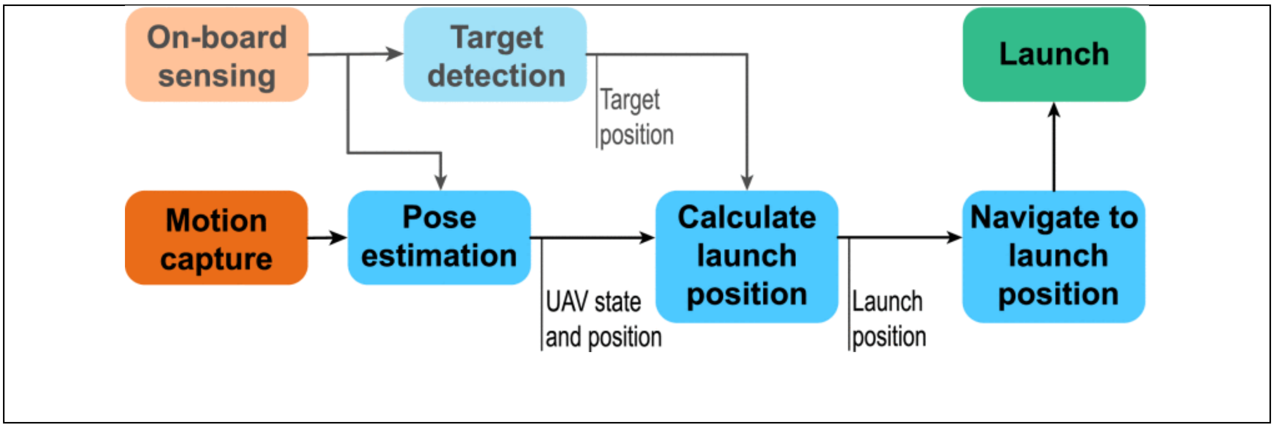
Relationship Among The Above 4 Variables in This article

Input and Output	Feature of This Solution	Contribution in This Work
Input: Sensor placement **Output**: Sensor deployment	Demonstrates a new aerial sensor placement method based on impulsive launching. Since direct physical interaction is not required, sensor deployment can be achieved in cluttered environments where the target location cannot be safely approached by the UAV	The proposed system does not require direct physical interaction to accurately place sensors which brings significant advantages in safety as well as operation in cluttered environments.

Positive Impact of this Solution in This Project Domain	Negative Impact of this Solution in This Project Domain
This will required the usage of vision state estimation and positioning, as well as a depth sensor for estimation of the target location.	**Nothing new in terms of core logic. Used two algorithms which are already defined.**

Analyse This Work By Critical Thinking	The Tools That Assessed this Work	What is the Structure of this Paper
Logically this is a good step for senspr placement without any physical interaction.	WSN, Trigger	Abstract I. Introduction II. Related Work III. Proposed Method IV. Experiment Results V. Conclusion

Diagram/Flowchart


On-board sensing
Target detection
Launch
Target position
Motion capture
Pose estimation
Calculate launch position
Navigate to launch position
UAV state and position
Launch position

3		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org/document/8317266	Anton A. Zhilenkov Ignat R. Epifantsev	Autonomous navigation deep learning, Control system, Drone
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
A propose model of Autonomous Navigation of the Drone in Difficult Conditions of the Forest Trails	To find optimal paths in difficult areas, ex: forest areas.	Convolutional neural networks, autonomous navigation of drones
The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process		

	Process Steps	Advantage	Disadvantage (Limitation)
1	1. Develop algorithms and models for processing panoramic video, route recognition, machine learning, decision making, optimized for the characteristics of mobile hardware platforms.	Reduced power latency, improve accuracy	complexity, limited scalability
2	Design a mobile hardware platform for autonomous navigation using neural network architectures that maximize performance and AI hardware acceleration technologies.	Can enable real-time autonomous navigation in complex environments	Expensive, time consuming, limited battery life
3	Develop software for the mobile hardware platform to implement the algorithms and models.	Portability, flexibility, maintainability	may not be able to achieve the same level of performance as hardware-accelerated solutions.
4	Design machine learning training methods and tools to make the system robust to different terrains and environmental factors.	Improved generalization performance, Increased safety	Reduced interpretability, increased training time

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
forest path recognition accuracy	CNN architecture	Environmental conditions	CNN features

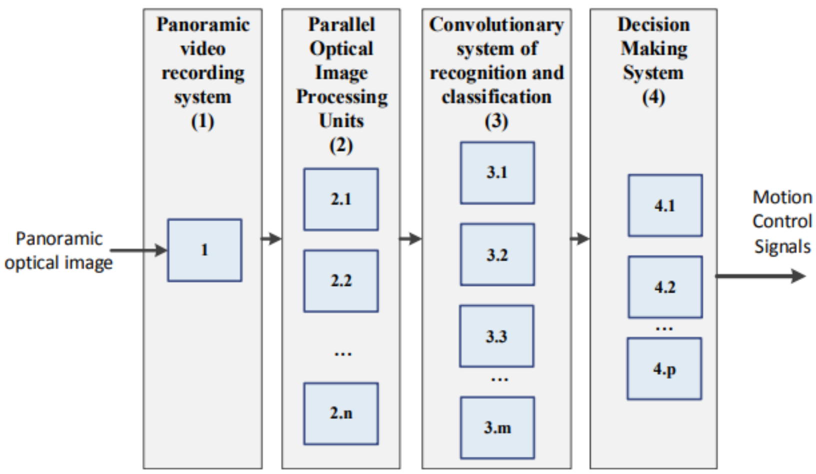
Relationship Among The Above 4 Variables in This article
The independent variable (CNN architecture) is hypothesized to have a significant impact on the dependent variable (forest path recognition accuracy). This impact is moderated by the environmental conditions. The mediating variable (CNN features) explains how the independent variable affects the dependent variable.

<table>
<tr><th>Input and Output</th><th>Feature of This Solution</th><th>Contribution & The Value of This Work</th></tr>
<tr><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>Processed panoramic image</td><td>Finding optimal path</td></tr></table></td><td>CNN-based forest path recognition for autonomous drone navigation</td><td>provides a new approach for autonomous drone navigation in forests.</td></tr>
</table>

<table>
<tr><th>Positive Impact of this Solution in This Project Domain</th><th>Negative Impact of this Solution in This Project Domain</th></tr>
<tr><td></td><td></td></tr>
</table>

<table>
<tr><th>Analyse This Work By Critical Thinking</th><th>The Tools That Assessed this Work</th><th>What is the Structure of this Paper</th></tr>
<tr><td>The paper makes a significant contribution to the field of autonomous navigation. The proposed system is a promising new approach for autonomous drone navigation in forests, and it has the potential to be used in other applications as well.</td><td>Convolutional neural networks, deep learning, control systems</td><td>Abstract
I. Introduction
II. Malicious spam detection overview
III. Related Work
IV. Proposed Methodology
V. Conclusion and Future work</td></tr>
</table>

Diagram/Flowchart



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Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org /document/8270406	Gayathri Devi Ramaraj Sriram Venkatakrishnan Ganeshaanand Balasubramanian Soorya Sridhar	PHD, UAV, OCSVM Classifier
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
Energy Efficient Coverage Path Planning	Deep Learning-Based Autonomous Drone Navigation System for Forest Trails	PHD, UAV, OCSVM Classifier
The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process		

	Process Steps	Advantage	Disadvantage (Limitation)
1	A dataset of panoramic video images of forest trails is collected. This dataset is used to train the CNN model.	it allows the model to learn to identify forest paths in a variety of different forest environments.	it can be difficult to label the video footage with the ground truth locations of forest paths

2	The drone is pre-fed with the following algorithms to help the drone achieve this. Three path planning algorithms for secure positioning and secure position verification have been used here: 1) Localizer Bee, 2) VerifierBee, and 3) PreciseVerifierBee.	securely determines the position of a set of devices and securely verifies the position of a set of devices. guarantees a bound on the positioning error, at a cost of a longer path.	The drone needs to process and execute the instructions of all three algorithms, which can put a strain on its computational resources.
3	A stream of real time images, with this background and frames are fed into the system and used to detect human movement.	This allows for immediate responses to potential threats or incidents. For example, if the system detects human movement in a restricted area, it can alert security personnel.	Human detection algorithms can sometimes be fooled by objects or animals that resemble humans. This can lead to false alarms and unnecessary alerts.
4	the drone has the GPS coordinates of the charging platforms to charge and maintain the battery capacity.	providing the drone with the GPS coordinates of charging platforms significantly enhances its operational efficiency, range, and reliability, making it a valuable asset for various applications.	The drone's flight path is constrained by the locations of charging platforms, reducing its ability to adapt to changing conditions or explore new areas without the need for additional charging infrastructure.

Major Impact Factors in this Work

Dependent Variable	**Independent Variable**	**Moderating variable**	**Mediating (Intervening) variable**

Surveillance of public areas	UAV with auto tracking features	Object detection	PHD, OCSVM

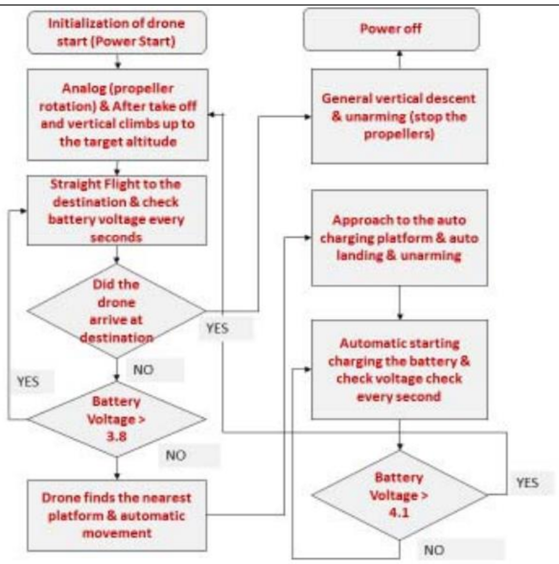
Relationship Among The Above 4 Variables in This article
The use of drones for surveillance purposes. Drones can be used to automatically track objects of interest in public areas using algorithms such as PHD and OCSVM. This technology has the potential to improve public safety and security.

Input and Output	Feature of This Solution	Contribution & The Value of This Work
Input: Stream of frames **Output**: Human/object position	Swarm of drones which can act autonomously with Image processing and autonomous tracking features.	This research has the potential to revolutionize public monitoring and security. The proposed system can be used to monitor large areas, such as borders or airports, for security threats. It can also be used to track and follow individuals, such as criminals or suspects.

Input	Output
Stream of frames	Human/object position

Positive Impact of this Solution in This Project Domain	Negative Impact of this Solution in This Project Domain
the solution can be used to monitor large areas for security threats, such as borders or airports. This can help to prevent terrorist attacks and other crimes. The solution can also be used to track and follow individuals, such as criminals or suspects by using PHD, OCSVM and other three algorithms.	Privacy concerns

Analyse This Work By Critical Thinking	**The Tools That Assessed this Work**	**What is the Structure of this Paper**
The proposed system addresses these shortcomings by using a swarm of drones that can autonomously track and follow individuals using image processing algorithms. The drones would be able to cover a much larger area than current surveillance systems, and they would be able to track individuals even if they are moving or partially occluded. The system would also require fewer human operators than current surveillance systems.	PHD, MCMC,EECPP,CMC,OCSVM	Abstract I. Introduction II. Path Planning III. Human Secure Verification of Position IV. Human Tracking V. Auto Charging Platform for the MCCTV VI. Conclusion
Diagram/Flowchart		



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Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org/ document/8769017	Ahmed Z. Bashir Bryan O'Halloran Douglas L. Van Bossuyt	Defence in Depth, Drone fleets, Model driven engineering, Mine Counter Measures
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
Defence in Depth concept	To explore the early assessment of drone fleet defense in depth capabilities for mission success.	UML, UAV, NMCM

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process

	Process Steps	Advantage	Disadvantage (Limitation)
1	Develop the domain specific metamodel that will enable the modelling of the system/process of interest.	offers in terms of improved communication, efficient analysis, reusable knowledge, and reduced complexity	the metamodel may need to be updated to reflect the changes, which can be resource-intensive.
2	Build the dependency model of the fleet.		
3	The tool first identifies the redundant functions and mapps the fleet components to the functions.		

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
Defence in Depth capabilities	Drone fleet	Environmental conditions	DiD

Relationship Among The Above 4 Variables in This article

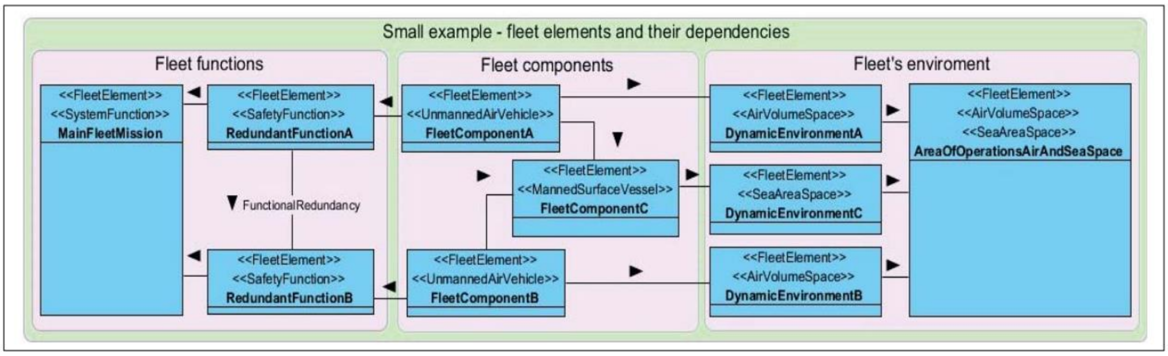
Input and Output	Feature of This Solution	Contribution & The Value of This Work

<table>
<tr><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>Drone fleet</td><td>In Depth capabilites</td></tr></table></td><td>it uses a fleet of drones that can be organized in a way that will increase the survivability of the drones and improve mission success.</td><td>This work is the development of a new framework for early assessment of drone fleet defense in depth capabilities for mission success. The framework is based on a set of key system effectiveness design parameters that are balanced against mission costs.</td></tr>
</table>

<table>
<tr><th>Positive Impact of this Solution in This Project Domain</th><th>Negative Impact of this Solution in This Project Domain</th></tr>
<tr><td>The solution will help to reduce drone crashes by providing a more accurate and reliable way to detect and avoid obstacles and will help to improve mission efficiency by allowing drones to fly more autonomously and avoid human intervention.</td><td>Privacy concerns</td></tr>
</table>

<table>
<tr><th>Analyse This Work By Critical Thinking</th><th>The Tools That Assessed this Work</th><th>What is the Structure of this Paper</th></tr>
<tr><td>The researchers found that using a fleet of drones can significantly increase the survivability of individual drones. This is because the drones can share information and support each other, which makes them more difficult to target and destroy. The researchers also found that using a fleet of drones can improve mission success rates. This is because the drones can</td><td>UML, UAV, HLIM</td><td>Abstract
I. Introduction
II. Methodology
III. Case study
IV. Conclusion</td></tr>
</table>

work together to cover a larger area and complete tasks more quickly.		
Diagram/Flowchart		



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Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://www.mdpi.com/1424-8220/19/16/3542	Eleftherios Lygouras, Nicholas Santavas, Anastasios Taitzoglou, Konstantinos Tarchanidis, Athanasios Mitropoulos, and Antonios Gasteratos	UAV, GNSS, NVIDIA Jetson X1, Obstacle detection

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The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	The Goal (Objective) of this Solution & What is the problem that need to be solved	What are the components of it?
Unsupervised Human Detection with an Embedded Vision System on a Fully Autonomous UAV for Search and Rescue Operations.	The goal of the solution is to develop a fully autonomous UAV system equipped with an embedded vision system to detect and rescue open water swimmers in peril without human intervention. The problem that needs to be solved is the timely and accurate detection and rescue of individuals in distress in open water environments using unmanned aerial vehicles.	Convolutional Neural Networks (CNN) for image processing and object detection , Hardware configurations such as the NVIDIA Jetson X1 for on board image processing, Software configurations for implementing the embedded vision system ,. Global Navigation Satellite System (GNSS) techniques for location tracking , Real-time processing capabilities to avoid the need for transmitting video data to a ground station for processing.

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process

	Process Steps	Advantage	Disadvantage (Limitation)
1	The fully autonomous UAV system, equipped with an embedded vision system, captures live video of open water environments.	Development of a fully autonomous UAV system with an embedded vision system for detecting and rescuing open water swimmers without human intervention.	Implementing advanced obstacle detection and avoidance systems can be costly, especially when considering the need for high-quality sensors, computational resources, and ongoing maintenance

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			and updates.
2	The embedded vision system processes each frame of the live video using a pipeline, dividing the input image into a grid and predicting bounding boxes and confidence scores for object detection.	Timely and accurate detection and rescue of individuals in distress in open water environments using unmanned aerial vehicles.	Obstacle detection systems, such as sensors and cameras, can be sensitive to environmental conditions like poor lighting, adverse weather, or occlusions. These conditions can affect the accuracy and reliability of obstacle detection, potentially leading to false positives or false negatives.
3	The system utilizes computational efficient computer vision algorithms to detect swimmers in the open water, ensuring effectiveness under all lighting conditions.	Utilization of computational efficient computer vision algorithms to detect swimmers in open water, ensuring effectiveness under various lighting conditions.	
4	Upon detection of individuals in distress, the UAV	Integration of obstacle detection, collision avoidance,	
	autonomously navigates to the location for rescue and trajectory control algorithms for safe and efficient operations, without the need for human intervention.The UAV navigation system's integrated obstacle detection, collision avoidance navigation during the rescue process	and trajectory control algorithms ensure safe and efficient during rescue operations.	

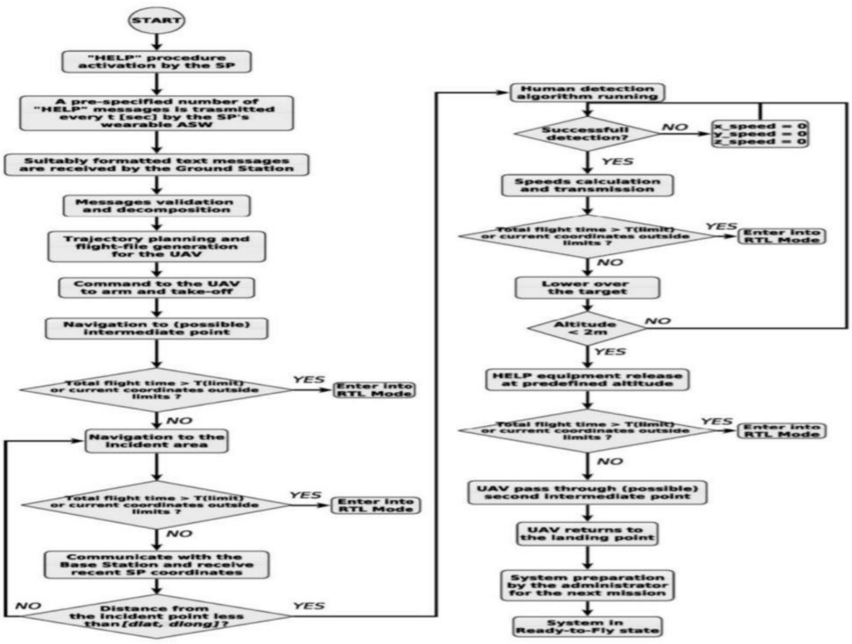
Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
Men average precision	Image characterisitcs	Environmental conditions	Image processing techniques

Relationship Among The Above 4 Variables in This article

Input and Output	Feature of This Solution	Contribution & The Value of This Work
The input to the system is live video captured by a camera The use of deep learning techniques, specifically the onboard the UAV, which is processed by the pipeline to	Tiny YOLO V3 architecture, for real-time human detect swimmers.	detection in search and rescue missions using

Positive Impact of this Solution in This Project Domain	Negative Impact of this Solution in This Project Domain
the system can significantly enhance the efficiency and effectiveness of search and rescue operations for missing children. The autonomous nature of the drone, combined with its ability to detect and locate individuals in peril, can lead to rapid response times and potentially life-saving interventions. This technology has the potential to improve the chances of successfully locating and rescuing missing children, particularly in challenging or	The limitations of a particular solution, such as its speed dependency and poor performance in certain weather conditions.

<table>
<tr><td colspan="2">remote environments. Overall, the solution can greatly enhance the capabilities of autonomous drones for missing child rescue, ultimately contributing to improved outcomes in such critical situations.</td><td></td></tr>
<tr><th>Analyse This Work By Critical Thinking</th><th>The Tools That Assessed this Work</th><th>What is the Structure of this Paper</th></tr>
<tr><td>This work is good, as they tried improving the performance of UAV using efficient object detection and tracking of the target</td><td>Self-supervised learning</td><td>Abstract
I. INTRODUCTION
II. RELATED WORK
III. PROPOSED ARCHITECTURE
IV. EXPERIMENTAL EVALUATION
V. RESULTS
VI. CONCLUSION</td></tr>
<tr><th colspan="3">Diagram/Flowchart</th></tr>
<tr><td colspan="3">
</td></tr>
</table>

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17		
Reference in APA format		
URL of the Reference	**Authors Names and Emails**	**Keywords in this Reference**
https://ieeexplore.ieee.org/document/9348925	Sahana , Aniket Sengar, Aniruddh Dubey, Umang Agrawal.	object detector, person detection, search and rescue operations, UAV, image processing , machine learning
The Name of the Current Solution (Technique/ Method/ Scheme/ Algorithm/ Model/ Tool/ Framework/ ... etc)	**The Goal (Objective) of this Solution & What is the problem that need to be solved**	**What are the components of it?**
Person Detection in Maritime Search And Rescue Operations	The objective of the solution is to develop and implement advanced technologies, such as unmanned aerial vehicles (UAVs) and deep convolutional neural networks, to enhance search and rescue operations. This includes automatic detection of individuals and objects in challenging environments, particularly in maritime search and rescue (MSAR) operations. The objective is to improve the efficiency, cost-effectiveness, and	Unmanned Aerial Vehicles (UAVs), Deep Convolutional Neural Networks, Multispectral Cameras, Feature Pyramid Networks, Monte Carlo Tree Search Method.

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	time-saving aspects of search and rescue missions through the use of innovative technology and machine learning algorithms.	

The Process (Mechanism) of this Work; Means How the Problem has Solved & Advantage & Disadvantage of Each Step in This Process

	Process Steps	Advantage	Disadvantage (Limitation)
1	Data Collection: Gathering relevant data, including images and videos, from sources such as UAVs and other reconnaissance methods.	The use of unmanned aerial vehicles (UAVs) and deep convolutional neural networks improves the efficiency of search and rescue operations by automating the detection of individuals and objects in challenging environments.	The integration and deployment of UAVs, deep convolutional neural networks, and advanced algorithms may require specialized technical expertise and resources.
2	Pre-processing: Preprocessing the collected data for analysis, which may involve tasks such as image	By utilizing advanced technology and machine learning algorithms, the solution offers a cost effective approach to search and rescue missions,	The use of advanced technologies for data collection and analysis raises concerns related to privacy, data security, and ethical

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	enhancement and data normalization.so model can be more accurate	potentially reducing the need for extensive human resources and manual search efforts..	considerations, particularly when dealing with sensitive information in search and rescue scenarios..
3	Model Training: Training deep convolutional neural networks using the collected data to enable automatic detection of individuals and objects in search and rescue scenarios.and Implementing the survivor finding algorithm, potentially utilizing the Monte Carlo Tree Search Method, to enhance the localization of individuals in need of rescue.	The automated detection and localization capabilities of the solution can significantly reduce the time required to identify and locate individuals in need of rescue, leading to faster response times and potentially saving lives.	
4	integrate the developed algorithms and components into the UAV systems and conduct thorough testing to	The use of UAVs and advanced data collection methods allows for a wider coverage area, enabling the identification of individuals in remote or	

	ensure their effectiveness in real-world search and rescue operations.	challenging terrains.	

Major Impact Factors in this Work

Dependent Variable	Independent Variable	Moderating variable	Mediating (Intervening) variable
Detection Accuracy,Performance of Neural Network Models,Localization Efficiency	UAV Sensor Data,Algorithm Parameters,Environmental Conditions	Environmental Factors,Technological Constraints,Human Intervention	Data Processing,Algorithm Performance,Decision-Making Processes

Relationship Among The Above 4 Variables in This article
In the context of speech recognition for people who stutter, the study investigates the impact of independent variables (Endpointer Threshold, ASR Decoder Tuning, Dysfluency Refinement) on dependent variables (Word Error Rate, Intent Error Rate), with stuttering severity serving as a moderating factor and dysfluency annotations as a mediating variable.

Input and Output	Feature of This Solution	Contribution in This Work
<table><tr><th>Input</th><th>Output</th></tr><tr><td>the inputs are Unmanned Aerial</td><td>the output is Detection and</td></tr></table>	The solution involves using UAVs with advanced vision systems and deep learning algorithms,	Good to have this knowledge from this paper as we can able

Vehicle (UAV) Sensor Data,Environmental Conditions	Localization Results ,performance metrics	such as CNNs and feature pyramids, to enhance search and rescue operations. It aims to achieve precise human detection and localization, potentially retraining models with real-world data, and applying the technology in cooperative missions.The solution involves using UAVs with advanced vision systems and deep learning algorithms, such as CNNs and feature pyramids, to enhance search and rescue operations. It aims to achieve precise human detection and localization, potentially retraining models with real-world data, and applying the technology in cooperative missions	to tack the object Using UAV efficiently.

Positive Impact of this Solution in This Project Domain	**Negative Impact of this Solution in This Project Domain**
The solution significantly enhances search and rescue operations within the project domain by leveraging advanced technology and algorithms. It brings about improved efficiency through precise	the possibility of technical malfunctions or errors, and the ethical considerations surrounding the use of surveillance technology in search and rescue operations

human detection and localization, potentially reducing search times and increasing the likelihood of successful rescues. Furthermore, the use of UAVs and advanced vision systems enhances safety by gathering crucial data without endangering human life.	

Analyse This Work By Critical Thinking	The Tools That Assessed this Work	What is the Structure of this Paper
This work is good, as they tried improving the performance of object detection and localization using deep neural network	Deep learning, convolutional neural network, machine learning method(Monte Carlo Tree Search Method).	Abstract I. Introduction II. Related Works III.Proposed Method IV.Experimental Setup V.Experimental Results and Evaluation VI. Conclusion VII. Future work
Diagram/Flowchart		

2.2 COMPARISON TABLE

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Authors	**Yea r**	**Approach**	**Description**
Andre Farinha	202 0	Micro sma based trigger, WSN	solution Demonstrates a new aerial sensor placement method
Chenchen Xu	202 0	RS and GIS for UAV Regulation, Low-altitude airspace, Urban region	This solution Ensures ethical operation of an Unmanned aerial vehicle at low-altitudes in urban areas through surveying and mapping technology in RS, GIS and geographical grid technology
Anton A. Zhilenkov	201 7	UAV navigation In miserable Conditions of the Forest Trails	This solution proposes a model of UAV Navigation in miserable Conditions of the Forest Trails This solution features with the help of Image processing and autonomous tracking features group of drones can act autonomously
Peter Harington	202 0	Payload capacity, cruise speed, drone, video transmission, communicatio n module	The project focused on creating a portable autonomous agricultural drone comprising three modules: mechanical, electrical/electronics, and communication.The mechanical module involved constructing the airframe with composite
Sankula Likhith Krishna	201 9	Cameras, Telemetry, Sensors, Drones, Conferences, Trajectory, INSPEC: Controlled Indexing,	The human Detection algorithm utilizes motion detection and assigns confidence scores to detected humans. By flying autonomously over predefined trajectories, the system aims to enhance Search and Rescue operations by swiftly identifying survivors and providing rescuers with critical data
Kadi Shiza nehwaz	202 0	video transmission, communicatio n module	The project focused on creating a portable autonomous agricultural drone comprising three modules: mechanical, electrical/electronics,and communication.

Anand	2021	Raspberry Pi, PM3DR, HC-05 Bluetooth Module, LiPo Battery, GPS Module:	The study aimed to link a Raspberry Pi with a Pixhawk Mini 3DR using Python for Bluetooth telemetry.Bluetooth, chosen for lower latency than radio telemetry(100ms),facilitated Successful communication.
Zhijun Meng	2021	Deep Reinforcement Learning for UAV Path Planning	The paper proposes UAV path planning algorithm utilizes POMDP, deep reinforcement learning with CNNs and RNNs, and a novel action selection strategy to enhance efficiency
Kevin Pluckter	2019	Precision UAV Landing in Unstructured Environment s	The drone takes off, records key features, and during landing, uses these features to find its position by adjusting for tilt and estimating 3D space based on a flat assumption
Jawad N. Yasin	2020	UAV Collision Avoidance System	obstacle detection using monocular or stereo cameras
Nicholas Santavas	2019	Deeplearning , (you only look once) YOLOV5	embedded vision system to detect and rescue in open water swimmers .
Gayathri Devi Ramaraj	2017	PHD, UAV, OCSVM Classifier, EECPP	This solution features a swarm of drones that can act autonomously with Image processing and autonomous tracking features.
Sungtae Moon	2023	Yolo v5 , image stiching	Autonomous drone system designed for real-time object detection. It incorporates the YOLO (You Only Look Once) algorithm to enable rapid and accurate detection of objects.
Xin Liu	2021	YOLO v4 (You Only Look Once version 4) Deep SORT (Deep Simple Online and	using YOLO v4 and Deep SORT algorithms to real-time vehicle detection environments using UAVs

		Realtime Tracking)	
MUHAM MAD ARIF ARSHAD	202 2	Drone-STM-RENet STM-based CNN blocks Regression CNN	it use of SLAM for robust urban navigation and a specialized Drone-STM-RENet neural network
Sahana	202 2	Deep Convolutional Neural Networks, Yolo v4	It uses advanced technologies, such as (UAVs) and deep convolutional neural networks, to enhance search and rescue operations.
B.Pinney	202 3	YOLO v4	object detection using YOLO V4
Hasegawa	201 8	Image recognition	Accuracy improvement by contrast correction
Mozhgan Navard	202 2	Neural networks, visual perception, deep learning	two different methods for implementing the NN inference phase onto tiny drones and analyzing the implementation results for each case: 1) a Cloud-IoT implementation and 2) Onboard Processing

2.3 WORK EVALUATION TABLE

	Work Goal	**System's Components**	**Systm's Mechanism**	**Features /Characteristics**	**Performance**	**Platfon**	**Results**

Eleftherios Lygouras, Nicholas Santavas, Anastasios Taitzoglou, Konstantinos Tarchanidis, Athanasios Mitropoulos, and Antonios Gasteratos	The goal of the solution is to develop a fully autonomous UAV system equipped with an embedded vision system to detect and rescue open water	Convolutional Neural Networks (CNN) for image processing and object detection , Hardware configurations such as the NVIDIA Jetson X1 for on board image processing , Software configurations for implementing the embedded vision system ,. Global Navigation Satellite System (GNSS	The use of deep The author focused on creating a completely autonomous UAV system with an integrated vision system to identify and assist open water swimmers in danger without human Involvement.	The use of deep learning techniques, specifically the Tiny YOLO V3 architecture, for real-time human detection in search and rescue missions using unmanned aerial vehicles (UAVs). It also incorporates a combination of global navigation satellite system (GNSS) techniques and computer vision algorithm.	The performance of the system will be dependent on training and algorithmic specifications.	-	-	improving the performance of UAV using efficient object detection and tracking of the target

	swimmers in peril without human intervention.	) techniques for location tracking .						
Sahana , Aniket Sengar, Aniruddh Dubey, Umang Agrawal. 2021	The objective of the solution is to develop and implement advanced technologies, such as	Unmanned Aerial Vehicles (UAVs), Deep Convolutional Neural Networks, Multispectral Cameras, Feature Pyramid Networks, Monte Carlo	The drone embedding advanced technologies, such as unmanned aerial vehicles (UAVs) and deep convolutional neural networks, to	The solution involves using UAVs with advanced vision systems and deep learning algorithms, such as CNNs and feature pyramids, to enhance search and rescue operations. It aims to achieve precise human	-	-	-	improving the performance of object detection and localization using deep neural network

	unmanned aerial vehicles (UAVs) and deep convolutional neural networks, to enhance search and rescue operations.	Tree Search Method.	enhance search and rescue operations.	detection and localization, potentially retraining models.				

SUNGTAE MOON JIHUN JEON DOYOON KIM YONGWOO KIM 2019	The goal is to create an unmanned drone which can fly itself and used for detection of	key hardware components used in the system, integration of these components into the drone, and Yolo algorith	an autonomous drone system designed for real-time object detection. It incorporates the YOLO (You Only Look Once)	It takes advantage of various sensors, including GPS and cameras , to gather comprehensive environmen	-	The performance of the system has been evaluated through checking the accuracy in prediction of the model.	The system's use of various sensors, Including RTK-GPS, ensures centimeter-level prec	-	This solution, incorporating YOLO object detection, addresses a critical real-world problem, but it encounters challenges due to its technical complexity

	real time objects such as person’s in larger areas.	m - This algorithm provides confidence scores for detected humans. This technology aims to expedite Search and Rescue operatio	algorithm to enable rapid and accurate detection of objects. The hardware components, including the Pixhawk Flight Controller and a camera, play a	tal data. This data informs the system's core function: generating precise flight paths for the Unmanned Aerial			ision in position estimation, enhancing the accuracy of object detection and tracking.		and sensitivity to adverse weather conditions.

		ns in natu ral disa sters by swif tly iden tifyi ng surv ivor s.	cruci al role in this setup.	Veh icle (U AV).					

		the recor ding of facial imag es durin g night time drivi ng.										to detecti ng drowsi ne ss without annoya n ce and interfer e nce

JAWAD N. YASIN , SHERIF A. S. MOHAMED , MOHAMMAD-HASHEM HAGHBAYAN , JUKKA HEIKKONEN1 , HANNU TENHUNEN1, JUHA PLOSILA . **2018**	The objective of the solution is to develop effective collision avoidance systems for autonomous vehicles, specifically unmanned aerial vehicles	collision avoidance strategies, sensors used for collision avoidance in UAVs, and various approaches and techniques for collision avoidance in different scenarios methodologies related to rada	on obstacle detection using monocular or stereo cameras, with a division of captured images into regions to reduce computational cost. Collision avoidance control and trajectory control	the effective collision avoidance systems for UAVs incorporates intelligent decision-making capabilities, obstacle detection algorithms, and path planning techniques. By analyzing real-time data, UAVs equipped with this solution can make informed	-	The system achieves a process speed of 44 ms per image, which is faster than YOLO by 18.	-	The system achieves an mAP of 86.4 on the testing set, outperforming R-FCN which achieves 67.7. It also shows more than 6% improvement in mAP on the test	The advantages of the system include its speed, accuracy, and robustness. It is faster than YOLO and other object detection algorithms, while outperforming them in accuracy. .	-	-	The system achieves a process speed of 44ms per image, an mAP of 86.4 on the testing set, and more than 6% improve ment in mAP on the testing set.

	(UAVs). The goal is to enhance the autonomy and safety of UAVs by integrating intelligent decision-making .	r sensors, artificial potential fields, particle swarm optimization, and path planning algorithms for UAVs. .	are combined, and an algorithm selects the optimal path based on obstacle classification for safe and efficient drone navigation.	decisions to avoid potential collisions by assessing the speed, trajectory.				ing set.				

Fadhlanhafeez 2018	The goal of the work is to improve object detection by accelerating the speed while maintaining high accuracy and generalization ability. The paper	You Only Look Once (YOLOv5) deep learning model for human detection in search and rescue operations. The model is trained using data collected during a simulation of search and rescue operations, where mannequins were used	The YOLO model breaks through the traditional approach of the CNN family and introduces a new way of solving object detection. It achieves high efficiency and speed by processing the	YOLO achieves unparalleled speed with a Frame Per Second (FPS) of 155 and a Mean Average Precision (mAP) of 78.6, surpassing the performance of Faster R-CNN. YOLOv2, an improved version, offers a trade	YOLO achievesa fast speed with a Frame Per Second (FPS) of 11.7, surpassing the performance of Faster R-CNN.	-	YOLO achieves a Mean Average Precision (mAP) of 78.6, surpassing the performance of Faster R-CNN	YOLO offers a simple and highly efficient way of solving object detection. It achieves fast speed and high accuracy, surpassing the performance of Faster R-CNN. It also has strong generalization ability to represent the	-	-	YOLO achieves a Frame Per Second (FPS) of 155 and a Mean Average Precision (mAP) of 78.6, surpassing the performance of Faster

	introduces the You Only Look Once (YOLO) model as a	to represent human victims.	entire image at once, rather than using region proposals	off between speed and accuracy. It also has strong generalization ability to				whole image			R-CNN

	solution to this problem.			represent the whole image.								

Sahana, Aniket Sengar, Aniruddh	The objective of the solution is to develop and implement	Unmanned Aerial Vehicles (UAVs), Deep Convolu	The drone embedding advanced technologies, such as unmanned aerial	The solution involves using UAVs with advanced vision systems	The validation results show high accuracy in object detection and localization	The automated detection and localization capabilities of the solution can significantly	-	improving the performance of object detection and localization using deep neural network

Dubey, Umang Agrawal. 2021	advanced technologies, such as unmanned aerialvehicles (UAVs) and deep convolutional neural networks, to enhance searchand rescue operations.	tional Neural Networks, Multispectral Cameras, Feature Pyramid Networks, Monte Carlo Tree Search Method.	vehicles (UAVs) and deep convolutional neural networks, to enhance search and rescue operations.	and deep learning algorithms, such as CNNs and feature pyramids, to enhance search and rescue operations. It aims to achieve precise human detection and localization, potentially retraining models.		reduce the time required to identify and locate individuals in need of rescue, leading to faster response times and potentially saving lives.		

SUNGTAEMOON JIHUNJEON DOYOONKIM YOONGW	The goal is to create an unmanned drone which can fly itself and used for detection of real time obj	key hardware components used in the system, integration of these components into the drone, and Yolo algorithm - This algorithm provides confidence scores for detected	an autonomous drone system designed for real-time object detection. It incorporates the YOLO (You Only Look Once) algorithm to	It takes advantage of various sensors, including GPS and cameras, to gather comprehensive environmental data. This data infor	-	The performance of the system has been evaluated through checking the accuracy in prediction of the model.	The system's use of various sensors, Including RTK-GPS, ensures centimeter-level precision in position estimation, enhancing the	-	This solution, incorporating YOLO object detection, addresses a critical real-world problem, but it encounters challenges due to its technical complexity and sensitivity to adverse weather conditions.

OOKIM 2019	ects such as person's in larger areas.	humans. This technology aims to expedite Search and Rescue operations in natural disasters by swiftly identifying survivors.	enable rapid and accurate detection of objects. The hardware components, including the Pixhawk Flight Controller and a camera, play a crucial	ms the system's core function: generating precise flight paths for the Unmanned Aerial Vehicle (UAV).			accuracy of object detection and tracking.		

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			role in this setup .						

		the recording of facial images during nighttime driving.							to detecting drowsiness without annoyance and interference

	solution to			represent the								

	this problem.			whole image.								

Sahana, Aniket Sengar, Aniruddh Dubey, Umang Agrawal. 2021	The objective of the solution is to develop and implement advanced technologies, such as unmanned aerial vehicles (UAVs	Unmanned Aerial Vehicles (UAVs), Deep Convolutional Neural Networks, Multispectral Cameras, Feature Pyramid Networks, Monte Carlo Tree Search Method.	The drone embedding advanced technologies, such as unmanned aerial vehicles (UAVs) and deep convolutional neural networks, to enhance search and rescue operations.	The solution involves using UAVs with advanced vision systems and deep learning algorithms, such as CNNs and feature pyramids, to enhance search and rescue operations. It	-	The validation results show high accuracy in object detection and localization	The automated detection and localization capabilities of the solution can significantly reduce the time required to identify and locate individuals in	-	-	improving the performance of object detection and localization using deep neural network

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	) and deep convolutional neural networks, to enhance search and rescue operations.			aims to achieve precise human detection and localization, potentially retraining models.			need of rescue, leading to faster response times and potentially saving lives.			

SUNTAE MOON JIHUN JEON DOYOON KIMYONGWOO KIM 2019	The goal is to create an unmanned drone which can fly itself and used for detection of real time objects suc	key hardware components used in the system, integration of these components into the drone, and Yolo algorithm - This algorithm prov	an autonomous drone system designed for real-time object detection. It incorporates the YOLO (You Only Look Once) algorithm to enable	It takes advantage of various sensors, including GPS and cameras, to gather comprehensive environmental data. This data infor	-	The performance of the system has been evaluated through checking the accuracy in prediction of the model.	The system's use of various sensors, Including RTK-GPS, ensures centimeter-level precision in position estimation, enhancing the accuracy of	-	This solution, incorporating YOLO object detection, addresses a critical real-world problem, but it encounters challenges due to its technical complexity and sensitivity to adverse weather

	h as person's in larger areas.	ides confidence scores for detected humans. This technology aims to expedite Search and Rescue operations in natural disasters by swif	rapid and accurate detection of objects. The hardware components, including the Pixhawk Flight Controller and a camera, play a crucial role in	ms the system's core function: generating precise flight paths for the Unmanned Aerial Vehicle (UAV).			object detection and tracking.		conditions.

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		tly identifying survivors.	this setup.						

		the recording of facial images during nighttime driving.								to detecting drowsiness without annoyance and interference

JAWAD N. YASIN , SHERIF A. S. MOHAMED , MOHAMMAD-HASHEM HAGHBAYAN , JUKKA HEIKKONEN1 , HANNU TENHUNEN1, JUHA PLOSILA . **2018**	The objective of the solution is to develop effective collision avoidance systems for autonomous vehicles, specifically unmanned aerial vehic	collision avoidance strategies, sensors used for collision avoidance in UAVs, and various approaches and techniques for collision avoidance in different scenariosmethodologies related to radar sensors, artificial potential fields, particle swarm optimization, and path planning algorithms for UAVs. .	on obstacle detection using monocular or stereo cameras, with a division of captured images into regions to reduce computational cost. Collision avoidance control and trajectory control are combined, and an algorithm selects the	the effective collision avoidance systems for UAVs incorporates intelligent decision-making capabilities, obstacle detection algorithms, and path planning techniques. By analyzing real-time data, UAVs equipped with this	The system achieves a process speed of 44 ms per image, which is faster than YOLO by 18.	The system achieves an mAP of 86.4 on the testing set, outperforming R-FCN which achieves 67.7. It also shows more than 6% improvement	The advantages of the system include its speed , accuracy, and robustness. It is faster than YOLO and other object detection algorithms , while outperforming them in accuracy..	-	The system achieves a process speed of 44ms per image, an mAP of 86.4 on the testing set, and more than 6% improvement in mAP on the testing set.

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	les (UAVs). The goal is to enhance the autonomy and safety of UAVs by integrating intelligent decision-making .		optimal path based on obstacle classification for safe and efficient drone navigation.	solution can make informed decisions to avoid potential collisions by assessing the speed, trajectory.		in mAP on the testing set.			

									.
Fad hla n hafe ez 201 8	The goal of the work is to impro ve object detect ion by accele rating the speed while maint aining high accur acy and gener alizati o n abilit y. The paper introd uces the You Only Look Once (YOL O) model as a	You Only Loo k Onc e (YO LOv 5) deep lear nin g mo del for hu ma n det ecti on in sea rch and res cue ope rati ons . The mo del is trai ned usi	The YOL O model breaks throug h the traditi onal approa ch of the CNN family and introd uces a new way of solvin g object detecti on. It achiev es high efficie ncy and speed by proces sing the entire image at once,	YOL O achie ves unpar allele d speed with a Frame Per Secon d (FPS) of 155 and a Mean Avera ge Precis ion (mAP) of 78.6, surpas sing the perfor manc e of Faster R- CNN. YOL Ov2, an impro ved	YOL O achi eves a fast spee d with a Fra me Per Sec ond (FP S) of 11.7 , surp assi n g the perf orm an ce of Fast er R- CN N.	YOL O achie ves a Mea n Aver age Preci sion (mA P) of 78.6, surp assi ng the perf orm ance of Fast er R- CN N	YOL O offers a simpl e and highl y effici ent way of solvi ng objec t detect ion. It achie ves fast speed and high accur acy, surpa ssing the perfo rman ce of Faste r R- CNN. It also has stron	-	YOL O achi eves a Fra me Per Sec ond (FP S) of 155 and a Mea n Ave rage Prec isio n (m AP) of 78.6 , surpa ssi ng the perfo rma nce of Faste r

		ng data a collected during a simulation of search and rescue operations, where mannequins were used to represent human victims.	rather than using region proposals	version, offers a tradeoff between speed and accuracy. It also has strong generalization ability to			g generalization ability to represent the whole image		R-CNN

	solution to this			represent the					

CHAPTER 3

PROPOSED SYSTEM

3.1 PROPOSED SYSTEM

The proposed approach is to find an innovative solution for finding lost children leverages AI-powered drones. These drones overcome limitations of traditional searches by rapidly covering large areas and seeing through dense foliage. Real-time data from the drones streamlines communication with rescue teams. The AI core, built on a Raspberry Pi, utilizes a YOLOv8 model to detect humans in real-time. This ten-step process includes training the model on data and ensuring the drone's safe operation. By offering a faster and more comprehensive search, our system significantly increases the chances of a successful rescue in these time-sensitive situations.

3.2 ADVANTAGES OF PROPOSED SYSTEM

The proposed system has the following advantages:

- Precision Navigation
- Unerring Detection
- Lifeline of Communication
- Synchronized Operations

3.3 SYSTEM REQUIREMENTS

The system requirements for the development and deployment of the project as an application are specified in this section.

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3.3.1 SOFTWARE REQUIREMENTS

Below are the software requirements:

I. CNNs

II. Mavlink

III. Mavproxy

IV. Ardupilot

V. computer vision

VI. OpenCV

VII. Raspbian

VIII. YOLOv8 model

3.3.2 HARDWARE REQUIREMENTS

Hardware requirements are as follows:

1. F450 quadcopter frame
2. A2212, 1000 KV BLDC motors (interchangeable with any similar industrial motor on the market)
3. 1045 screws (clockwise and counterclockwise rotary pairs)
4. 30A Cmonk ESCs
5. Pixhawk 2.4.8 hardware control unit
6. Flysky FSI6 as a radio transmitter and receiver
7. 3300mAh LiPo cell battery
8. XT60 connector
9. IMAX B6 AC charger

3.3.3 IMPLEMENTATION TECHNOLOGIES

Path planning and Altitude Fixing:

Path planning and altitude fixing are both crucial aspects of ensuring efficient and safe drone operation, especially in search and rescue missions. Path Planning involves creating a pre-programmed flight path for the drone to follow during its search. Imagine it like a roadmap in the sky. Path planning software considers factors like the search area size, desired coverage pattern (grid, spiral, etc.), and potential obstacles like trees or power lines. An efficient path minimizes wasted flight time and ensures the drone covers the entire search area thoroughly. **Altitude Fixing** refers to maintaining a specific and consistent height for the drone throughout its mission. Altitude fixing is important for several reasons. First, it ensures the drone captures consistent image data at a usable resolution for human detection. Second, it minimizes the risk of collisions with obstacles, especially in forested environments with uneven terrain. Finally, maintaining a safe altitude optimizes battery life and communication range between the drone and the control center. Altitude fixing can be achieved through onboard sensors and pre-programmed flight instructions.

Fail-safe Mechanism:

A fail-safe mechanism in our drone system is essentially an automated safety net embedded in the flight control software. It constantly monitors vital flight parameters and pre-set safety thresholds. If these thresholds are exceeded or anomalies detected, the fail-safe kicks in, taking pre-programmed corrective actions like initiating a return-to-home sequence or safe landing maneuvers. This ensures the drone's safe return even in case of communication loss or malfunctions.

YOLO v8:

You Only Look Once (YOLO) is a real-time object detection algorithm known for its speed and single-stage processing. Unlike some object detection methods that perform multiple scans of an image and refine detections iteratively, YOLO utilizes a single neural network to predict bounding boxes and class probabilities for objects in an image during a single forward pass. This approach prioritizes speed and efficiency, making it ideal for real-time applications like autonomous vehicles, drone object detection, and video analysis. While YOLO may sacrifice some accuracy compared to more complex detectors, the trade-off is often acceptable in scenarios where immediate results are critical.

MAVLink Protocol:

MAVLink, short for Micro Air Vehicle Link, is a communication lifeline for resource-constrained drones. It acts as a simple language for drones and Ground Control Stations (GCS) to exchange information effectively. Unlike complex protocols, MAVLink keeps messages short and uses a byte format, perfectly suited for drones with limited processing power and bandwidth. But MAVLink offers more than just brevity. It's also configurable, allowing communication between the drone and the GCS, as well as between the drone's internal components like sensors and flight software. In the world of autonomous drones, this standardized protocol is a game-changer, ensuring seamless interoperability between devices from different manufacturers and software tools.

CHAPTER 4

SYSTEM DESIGN

4.1 PROPOSED SYSTEM ARCHITECTURE

The proposed solution architecture depicted in Fig. 6 involves several processes and components. It is an artificial intelligence-based system designed to detect humans in the context of search and rescue operations. The first step involves hardware integration, which requires the collection of necessary components such as a quadcopter frame, motors, screws, ESCs, Pixhawk 2.4.8 hardware control unit, a radio transmitter/receiver, a LiPo cell battery, an XT60 connector, and tools such as a soldering iron, zip ties, scissors, etc. The next step is to calibrate the drone, which involves ensuring that the drone is level and balanced. After hardware integration and calibration, the next step is to integrate the Raspberry Pi 4. The Raspberry Pi is a small, single-board computer that can be used for various applications such as image processing and object detection. The next steps are data collection and data preprocessing, which involve collecting and labeling images using tools like LabelImg to define bounding boxes and assign class labels. This data is then organized into train and validation folders. The YOLOv8 model is then implemented as part of the solution. A YAML training configuration file is created containing class information, image paths, training parameters, and a desired model architecture. The model is then trained using the ultralytics library, and training metrics such as loss and accuracy are monitored. The best-performing model is then selected for deployment.

Finally, the model is tested to ensure that it can accurately detect and locate humans in real-world scenarios. Overall, the proposed solution architecture involves a combination of hardware and software components and processes, working together to detect humans in search and rescue operations.

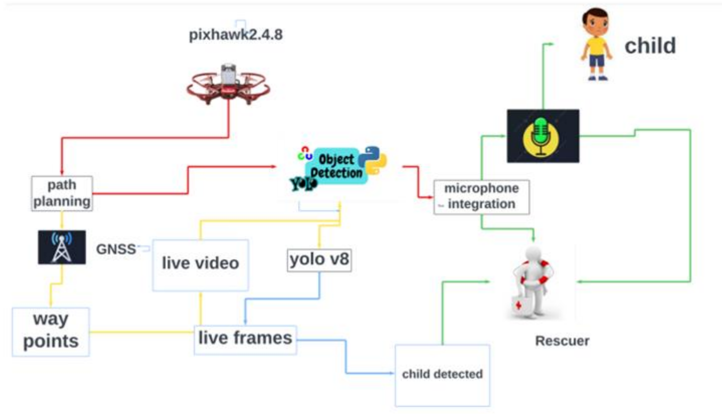

Figure 1: Architecture of proposed system

4.2 APPLICATION MODULES

The following modules are involved in the proposed implementation:

a) Path Planning

b) Object Detection

c) Data Visualisation

d) Response Generation

4.2.1 Path Planning:

The drone's autopilot relies heavily on a strong GPS signal and seamless integration with Ardupilot (Mission Planner) software. A Mavlink connection establishes communication, displaying the drone's real-time location on the Mission Planner map. Before planning a mission, ensure a good GPS signal with enough satellites and a healthy battery level. Once these checks are complete, you can define waypoints on the map. Each waypoint requires two things: altitude (relative to the takeoff point) and commands like takeoff, return-to-home (RTH), or directional changes. Arming the drone activates the autopilot, enabling it to follow the pre-programmed waypoints autonomously. The "home point" is where the drone was disarmed, and an RTL mission will return there. Rally points can be designated as alternative return locations for specific situations.

4.2.2 Object Detection:

Object detection, in general, is the task of locating and identifying objects within an image or video sequence. The proposed system aims to use object detection to locate and detect humans in aerial imagery for the purpose of search and rescue operations. YOLOv8 is a real-time object detection model that was used in this system for human detection. The model uses convolutional neural networks (CNNs), which are a type of deep learning algorithm, to detect and classify objects in real-time video streams. The YOLOv8 model is much faster compared to other object detection models because it performs both object detection and classification in a single forward pass through the network.

4.2.3 Data Visualization:

By using a combination of real-time video feeds from the drone fleets and data from external sources such as search area maps and weather data to help visualize the search and rescue operation. The proposed system aims to visualize the location of the missing child, the location of the search team, and any obstructions that may be impeding the search.

The data visualizations are made possible by integrating the drone fleet's controller software with other visual tools like GIS and data analysis software. The paper proposes using real-time video feeds from the drone fleet to generate a live video map overlaid on a search area map for better search area coverage.

4.2.4 Response Generation:

autonomous drone fleet system for missing child search and rescue operations, and it includes communication as a crucial aspect of their proposed solution. The system involves using a network of autonomous drones with a command and control server (CCS) responsible for managing the fleet's communication network. An essential part of the communication aspect of the system is the use of drones to provide live video feeds to rescuers on the ground. The paper suggests using a low latency video stream to provide real-time video footage to rescuers, which will help locate the missing child and assess the surrounding area. This live video feed could also help in quickly identifying obstructions or hazards during the rescue operation by using MAVLink Protocol.

4.3 UML DIAGRAMS

UML, or Unified Modeling Language, offers a standardized visual notation for software development. It's a technical language distinct from natural language descriptions, using a collection of specialized diagrams with precise symbols and notations to represent software components and their interactions. This enables UML to address various software development aspects: Class diagrams capture a system's static structure, detailing classes (data and functionality holders) and their relationships. Use case diagrams depict user interactions (actors and use cases) from a behavioral perspective. Sequence diagrams delve into the dynamic interactions between objects within a use case, showcasing the message sequence with parameters exchanged to fulfill user requests. By combining these targeted diagrams, developers build a comprehensive technical blueprint of the entire software system, promoting clear communication, early problem identification, and ensuring the final product aligns with user needs and system functionalities.

4.3.1 Use Case Diagram

The use case diagram depicts the inner workings of a small drone, likely a quadcopter. It showcases how various electronic components work together to achieve flight. The battery provides power, which is distributed to the flight controller, motors, and other systems. The flight controller, the brain of the operation, receives control signals from the remote and interprets them. It then instructs the electronic speed controllers, which manage the speed and direction of each motor. These motors spin the propellers, generating thrust for flight. Additional components like cameras and sensors can be integrated for functionalities like capturing footage or aiding navigation.

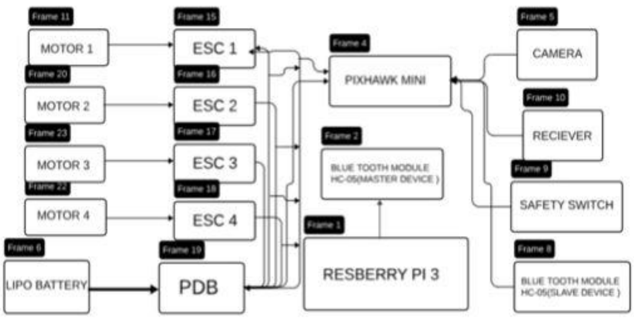

Figure 2: Use Case Diagram

4.3.2 Class Diagram

The class diagram illustrates the fundamental structure of the autonomous drone system, comprising key classes and their associated attributes and methods. The AutonomousDrone class embodies the drone itself, managing attributes like ID, location, speed, and battery level, alongside methods for navigation and operation. The Child class represents the subject of search operations, tracking attributes such as ID, location, and status. SearchAlgorithm encapsulates search logic, while CommunicationModule facilitates data exchange with attributes for transmission type and signal strength. GPSModule and CameraModule handle location tracking and image processing, respectively, and Battery manages power-related functionalities. This depiction offers a comprehensive understanding of the system's architecture, aiding in its development and comprehension.

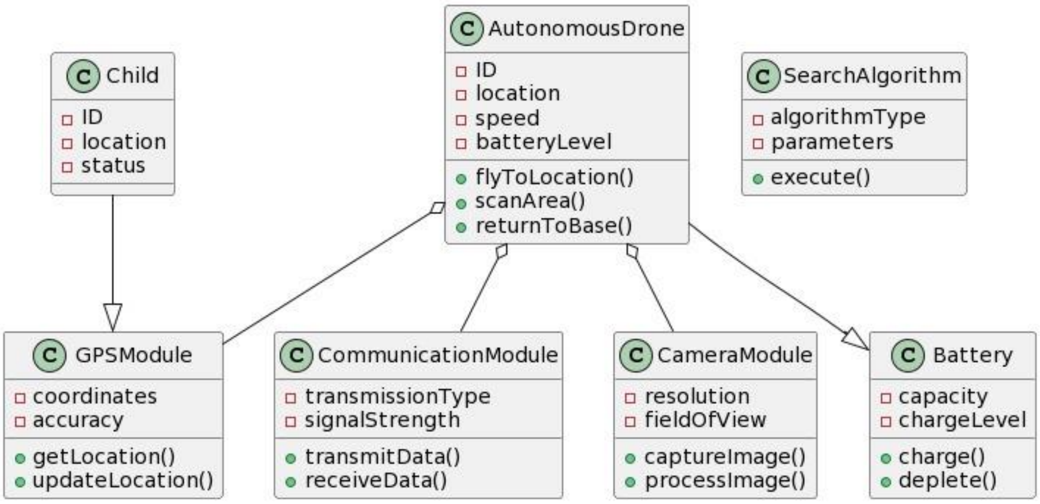

Figure 3: Class Diagram

4.3.3 Sequence Diagram

The provided sequence diagram illustrates the sequential flow of interactions between various objects within the autonomous drone system during a rescue operation. Initially, the system initializes essential components such as the drone, GPS module, camera module, and communication module. Subsequently, the search operation commences, wherein the drone navigates to a designated location, scans the area using its camera module, and evaluates the presence of the missing child. Depending on the outcome, if the child is found, the drone transmits the location to the base station via the communication module; otherwise, it updates its location and resumes the search. Finally, upon receiving a return command, the drone returns to the base station, completing its mission. This sequence diagram serves as a blueprint for understanding the dynamic interactions and behaviors of the autonomous drone system throughout the rescue process.

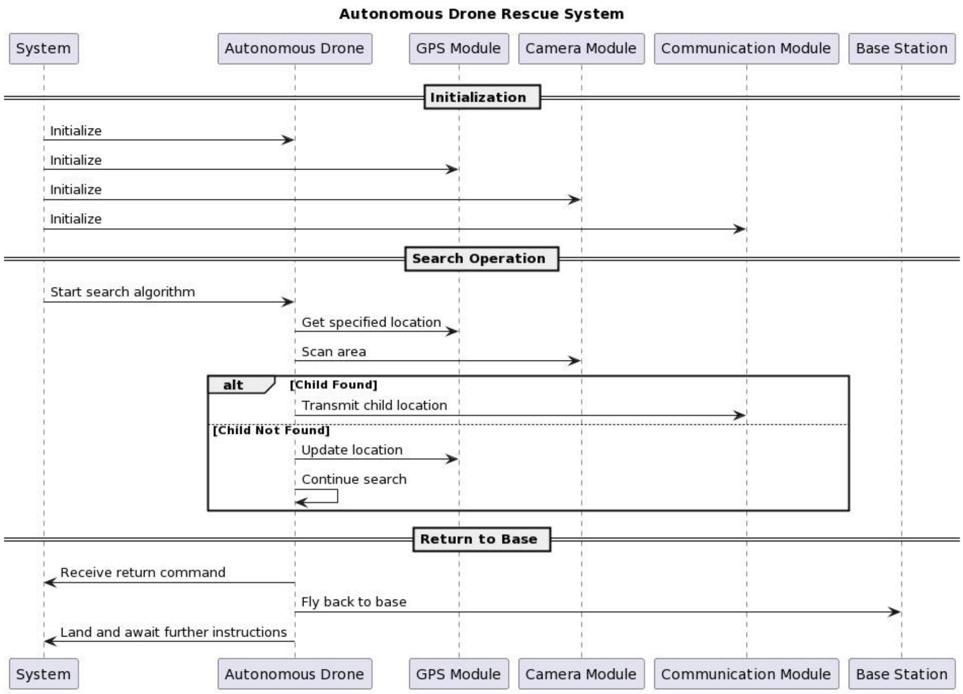

Figure 4: Sequence Diagram

4.3.4 Activity Diagram

The activity diagram outlines the workflow for a coordinated search and rescue operation using a fleet of autonomous drones to find a missing child. The flowchart starts with receiving an alert about a missing child and defining a search area. Weather conditions are then checked to determine if drone deployment is safe. If conditions are favorable, the search area is divided into zones and drones are dispatched with specific flight paths. Each drone searches its assigned zone using cameras to find the child. If a potential sighting is made, the drone captures images and attempts communication. All findings are reported back to a base station where human operators review the data and prioritize dispatching ground search teams. The flowchart concludes with the search outcome, which may involve switching to recovery operations or continued monitoring based on new information.

`

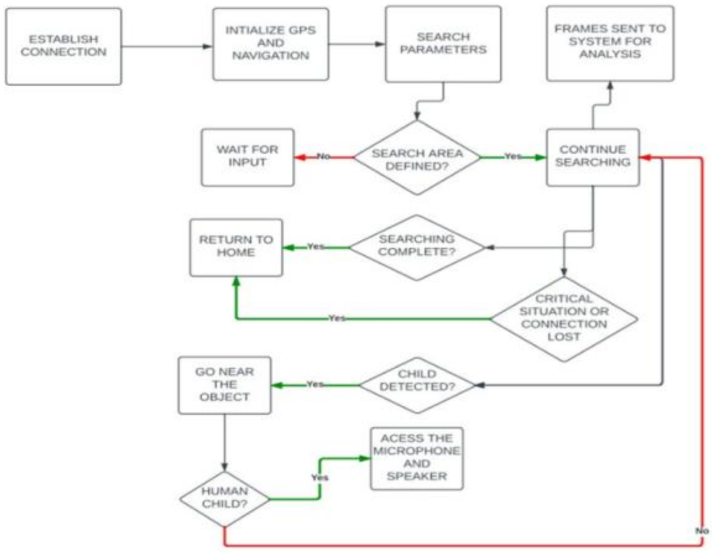

Figure 5: Activity Diagram

CHAPTER 5

IMPLEMENTATION

5.1 IMPLEMENTATION OF THE AUTONOMOUS DRONE SYSTEM FOR SEARCH AND RESCUE

The implementation spearheads a paradigm shift in search and rescue with its cutting-edge autonomous Unmanned Aerial Vehicles (UAVs). Imagine expansive search zones traversed with unparalleled efficiency, pinpointing missing subjects even within treacherous geographies characterized by complex topography. These UAVs, equipped with low-latency data transmission protocols, advanced Machine Learning algorithms, and high-resolution electro-optical sensors, can furnish rescue teams with mission-critical intel in real-time. In time-sensitive scenarios involving missing minors, the strategic deployment of autonomous UAV fleets has the potential to exponentially increase the probability of a favorable outcome. These UAVs not only expedite the search process by leveraging their extensive coverage capabilities, but also enhance its precision through the integration of AI-powered object detection and recognition algorithms. By incorporating such UAV swarms into search and rescue operations, we can revolutionize response times and mission effectiveness.

5.1.1 Drone Hardware Integration (Pixhawk 2.4.8 Set)

• **Component Selection:** Before commencing with the process of minor integration, one must first collect all of the necessary components. These include:

– F450 quadcopter frame
– A2212, 1000 KV BLDC motors (interchangeable with any similar industrial motor on the market)
– 1045 screws (clockwise and counterclockwise rotary pairs)
– 30A Cmonk ESCs
– Pixhawk 2.4.8 hardware control unit
– Flysky FSI6 as a radio transmitter and receiver
– 3300mAh LiPo cell battery
– XT60 connector
– IMAX B6 AC charger
– Tools: soldering iron, soldering wire, soldering paste, zip ties, dual-sided tape, scissors

• **Frame Assembly**: The first step is to set up the quadcopter frame, with the bottom plate serving as the power distribution board and the top plate. Fasten the X-shaped arms to the base plate using four M2 screws. Ensure proper alignment and orientation to ensure that the black arm selects the forward direction for easier directional identification.

• **ESC Installation:** Use solder to attach the ESCs to their specified pads on the power distribution board to ensure a good fastening. Correct soldering procedure is important to avoid mid-flight malfunctions. Use zip ties to anchor the ESCs on the arms to prevent vibrations.

• **Motor Mounting:** Install the BLDC motors on the frames onto the motor mounts using the M3 screws. Pay attention to the thread alignment of motor screw threads and frame holes to protect motor windings. Thread the motor wires along the arms and attach them to their respective ESCs in a clean manner.

• **Wiring and Connections:** Direct the motor wires to the relevant ESCs, taking care of the positive and negative terminals. Wire the ESCs to the flight controller's motor output pins per the customized list. Apply the supplied cables to connect the receiver and the flight controller as indicated by the signal polarity and pin configuration.

• **Flight Controller Installation:** Get a Pixhawk 2.4.8 flight controller and properly mount it to the center of your frame with dual-sided tape. Ensure the frame's arrow is pointing forward and align properly with the orientation indicators. Ensure that the motor and receiver terminals are securely screwed and appropriately inserted.

• **Additional Accessories Integration:** Connect a buzzer onto the control board as a warning during flight. Fasten the LiPo battery to the frame using a battery strap and position it so that no propellers will contact it. Handle and charge the LiPo battery carefully to avoid accidents.And also connect the Gps module to the pixhawk 2.4.8 for accurate postioning.The arrow on the Gps must be inclined with the arrow of the pixhawk .

5.1.2 Drone Software Integration (Pixhawk 2.4.8 Set)

Mission Planner (Ardupilot) serves as the central hub for drone setup and calibration. This software connects to the Pixhawk flight controller via USB using the Mavlink communication protocol. The first crucial step is uploading the appropriate firmware to the Pixhawk. Following this, a series of calibrations are performed to ensure optimal flight performance.

`

- **Sensor Calibration:** This includes accelerometer calibration, which involves physically maneuvering the drone in specific orientations as instructed by the software. Additionally, compass calibration requires rotating the drone with its GPS unit to capture magnetic field data from all directions.

- **Radio Calibration:** Here, the software verifies communication between the drone and your remote controller, ensuring proper signal reception.

- **Fail-safe Configuration:** This critical safety feature defines the drone's automated response to situations like low battery or signal loss, typically prompting a return to home.
- **ESC Calibration:** The final step ensures proper synchronization between the Pixhawk and the Electronic Speed Controllers (ESCs) that power the motors.

Once these calibrations are complete, your drone is ready for flight with propellers attached.

This revised version streamlines the explanation and emphasizes key steps:

- Mission Planner as the central software tool.
- Uploading firmware and performing essential calibrations.
- The purpose and importance of each calibration step (sensor, radio, failsafe, ESC).

5.1.3 Working with yolo v8

Model Selection and Training: We selected the YOLOv8 model for its accuracy and CPU inference speed. Raspberry Pi 4 is computationally heavy for YOLOv8 operations but feasible for smaller datasets. To overcome this, utilize optimization techniques like pruning and quantization, and leverage cloud training for large-scale training with minimal impact on RPi4 resources.

Model Deployment and Inference Finalization for Drones: The trained YOLOv8 model has been deployed onto the Raspberry Pi 4 coupled with the drone. The deployment involves model conversion and real-time inference using libraries like Open-CV.

Environment Setup: Install Python version 3.11.7 or later compatible with your OS. Create a virtual environment to manage project dependencies

Data Preparation: Organize data into train and validation folders. Collect and label images using tools like LabelImg to define bounding boxes and assign class labels.

Configuration and Training: By Creating a YAML training configuration file containing class information, image paths, training parameters, and desired model architecture, we can train the YOLOv8 model using the ultralytics library and monitor training metrics. Select the best model based on performance before deployment.

Training: To execute the code for training the YOLO model, follow these steps: First, the training starts up using the suggesting command should be specified - the amount of epochs, configuration file name, model name, image size, and batch size. When training is over, compile all the models by moving to runs/weights and select the best performing model named "best.pt". After that the object detection will be performed by executing the prediction command that identifies objects in the given video file with threshold confidence of 0.5. Saved results will be in runs/predict directory. This way helps YOLO to train and predict in a workable functional mode which is needed for accurate object detection in picture or video.

5.1.4 Integrating Raspberry pi 4:

Connecting the Raspberry Pi (RPi4) to the Pixhawk flight controller is a crucial step. A micro USB or DF-13 cable establishes the physical connection. Power the RPi4 with 5V via USB or another source, ensuring reliable operation for search and rescue missions. Finally, connect additional components specific to your drone design, such as receiver lines, motor controls (ESCs), steering servos, telemetry modules, and power cables.

On the software side, install communication packages for the RPi4 to interact with the Pixhawk. Consult official documentation or reliable summaries for the latest instructions and compatibility needs. This typically involves installing frameworks like Mavlink and Mavproxy. Additionally, configure the RPi4's firmware to enable UART communication compatible with Pixhawk. Tools like raspi-config might be used here, and further documentation might be necessary for proper configuration.

Once hardware and software are connected, thoroughly verify communication between the RPi4 and Pixhawk. You can use the mavproxy command or a Python script (refer to the book for details), but remember to replace "/dev/ttyAMA0" with the actual connection string.

Rigorous testing is essential before deploying the system for real-world search and rescue tasks. This ensures reliability and mitigates risks during critical operations.

5.1.5 Path planning and Altitude Fixing

The drone's autonomous flight relies heavily on its GPS and Ardupilot integration. A Mavlink connection with Mission Planner establishes communication, displaying the drone's real-time location on the software's map.

Before mission planning, ensure a strong GPS signal with sufficient satellites and a healthy battery voltage. Once these prerequisites are met, you can define waypoints on the map. Each waypoint requires two things: altitude (relative to the takeoff point) and commands like takeoff, return-to-home (RTH), or directional turns.

Arming the drone activates the autopilot, enabling it to follow the pre-programmed waypoints autonomously. The "home point" is the location where the drone was disarmed, and an RTL mission will return there. Rally points can be designated as alternative return locations for specific situations.

The Mission Planner's command menu provides various options depending on the type of drone you're using (copter, rover, etc.). These commands fall into four categories:

- Navigation: These guide the drone to reach waypoints.
- Loiter: These commands instruct the drone to hover at a specific location for a set duration.
- DO commands: These trigger specific actions like taking pictures or executing custom code.
- Condition commands: These control when certain actions are performed based on pre-defined conditions.

Each command requires user-defined parameters, such as waypoint coordinates, desired altitude, or specific action details.

5.2 SOURCE CODE

Training and Testing:

```
# -*- coding: utf-8 -*-
"""project.ipynb
```

```
Automatically generated by Colaboratory.

Original file is located at
    https://colab.research.google.com/drive/1cUQvOLgl1YLVQuPTqUiL3ACMn2XeyBOa
"""

!pip install torch
!pip install torch --extra-index-url https://download.pytorch.org/whl/cu116

pip install ultralytics

pip install --upgrade pip

!pip install split-folders

pip install clearml

!pip install colorama

! python -m venv env

# prompt: apt install python3.10-venv

!apt install python3.10-venv

!python -m venv env

!pip install colorama

import os
import shutil
import splitfolders
import pandas as pd
import numpy as np
from tqdm import tqdm
from colorama import Fore

IMAGE_PATH = "/content/drive/MyDrive/Colab Notebooks/drone-dataset/ds0/img" # The
path to the folder with images.
TARGET_PATH ="/content/drive/MyDrive/Colab Notebooks/drone-dataset/ds0/ann"

def create_dataset(data_path,target_path) :
    assert isinstance(data_path, str)
    assert isinstance(target_path, str)

    dict_paths = {
        "image": [],
```

```
        "annotation": []
    }

    for dir_name, _, filenames in os.walk(data_path):
        for filename in tqdm(filenames):
            name = filename.split('.')[0]
            dict_paths["image"].append(f"{data_path}/{name}.jpg")
            dict_paths["annotation"].append(f"{target_path}/{name}.txt")


    dataframe = pd.DataFrame(
        data=dict_paths,
        index=np.arange(0, len(dict_paths["image"]))
    )

    return dataframe

def prepare_dirs(dataset_path: str,
                 annotation_path: str,
                 images_path: str) -> None:
    if not os.path.exists(dataset_path):
        os.mkdir(path=dataset_path)
        os.mkdir(path=annotation_path)
        os.mkdir(path=images_path)

def copy_dirs(dataframe, data_path: str,target_path: str) :

    assert isinstance(dataframe, pd.DataFrame)
    assert isinstance(data_path, str)
    assert isinstance(target_path, str)

    for i in tqdm(range(len(dataframe))):
        image_path, annotation_path = dataframe.iloc[i]
        shutil.copy(image_path, data_path)
        shutil.copy(annotation_path, target_path)

def finalizing_preparation(dataset_path: str, ladd_path: str):
    assert os.path.exists(f"{dataset_path}")

    example_structure = [
        "dataset",
        "train", "labels", "images",
        "test","labels", "images",
        "val", "labels", "images"
    ]

    dir_bone = (
        dirname.split("/")[-1]
```

```
        for dirname, _, filenames in os.walk('/content/drive/MyDrive/Colab
Notebooks/drone-dataset/working/dataset')
        if dirname.split("/")[-1] in example_structure
    )

    try:
        print("\n~ Lacmus Dataset Structure ~\n")
        print(
        f"""
       ├── {next(dir_bone)}
       │   │
       │   ├── {next(dir_bone)}
       │   │   └── {next(dir_bone)}
       │   │   └── {next(dir_bone)}
       │   │
       │   ├── {next(dir_bone)}
       │   │   └── {next(dir_bone)}
       │   │   └── {next(dir_bone)}
       │   │
       │   ├── {next(dir_bone)}
       │   │   └── {next(dir_bone)}
       │   │   └── {next(dir_bone)}
        """
        )
    except StopIteration as e:
        print(e)
    else:
        print( "-> Success")
    finally:
        os.system(f"rm -rf {ladd_path}")

import os

df = create_dataset(
    data_path=IMAGE_PATH,
    target_path=TARGET_PATH
)

dataset_path = "/content/drive/MyDrive/Colab Notebooks/drone-
dataset/working/dataset"
ladd_path = "/content/drive/MyDrive/Colab Notebooks/drone-dataset/working/ladd"
annotation_path = "/content/drive/MyDrive/Colab Notebooks/drone-
dataset/working/ladd/labels"
image_path = "/content/drive/MyDrive/Colab Notebooks/drone-
dataset/working/ladd/images"

prepare_dirs(
    dataset_path=ladd_path,
```

```
    annotation_path=annotation_path,
    images_path=image_path
)

copy_dirs(
    dataframe=df,
    data_path=image_path,
    target_path=annotation_path
)

splitfolders.ratio(
    input=ladd_path,
    output=dataset_path,
    seed=42,
    ratio=(0.80, 0.10, 0.10),
    group_prefix=None,
    move=True
)

import colorama

finalizing_preparation(
    dataset_path,
    ladd_path
)

pip install clearml

!pip install clearml

! clearml-init

import yaml
from ultralytics import YOLO
from PIL import Image
import matplotlib.pyplot as plt
from matplotlib.patches import Rectangle

config = {
    "path": "/content/drive/MyDrive/Colab Notebooks/drone-
dataset/working/dataset",
    "train": "/content/drive/MyDrive/Colab Notebooks/drone-
dataset/working/dataset/train/images",
    "val": "/content/drive/MyDrive/Colab Notebooks/drone-
dataset/working/dataset/val/images",
    "predict": "/content/drive/MyDrive/Colab Notebooks/drone-
dataset/working/test/train/image",
    "nc": 1,
```

```python
    "names": ["human"]
}

with open("config.yaml", "w") as f:
    yaml.dump(config, f)

with open("config.yaml", "r") as f:
    print(f.read())

# prompt: exactly which code to be altered to change it to cpu instrad of cuda
also alter the code

def main():
    model = YOLO("yolov8n.pt")
    model.train(
        # Project
        project="Polar-Owl",
        name="yolov8n",

        # Random Seed parameters
        deterministic=True,
        seed=42,

        # Data & model parameters
        data="/content/config.yaml",
        save=True,
        save_period=5,
        pretrained=True,
        imgsz=1280,

        # Training parameters
        epochs=20,
        batch=4,
        workers=8,
        val=True,
        device="cpu",

        # Optimization parameters
        lr0=0.0195,
        patience=3,
        optimizer="SGD",
        momentum=0.957,
        weight_decay=0.0005,
        close_mosaic=5,
    )

if __name__ == '__main__':
    main()
```

CHAPTER 6

RESULTS

Our goal is to build a top-notch object detection model. To achieve this, we'll use a toolbox of metrics during development. We'll track various "loss functions" to pinpoint areas for improvement, like how well the model differentiates objects and their locations. Additionally, a metric called mAP@50 will provide a big-picture view of the model's overall accuracy. Throughout training, we'll closely monitor specific losses to ensure the model is learning effectively and reaches its full potential. By analyzing this data, we can identify both strengths and weaknesses, allowing us to refine the model for optimal performance. We'll further test the model across various situations using different datasets to find the most effective configuration. This evaluation process could pave the way for applications in fields like self-driving cars and video surveillance. Ultimately, we aim for an accuracy of at least 70%, ensuring the model is robust enough for real-world use. The results are as follows:

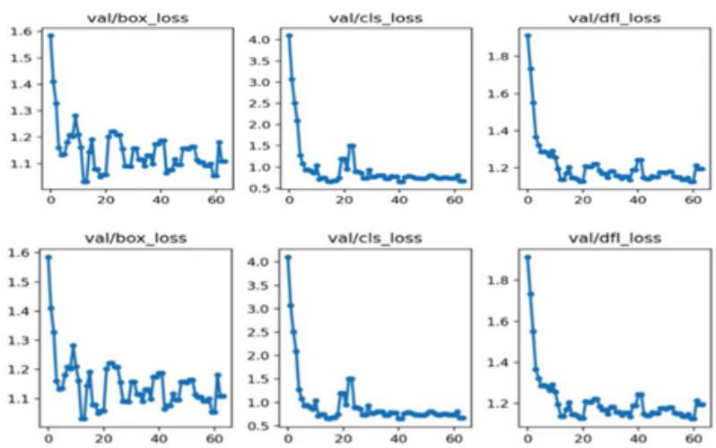

Figure 6: Metrics

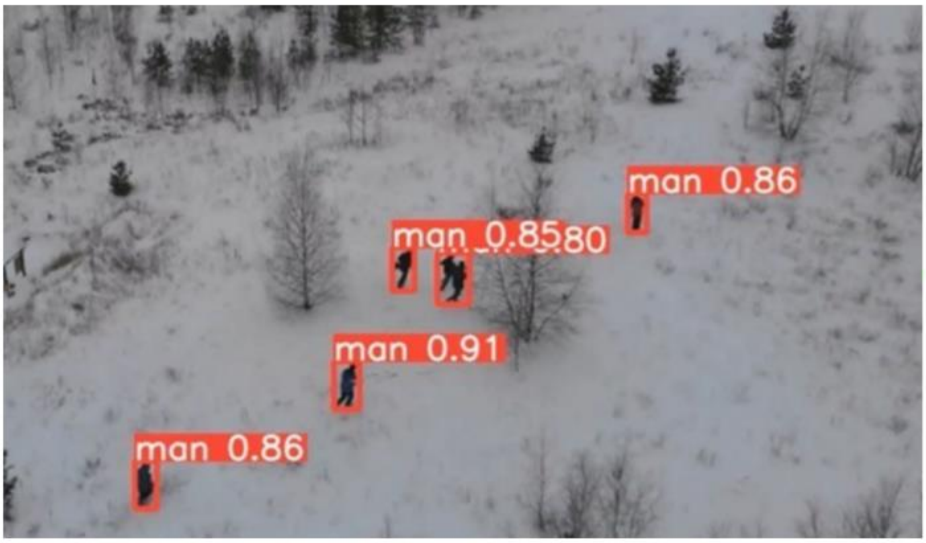

Figure 7: Image representing the prediction of YOLOv8 model

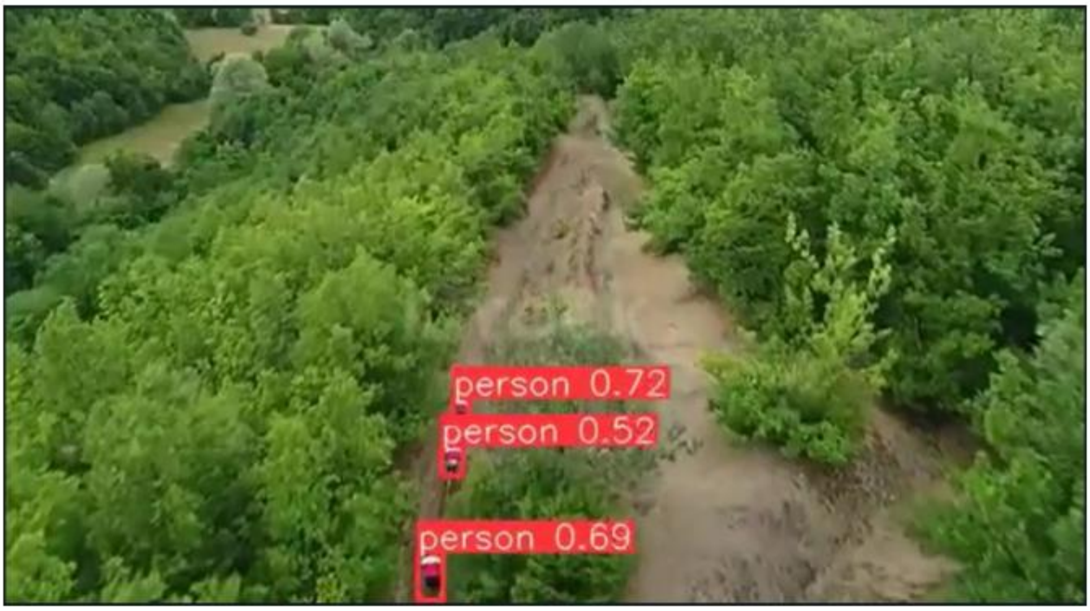

Figure 8: Image representing the prediction of YOLOv8 model 2

`

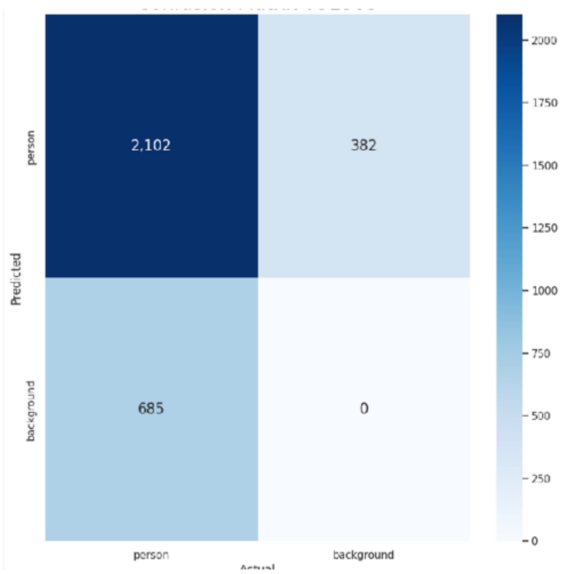

Figure 9: Image representing the prediction of YOLOv8 model

CHAPTER 7

CONCLUSION

Imagine a future where search and rescue missions are revolutionized by AI-powered drones. This document outlines the development of such a system. The core lies in a powerful single-board computer, the Raspberry Pi 4, which acts as the drone's brain. This tiny powerhouse is equipped with a cutting-edge Artificial Intelligence model called YOLOv8. Unlike traditional AI, YOLOv8 excels at real-time object detection, making it perfect for spotting humans from the drone's aerial perspective. But safety is paramount. The system leverages Ardupilot software, a proven flight planning program. Ardupilot meticulously charts a safe path for the drone, adhering to all necessary altitude and safety regulations. This ensures the drone can efficiently cover vast areas while minimizing risks. Ultimately, this AI-powered drone system holds immense potential. Search and rescue operations could become significantly faster and more extensive, potentially saving countless lives in the process.

FUTURE ENHANCEMENTS AND DISCUSSIONS

This paper permits an autonomous drone to function by means of a human detection artificial intelligence system. For real-time object detection, a Raspberry Pi 4 and a YOLOv8 Model were used. To put this system into practice. In order to identify people in aerial imagery, the YOLOv8 Model was trained on an appropriate labeled dataset. The drone will be able to fly in accordance with all essential safety regulations and at an altitude for effective search modalities because of Path Planning with Ardupilot Software. This method might enable us to carry out search and rescue operations more quickly and thoroughly.