Meeting Report

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Participants:

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Project 1: Autonomous Image Analysis and Threat Assessment System

Project Scope:

This project aims to perform object recognition and threat assessment operations on images obtained through drones. Within this scope, it is targeted to recognize objects present in the scene using image processing algorithms, determine whether they are humans or objects, and then prioritize them based on threat levels. The project will particularly focus on images containing military munitions.

Project Steps:

- Decision for Literature Review: In the meeting, it was decided that a comprehensive literature review should be conducted to ensure the healthy progression of the project. Existing methods and technologies in image processing, object recognition, threat assessment, and prioritization will be examined to identify the algorithms to be used in the project. This step is especially important to evaluate the suitability of deep learning models like YOLO (You Only Look Once) for the project.
- Training the YOLO Model: The YOLO (You Only Look Once) model will be used in the project for object recognition operations. In this context, the model will be trained

to detect 25 different object types per second in images, particularly those containing military munitions. Images and videos featuring weapons, explosives, and armored vehicles used in military fields will be utilized for the model training. Based on YOLO's high detection speed and accuracy, real-time detection of threat elements will be achieved.

- Object Recognition and Classification: Objects present in the image will be automatically recognized and classified by the model. In the initial stage, it will determine whether the entities in the image are human or objects, and the objects will be categorized into subcategories such as military munitions, vehicles, and civilian objects. This process is critically important for the project because accurate and rapid classification in situations requiring quick decisions during military operations can have life-or-death consequences.
- Threat Assessment: Classified objects will be analyzed based on their threat potentials. For example, an explosive or a weapon will be assessed as a high threat level, while a civilian vehicle may remain at a lower threat level. This assessment will be conducted in real-time and repeated with each new image. Additionally, geographical location, the movement directions of objects, and their speeds may also be utilized in the threat assessment.
- Prioritization: A prioritization of objects will be made based on their threat levels. For example, an object carrying a mine or RPG will be assigned the highest priority level, ensuring that security measures are taken first for this threat. Other objects with lower threat levels will be addressed subsequently. This ranking will expedite the intervention process for drone operators or automated security systems.

Project 2: Collaborative Target Assignment and Obstacle-Aware Path Optimization Using Deep Reinforcement Learning for Autonomous Swarm Drones

Project Scope:

This project will focus on the task distribution and obstacle avoidance algorithms of a system composed of a drone fleet aligned with specific missions. Drones will be directed to perform their tasks by targeting specific objectives. During task distribution among the drones, dynamic route creation and obstacle avoidance algorithms will be utilized when encountering obstacles.

The project will operate in real-time, optimizing each drone's performance in reaching its targets.

Project Steps:

- Decision for Literature Review: A literature review is necessary for this project as well. Existing algorithms and applications regarding task distribution among drones, target achievement, and obstacle avoidance will be examined to identify the most suitable methods for the project. Special emphasis will be placed on real-time route generation, obstacle avoidance, and inter-drone communication.
- Task Distribution and Prioritization: The drone fleet involved in the project will be directed to designated targets in order of priority. Task distribution among the drones will be based on the risk levels of the targets, with each drone focusing on a specific target. High priority will be assigned to dangerous targets, while lower-risk targets will be assigned to drones with lower priorities. This ranking will enhance the speed and efficiency of the drones in fulfilling their missions.
- Lead Drone and Command System: Within this project, one drone will be designated as the lead drone, which will command the other drones. The lead drone will ensure the other drones focus on their targets and optimize their routes. Its role will be to manage the overall operation and provide coordination among the drones.
- Obstacle Avoidance and Path Optimization: As drones progress towards their targets, they may encounter various obstacles (buildings, trees, other objects). An obstacle avoidance algorithm will be developed to help them navigate these challenges. The drones will identify surrounding obstacles and find optimal paths to circumvent them with minimal energy and time loss. Each drone’s position and target will be known, allowing them to create dynamic routes based on this information. This route optimization will be recalculated in real-time as obstacles are encountered.
- Customized Tasks: Each drone in the project will have different characteristics. Some drones will be optimized for long-distance missions, while others will be used for short-distance, rapid tasks. These differences will be taken into account during task distribution to ensure the efficient use of drones. Additionally, a system will be developed to assign new tasks to each drone after completing its current mission.

Meeting Outcomes:

For the **first project**, it was decided to use the YOLO model to detect 25 different object types, analyze videos containing military munitions, and perform threat assessments. A literature review will be conducted for the project, and datasets will be prepared for training the YOLO model.

For the **second project**, it is necessary to carry out task distribution among the drones, direct them towards their targets, and develop obstacle avoidance algorithms. A literature review will also be conducted for this project, focusing on task distribution and path optimization.

Next Steps:

- A literature review will be initiated to identify suitable algorithms and methods for both projects.
- Datasets for YOLO training will be prepared, and training will commence.
- Work will begin on task distribution and obstacle avoidance algorithms for the drones.
- Progress reports will be regularly prepared, and logs will be maintained for meetings.

This meeting report provides a detailed summary of the technical decisions, planned steps, and resolutions made regarding the two projects.