Meeting Report

Date: October 11, 2024

Participants:

- Beyza GÖKCE
- Onur BİRCAN
- Furkan ÇUKUR
- Jara GEZİK
- Volkan ÇEVİK

Agenda:

- Prototype Development and Research Phase
- First Project - Video Tracking Simulation
- Second Project - Threat Assignment and Path Optimization

Discussion Summary:

1. Prototype Development and Research Phase:

- Small-scale prototypes will be developed during the first term.
- These prototypes will serve as research tools for defining requirements and may be discarded later (throw-away prototypes).
- The focus will be on understanding requirements through iterative development and research.

2. **Project 1:** Autonomous Image Analysis and Threat Assessment System

- Simulated UAV Position Tracking: A Python-based program will simulate UAV (drone) position tracking during video playback.

- Object Selection and Background Change: When an object is selected, its background can be changed or updated. The system will recognize the selection and untrack it accordingly.
- Select Region: Users will be able to mark an area as "friendly," and the system will apply a specific color code to indicate it.
- Threat Assessment: The system will perform threat assessment and display distances and threat levels. Pre-coded artillery ranges will be stored in a rule-based database and applied during the assessment.

3. Track Lost & Frame Analysis:

- A feature will be implemented to identify the specific frame and second when tracking is lost during video playback.
- The GUI will enable real-time tracking of pixel data to determine if objects remain inside the selected window or have moved outside the designated area.

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

- Threat Assignment: A rule-based system will assign appropriate UAVs to handle detected threats. For example, UAVs capable of neutralizing tanks will be assigned to tank threats.
- Path Optimization: After threat assignment, path optimization will be carried out. The professor's latest paper on path optimization will be thoroughly analyzed, and the methods presented will be applied to the project.
    - GitHub codes related to the paper will be reviewed for potential implementation.
- Obstacle Avoidance: The current approach lacks obstacle avoidance, which will be addressed by integrating additional research and techniques from Good's paper.

5. Reinforcement Learning:

- Theoretical knowledge on reinforcement learning will be provided by the professor after the team conducts some preliminary research. The goal is to explore how reinforcement learning can enhance threat detection, assignment, and path optimization processes.

Next Steps:

- Begin prototyping and iterating based on research findings.
- Continue development of the Python-based video tracking simulation.
- Analyze the professor's paper for path optimization and apply findings to Project 2.
- Conduct further research on reinforcement learning for its application in both projects.

This meeting emphasized the importance of iterative development, requirement analysis, and rule-based methodologies for both image analysis and threat response systems.