Software Requirements Specification (SRS) Document

GUI for Anti-Drone System, Team 41

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Brief problem statement

The project's objective is to enhance the Graphical User Interface (GUI) for an Anti-Drone System, aimed at mitigating the escalating issue of small UAV airspace intrusions along the Indian borders. Currently under development using Rust and Tauri, the GUI requires additional functionalities to improve its efficacy. These include user controls for drone engagement, dynamic map zooming based on drone proximity, and a visual representation of drone trajectories. Additionally, the integration of kill markers on the map and a catalog for recorded events are essential enhancements. Moreover, a settings tab will be implemented to facilitate functionalities such as updates and theme selection. The primary aim is to design an intuitive and user-friendly interface tailored for army personnel, ensuring usability for individuals with limited educational backgrounds.

System requirements

- **Compatibility:** Works on Linux and MacOS.
- **Required Libraries and Dependencies:**
    - `libudev-dev` for **USB** serial port enumeration (Linux).
    - **Tauri** Prerequisite.
    - **NodeJS** version >= 18.16.0
    - **Yarn** version >= 3.5.1
    - **Mavlink** for communication and sending messages.
    - **CryptoJS** library for AES256 Encryption to store data.
    - **JavaScript**
    - Access to **GPS** and **Magnetometer** of the device.
    - **SQLite** for storing the encrypted data.

Users profile

Our system will cater to two primary user groups: army personnel and the team at Arka Aerospace**.**

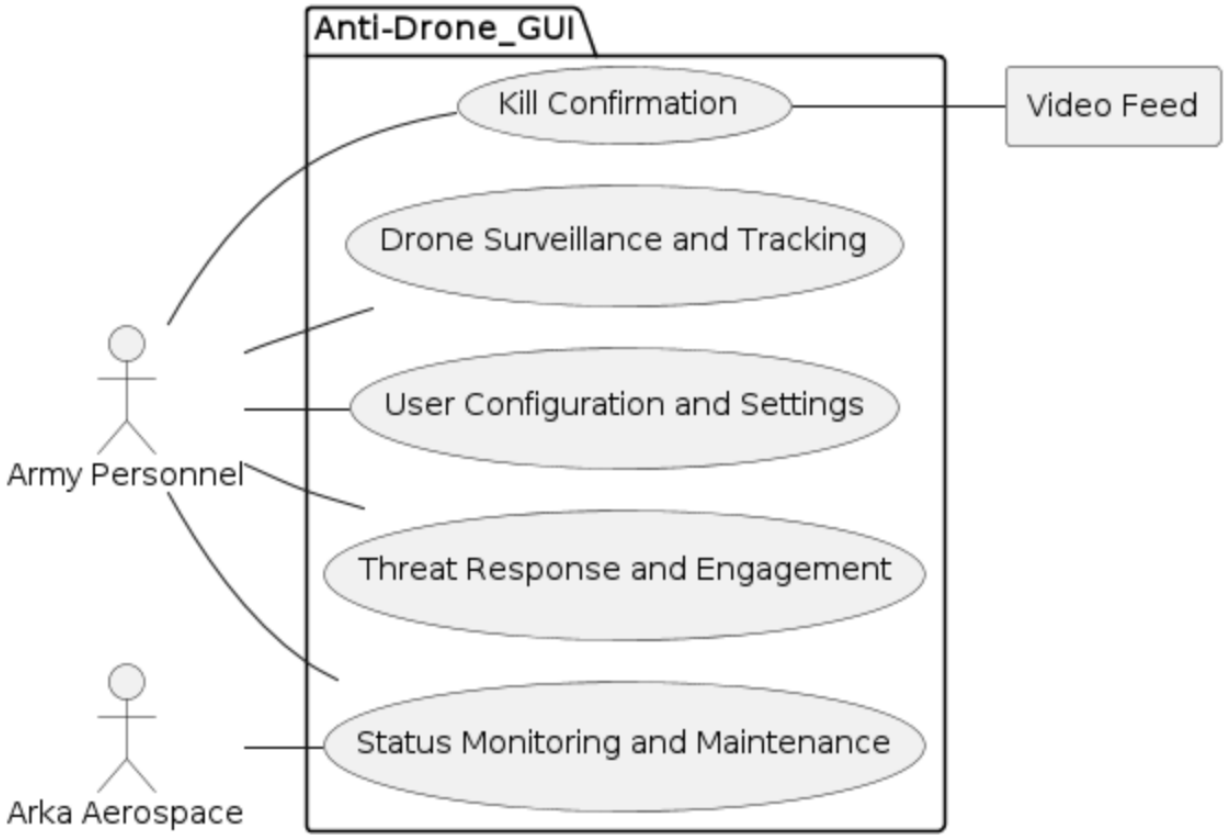
1. Army Personnel**:**
    - Profile: The army personnel who will be using the system are expected to be familiar with basic computer usage and training protocols. They will receive specific training on how to operate the system effectively.
    - Mode of Usage: Army personnel will use the system in various scenarios, such as deploying and controlling drones for reconnaissance or surveillance missions. They will interact with the system in real-time situations where quick and accurate responses are crucial.
2. Arka Aerospace Team:
    - Profile: The team members at Arka Aerospace are likely to be proficient in using computers and software applications, given their involvement in drone manufacturing. They possess a deep understanding of the technology and software used in the system.
    - Mode of Usage: The Arka Aerospace team will utilize the system primarily for development, testing, and maintenance purposes. They will engage with the system to ensure its compatibility with their drone manufacturing processes and may provide feedback for further improvements.

Feature requirements (described using use cases)

No.	User Case Name	Description	Release
1.	Drone Surveillance and Tracking	The user can view the ‘anti-drone’ position on the map along with a 500m radius area around it. Enemy drones would be displayed with a corresponding icon.	R1
2.	Status Monitoring and Maintenance	A status tab provides real-time updates on the drone’s signal strength with the ground station, remaining ammunition, and battery life	R1
3.	User Configuration and Settings	User can choose to have grid lines on the map, zoom in/out of the map and check for updates of the system. Users can also specify ‘no-kill’ zones where drones cannot engage with enemy drones.	R1
4.	Threat Response and Engagement	On reaching a specified distance from enemy drone, the ‘user’ can send a ‘kill’ command to initiate anti-drone maneuvers.	R2

5.	Kill Confirmation	When the user initiates a ‘kill’, they may choose to switch to a live video feed of the drone for a visual confirmation of the ‘kill’	R2
6.	Ready Check	The drone is subjected to checks while initialized to confirm safety for flight.	R2

Use case diagram



Use case description

Use Case Number:	UC-1
Use Case Name:	Drone Surveillance and Tracking
Overview:	The drone's location will serve as the central point for the map display, which will only extend to a radius of 500 meters from the drone's current position.
Actors:	Operator (Military Personnel)

Precondition:	The Drone must establish connection to the device with our software and send the relevant data via MavLink, and ground radar must also establish a connection with our software.
Flow:	Main (success) Flow: 1. The software will receive the drone coordinates through MavLink and will display the map accordingly (Map takes 66% of the left side of the screen – the button now present at the bottom of the screen would be moved to the right-side bar). *2.* The ground radar will provide the coordinates of the enemy drone which would then be shown on the map with another icon. *3.* The size of the map will automatically resize based on the distance between friendly drone and enemy drone to keep both visible in the map.
	Alternate Flows: 1. If the drone is not able to connect then the last spotted position of the drone will be displayed on the map.
Post Condition:	The operator can see the current position of the friendly and enemy drone on the map.

Use Case Number:	UC-2
Use Case Name:	Status Monitoring and Maintenance
Overview:	The Status of friendly drones is displayed on the Screen. The Details shown include signal strength, battery, ammunition etc.
Actors:	Operator (Military Personnel)
Precondition:	The Drone must establish connection to the device with our software and send the relevant data via MavLink
Flow:	Main (success) Flow: 1. The Operator after getting connected to the drone can check its vital information. *2.* The Information provided enables him/her to make decisions on when/who to attack and when to recall a drone.
	Alternate Flows: 1. The Drone can be guided away from the areas of low signal areas to prevent loss of communication.
Post Condition:	Relevant Information about the Friendly drones is always available to the operator that assists him/her to complete the mission.

Use Case Number:	UC-03
Use Case Name:	User Configuration and Settings

Overview:	User can choose to have grid lines on the map, zoom in/out of the map and check for updates of the system. Users can also specify 'no-kill' zones where drones cannot engage with enemy drones,
Actors:	Operator (Military Personnel)
Precondition:	N/A
Flow:	Main (success) Flow: **Grid Lines & Zoom** 1. The user can toggle grid lines through the icon on the top on the map. *2.* They may zoom in/out using the corresponding icons and adjust view. **Updates & No-kill zones** *3.* The operator opens the settings panel. 4. A button can be clicked to check for system updates. 5. The operator may define 'no-kill' zones on the map where drones cannot engage with enemy drones. 6. The no-kill zones will be encrypted and stored in a SQLite data base on the user's device locally. AES256 encryption algorithm will be used for encrypting the information.
	Alternate Flows: 1. If system updates are available, the user may choose to initiate the update process. *2.* If the operator tries to set a 'no-kill' zone in an area that is not allowed or already exists, the system shows an error message.
Post Condition:	The system saves the operator's configurations and applies the settings to the drone control interface. The operator now operates the drones with the updated settings and configurations. The 'no-kill' zones are marked on the map and the drones are programmed not to engage with enemy drones in these zones.

Use Case Number:	UC-4
Use Case Name:	Threat Response and Engagement
Overview:	On reaching a specified distance from enemy drone, the 'user' can send a 'kill' command to initiate anti-drone maneuvers.
Actors:	Operator (Military Personnel)
Precondition:	The Enemy Drone is detected by a ground radar and the information is received by the system.
Flow:	Main (success) Flow: 1. A friendly Drone is dispatched to counter the enemy drone.

	2. It is given a kill command by the operator and the friendly drone chases it and launches a net on the enemy drone to neutralize it. 3. When the kill command is initiated, the user will be prompted to slide to confirm button before the kill command is sent to the drone. 4. When the enemy drone and friendly drone are in vicinity then then the enemy drone icon will be fixed at the center of the screen and the map in the background will move accordingly. And the map will keep zooming smoothly to adjust the display based on the distance between the drones to a lower limit of 10m resolution.
	Alternate Flows: 1. The Net might end up killing the drone or it might not, and further other drones can be deployed if the attack fails.
Post Condition:	The Rogue Enemy drones are neutralized.

Use Case Number:	UC-5
Use Case Name:	Kill Confirmation
Overview:	When the user initiates a 'kill', they may choose to switch to a live video feed of the drone for a visual confirmation of the 'kill'
Actors:	Operator (Military Personnel)
Precondition:	The Enemy Drone has been authorized to be eliminated.
Flow:	Main (success) Flow: 1. The Friendly drone autonomously chases the enemy drone. 2. As we near the 2 drones near each other, the map on the screen is replaced by a live video feed of the onboard camera. 3. The Kill can be witnessed on the video feed.
Post Condition:	The Video feed is used to ensure if the drone was killed.
Use Case Number:	UC-6
Use Case Name:	Ready Check
Overview:	The drone is subjected to checks while initialized to confirm safety for flight.
Actors:	Operator (Military Personnel)
Precondition:	The Friendly drone is connected.

Flow:	The drone sends a lot of initialisation messages, which are checked to ensure preflight checks and ensure that every mission critical requirement is satisfied. Either Passes all tests or Fails some tests.
Post Condition:	The Drone is cleared to takeoff or Taken for inspection.