

# SMART INDIA HACKATHON 2025



## TITLE PAGE

- **Problem Statement ID – SIH25132**
- **Problem Statement Title- A4S+: An AI-Powered System for Soldier Safety, Predictive Health Monitoring, Safe Route Planning, and Drone Surveillance in Extreme Terrains like Siachen.**
- **Theme- AI-Powered Siachen Safety & Surveillance System**
- **PS Category- Software**
- **Team ID- NA**
- **Team Name :- त्रिनेत्र (THE THIRD EYE )**



# A4S+ — AI-Powered Siachen Safety & Surveillance System

## ❖ Proposed Solution



### Digital Twin of Soldiers

Real-time health monitoring and predictive analytics for each soldier



### Safe Route Planner

A\* Algorithm optimizes paths while avoiding hazardous terrain zones



### Drone Swarm Surveillance

Coordinated UAV network provides comprehensive area monitoring



### Security & Explainable AI

Military-grade encryption with transparent AI decision-making

### Innovation & Uniqueness:

- Combines multiple technologies into **one unified software**.
- Introduces **soldier digital twin + explainable AI** (rare in defence).
- Fully **software-only prototype**, scalable with hardware support.

ⓘ **Implementation Strategy:** Software-first approach with hardware support provided by Army infrastructure

# TECHNICAL APPROACH

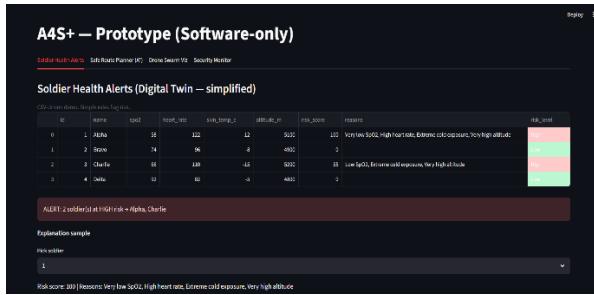


## Current Prototype

- Python & Streamlit interface
- CSV-based vital sign simulation
- A\* pathfinding algorithm
- Drone swarm visualization



Python



PyTorch

## Future Expansion

- LSTM predictive health AI
- CNN vision (YOLO/Detectron2)
- Edge AI deployment (Jetson)
- AES-256 encryption
- Explainable AI frameworks



TensorFlow

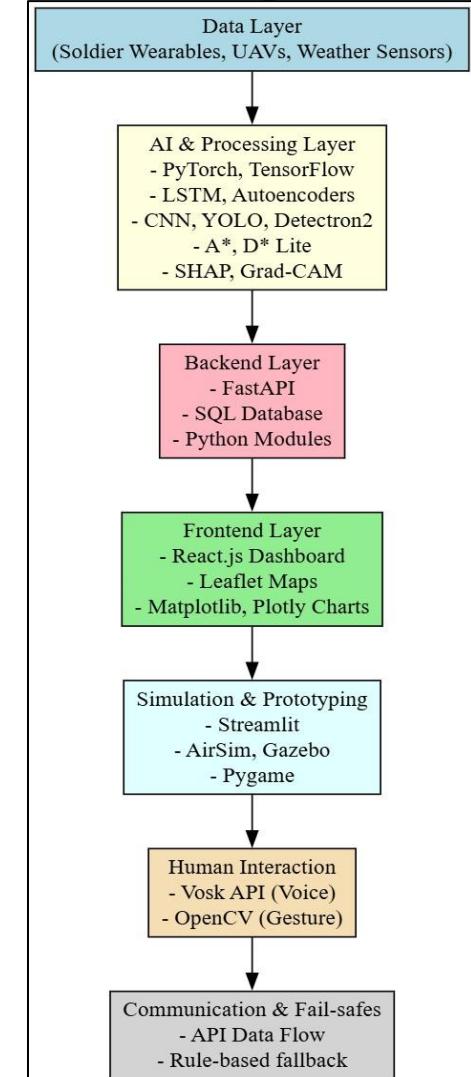


YOLO



## Methodology:

1. Collect dummy soldier vitals (CSV / simulated data).
2. Apply rule-based AI for alerts → scale to ML models.
3. Implement safe route planner with danger zones.
4. Simulate drone swarm with simple animations.
5. Integrate all modules into a dashboard for demo.



# FEASIBILITY AND VIABILITY



## Feasibility

- Software-only prototype.
- Built using open-source tools (Python, Streamlit, PyTorch, SQL).
- Dummy datasets & simulations remove dependency on real military data.
- Modular design → easy future integration with wearables & drones.

## Viability

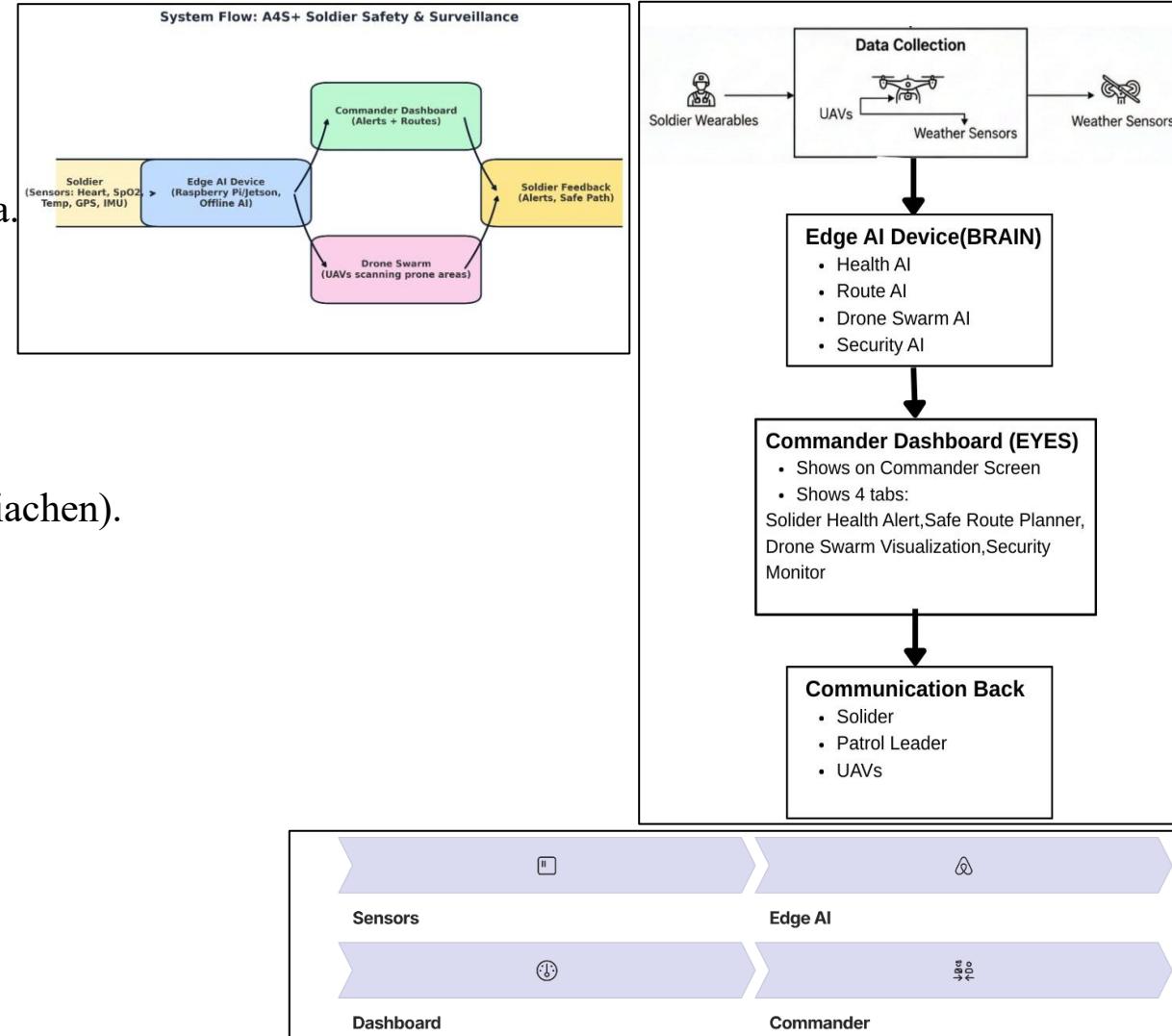
- Low-cost development at prototype stage.
- Scalable with government/defence funding for hardware deployment.
- Tackles critical issue: reducing non-combat soldier casualties (97% in Siachen).
- Future use in disaster relief, border surveillance, logistics.

## Potential Challenges:

- Lack of real-time Siachen data.
- Hardware deployment (drones, wearables).

## Mitigation:

- Use open datasets + simulations for proof-of-concept.
- Scale with government support for real-world trials.



# IMPACT AND BENEFITS



## Lives Saved

Predictive health monitoring prevents medical emergencies in extreme conditions

## Safer Operations

AI-powered route planning minimizes exposure to avalanche and crevasse risks

## Economic Savings

Reduced casualties and equipment losses translate to significant cost savings

## Strategic Advantage

Enhanced surveillance capabilities strengthen border security operations

- Boosts morale of troops & families through improved safety measures.
- Drone swarms provide continuous surveillance without risking soldiers.
- Enhances border security, situational awareness, and decision-making speed.
- Adaptable for disaster relief, mountaineering rescue, flood & earthquake response.

**Indian Army Drone Swarms (2021): 75 indigenous drones in coordinated swarm ops.**

<sup>3</sup> The Week: <https://www.theweek.in/news/india/2021/01/15/why-indian-army-drone-swarm-demo-is-milestone-in-disruption-in-warfare.html?>

**Operational Deployment (2025): First offensive swarm drone system inducted.**

<sup>3</sup> The Print: <https://theprint.in/defence/army-gets-its-first-set-of-offensive-swarm-drone-system-iaf-next/1368508/>

**Exercise DIVYA DRISHTI (2025): AI + drones tested in high-altitude Himalayas.**

<sup>3</sup> Economic Times: <https://economictimes.indiatimes.com/news/defence/watch-indian-army-simulates-future-warfare-using-ai-and-drones-near-china-border/articleshow/122949671.cms?>

**DRDO DEBEL Wearables: Oxycare system, heated jackets, smart vests for soldier survival.**

<sup>3</sup> Wikipedia – DEBEL: [https://en.wikipedia.org/wiki/Defence\\_Bioengineering\\_and\\_Electromedical\\_Laboratory?](https://en.wikipedia.org/wiki/Defence_Bioengineering_and_Electromedical_Laboratory?)

**Soldier Digital Twins Research: Predicts fatigue, injury & performance using vitals.**

<sup>3</sup> LinkedIn Article: <https://www.linkedin.com/pulse/simulating-sovereignty-rise-digital-twins-military-strategy-beam-ddenc/>