Percepta

Persistent GPS-Free Battlefield Awareness

What The Warfighter?: Path 1

Problems with current surveillance and intel gathering systems

Need GPS to know where the picture was taken for intel to be meaningful

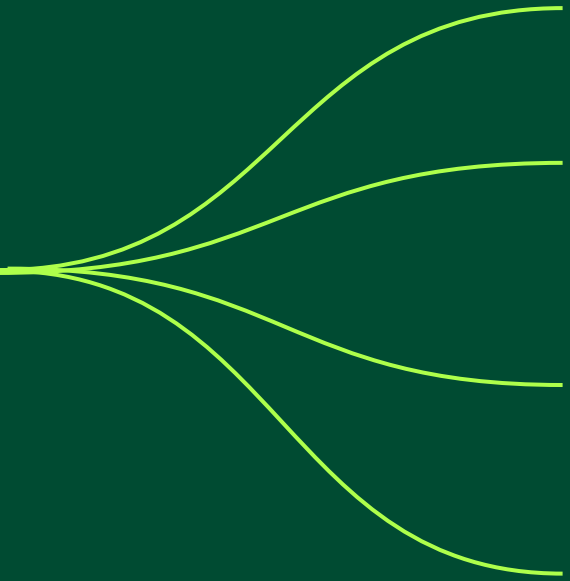
The need to process large amounts of data, such as live videos from drones

High bandwidth is required to transmit large data

Most of the data is noise with no military use

Targets are only visible in very short parts of the video

What does it mean?



Transmissions are easy to jam (high bandwidth, constant streaming)

When GPS fails, the intel is harder to retrieve

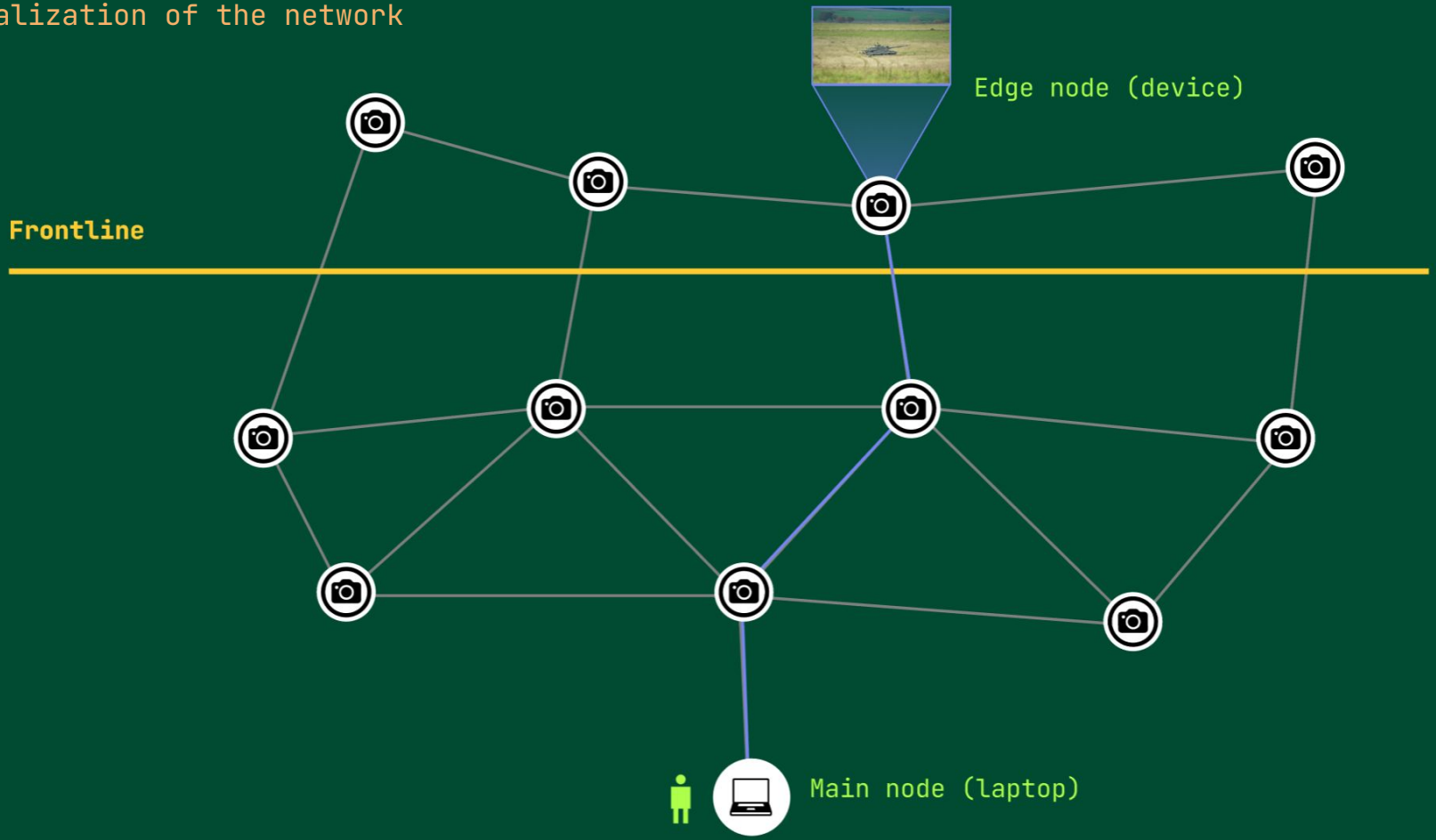
Automating data processing would require large amount of processing power

The intelligence officers/drone operators can get overwhelmed by the amount of inputs

Our solution - Percepta

1. We place large numbers of cheap stationary camera sensors in specified locations, creating a big structured network.
2. These camera sensors detect changes in the video feed (without running expensive detection models like YOLO), crop out the part of the image where change occurred and send it through the mesh network.
3. Each camera sensor is equipped with a low-bandwidth radio transmitters and sends the signal between the devices until it arrives in the main processing centre (main node).
4. The main node is a larger device (e.g. good laptop) which classifies the object into one of the categories (soldier, tank, car, etc.).
5. If confirmed, the main node alerts the officer by sending the image, specifying the type of object detected, number of objects and the time of detection.
6. Using the intel from different nodes, computer draws conclusions about enemy movements and drafts a preliminary FRAGO report using an LLM that can be confirmed, changed or discarded by the officer.

Visualization of the network



How does this solve the problems

- Transmissions are hard to jam because we send them only when something was detected and use low-bandwidths
- The system is stationary with predefined locations, so there is no need for GPS
- Data processing is very easy to automate, because we only send cropped images of detected targets
- Concise data allows us to offload the officers by implementing a simple LLM for completing the reports, while officers only assess quality (way less reliable with large data input as LLMs are likely to omit significant information)

Overview of the technology

Edge node (device)

Motion is detected and the object is segmented in a computationally cheap way

Cropped gray-scale image

Pass the image through other edge nodes

Main node (laptop)

Object classified with YOLOv8 and fed to the pipeline to generate FRAGO


```
{
  "timestamp": "2025-10-04T14:28:44.096101",
  "latitude": 60.1699,
  "longitude": 24.9384,
  "total_detections": 1,
  "object_counts": {
    "tank": 1
  },
  "detections": [
    {
      "class_name": "tank",
      "confidence": 0.92
  ]
}
```


FRAGO

Technical info & cost

1x camera module	€7-10
1x battery	€7-10
1x ECP32 chip	€2-3
1x radio transmitter and receiver	€3-6
other	€3-4

Total: €22-33 per piece

The battery alone will be able to maintain the device for around 6 weeks, this time can be extended by various methods of collecting energy from the environment.

*considering a bulk order from 1,000+ pcs

Get ready for the war of tomorrow!

- The presented version will undergo necessary changes to achieve battle readiness (implementation of infrared cameras for better nighttime detection, better energy conservation)
- This network is NOT going to solve war by itself - it is a part of a complex structure of different surveillance technologies running alongside and complementing each other
- The automated LLM report system has a great potential to combine all methods of surveillance into a comprehensive tool, essential for leveraging the battlefield of things

Thank you!

bonus: