Solving Elephant-Human Conflict with UAVs

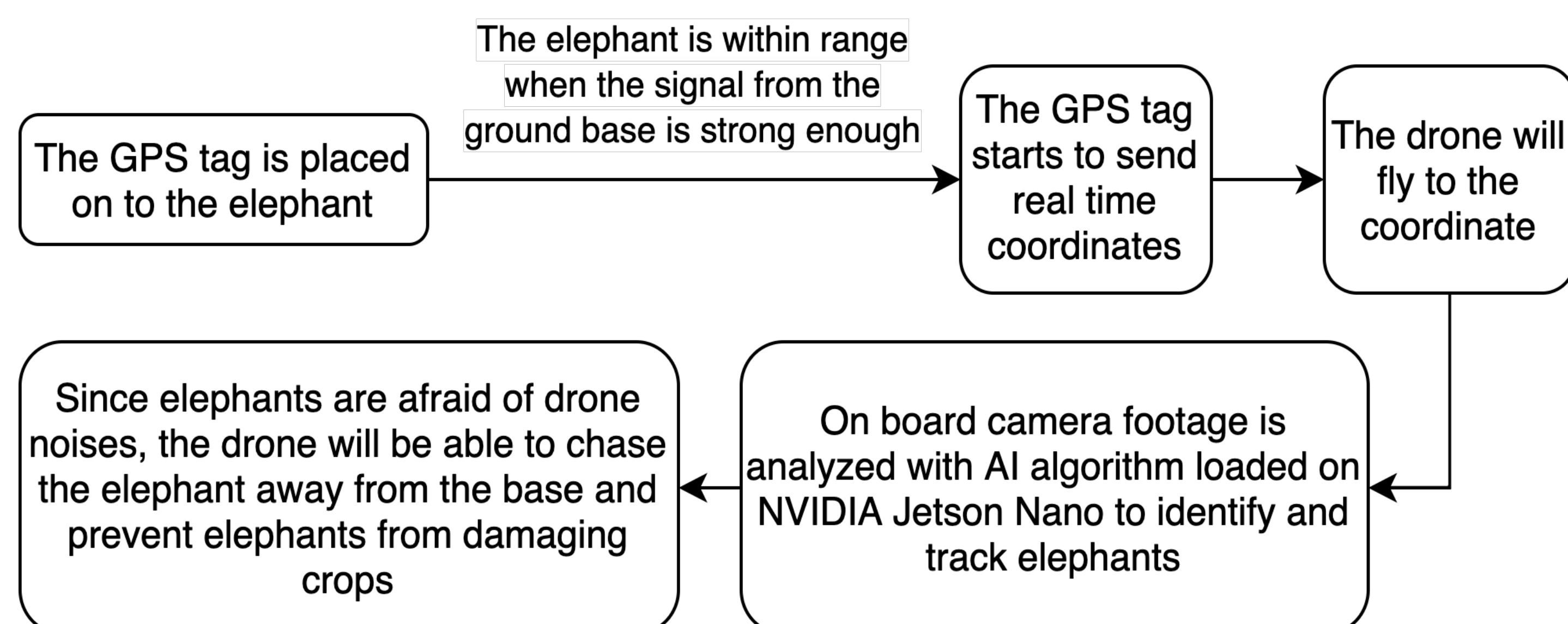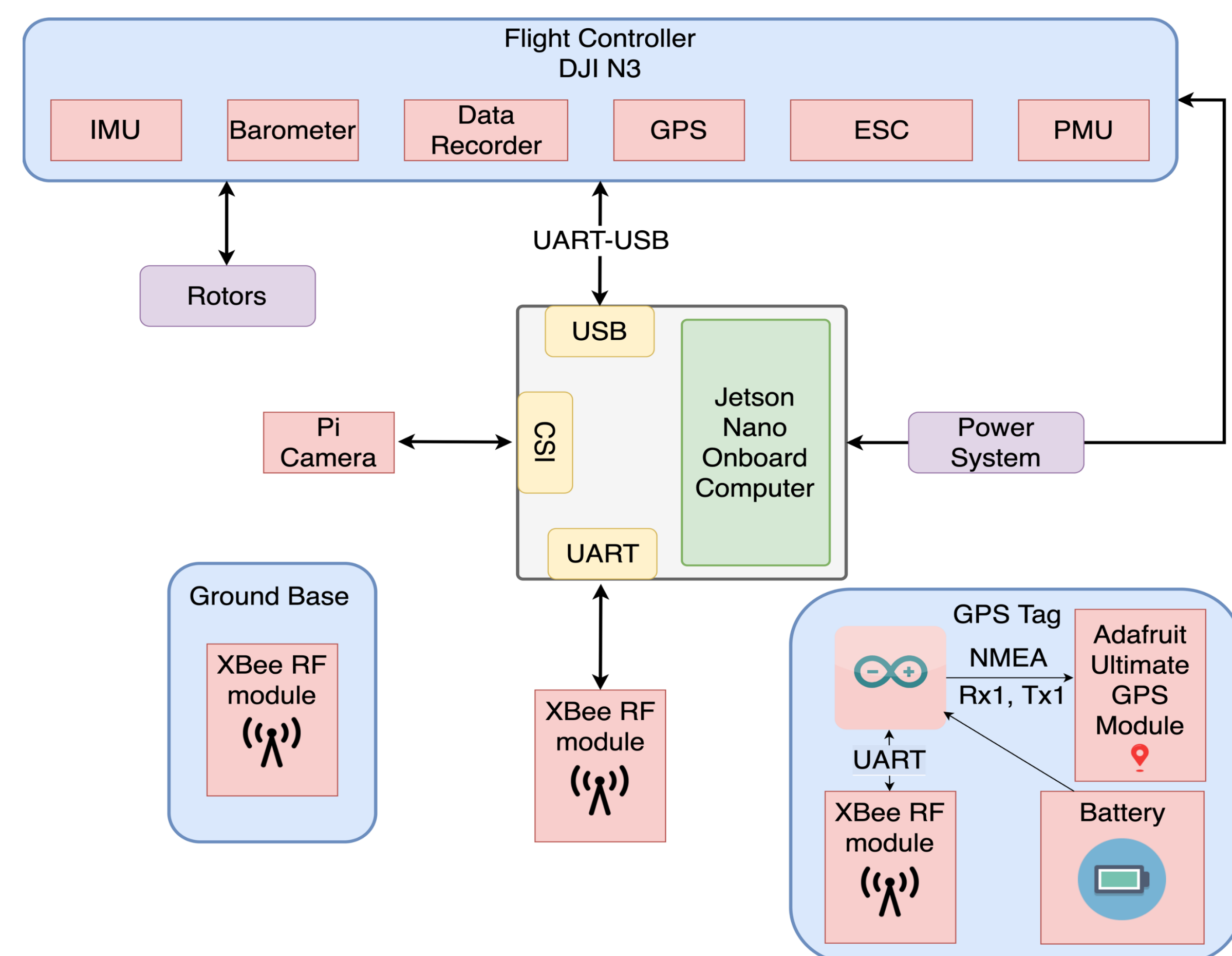**Weiyun Jiang | Alexis Yang | Ning Du | Jiajun Wan**

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Background

Nearly **20%** of the world's population lives in or near elephant habitats. Crop-raiding is the main conflict between elephants and humans. In small plantations, 200-600 pounds of food is lost per day, and a few thousand dollars is lost per household per raid. In large plantations, which produce mainly palm oil and timber, 105 million dollars is lost each year. In India 100-300 humans and 40-50 elephants are killed during crop-raiding each year. Around the globe, 500 people are killed by elephant each year according to National Geographic Channel documentary *Elephant Rage*.

Task Flow Chart

The GPS tag is placed on to the elephant → The elephant is within range when the signal from the ground base is strong enough → The GPS tag starts to send real time coordinates → The drone will fly to the coordinate → On board camera footage is analyzed with AI algorithm loaded on NVIDIA Jetson Nano to identify and track elephants → Since elephants are afraid of drone noises, the drone will be able to chase the elephant away from the base and prevent elephants from damaging crops

## Block Diagram

Drone System Setup

Key Components

IMX219-120 Camera
Sony 8-megapixel sensor, 120-degree field of view for elephant detection and tracking. Dimension 25x24mm

NVIDIA Jetson Nano
ARM Cortex-A57 and Maxwell GPU. Onboard processor for computer vision tasks. PCB dimension: 70x45mm

DJI N3 Flight Controller
Dual IMU Redundancy, GNSS Compass, and PMU for flight stability. Controller: 57.9x39x17mm PMU: 40x 28.2x11.2mm GPS-Compass: 50 (diameter)x12.2mm

FGPMMOPA6H GPS
Collect GPS coordinates on the tag.
Update rate 1 - 10 Hz.
Position Accuracy < 3 meters.
Dimension: 16x16x5.2mm

The GPS Tag
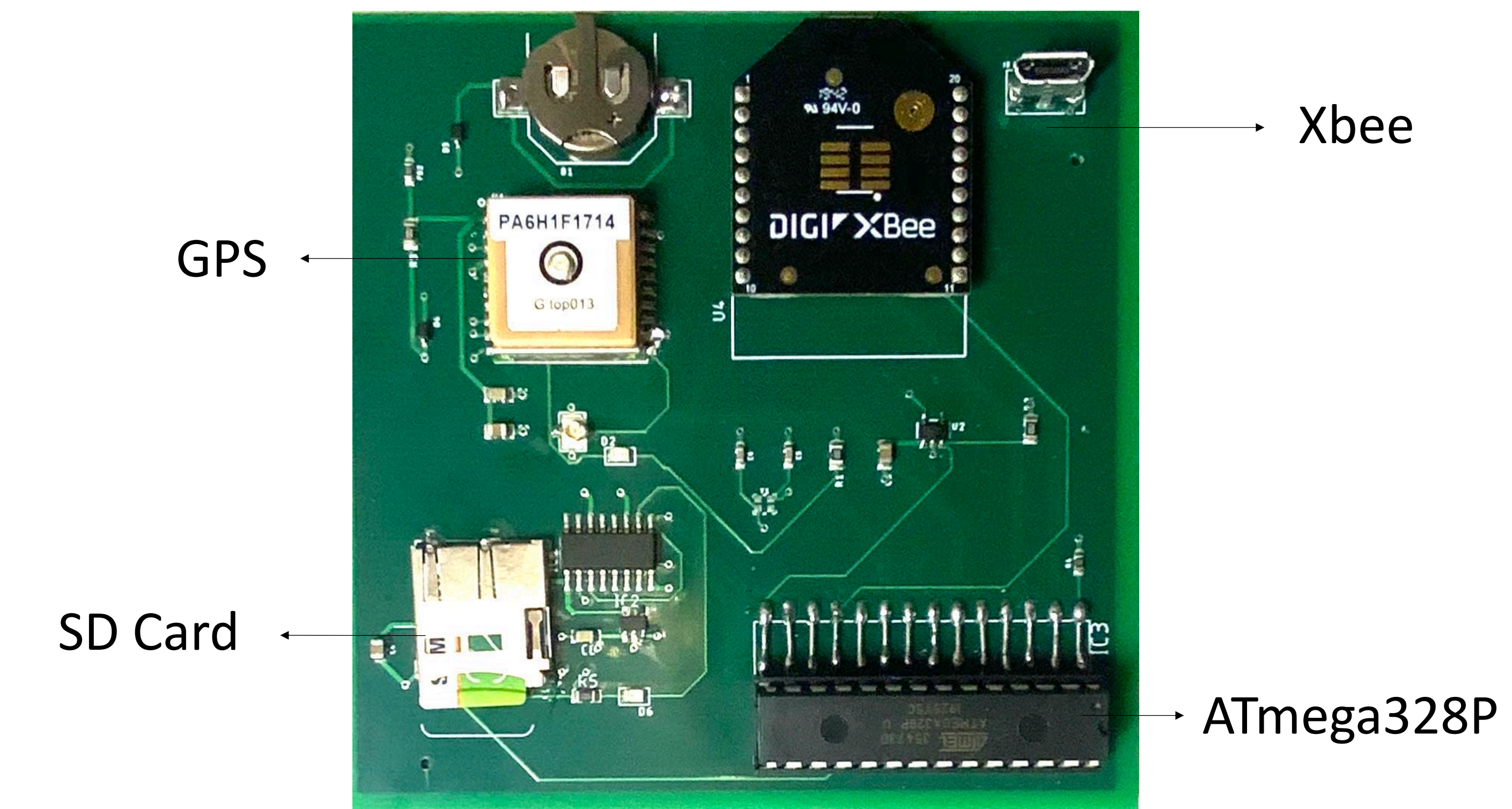
- Xbee module used to send out GPS coordinates
- SD card provides storage for location logging
- Dimension: 8.4x8.4mm Weight: 26.3g
- Expected battery life: 198 days

Simulation Result
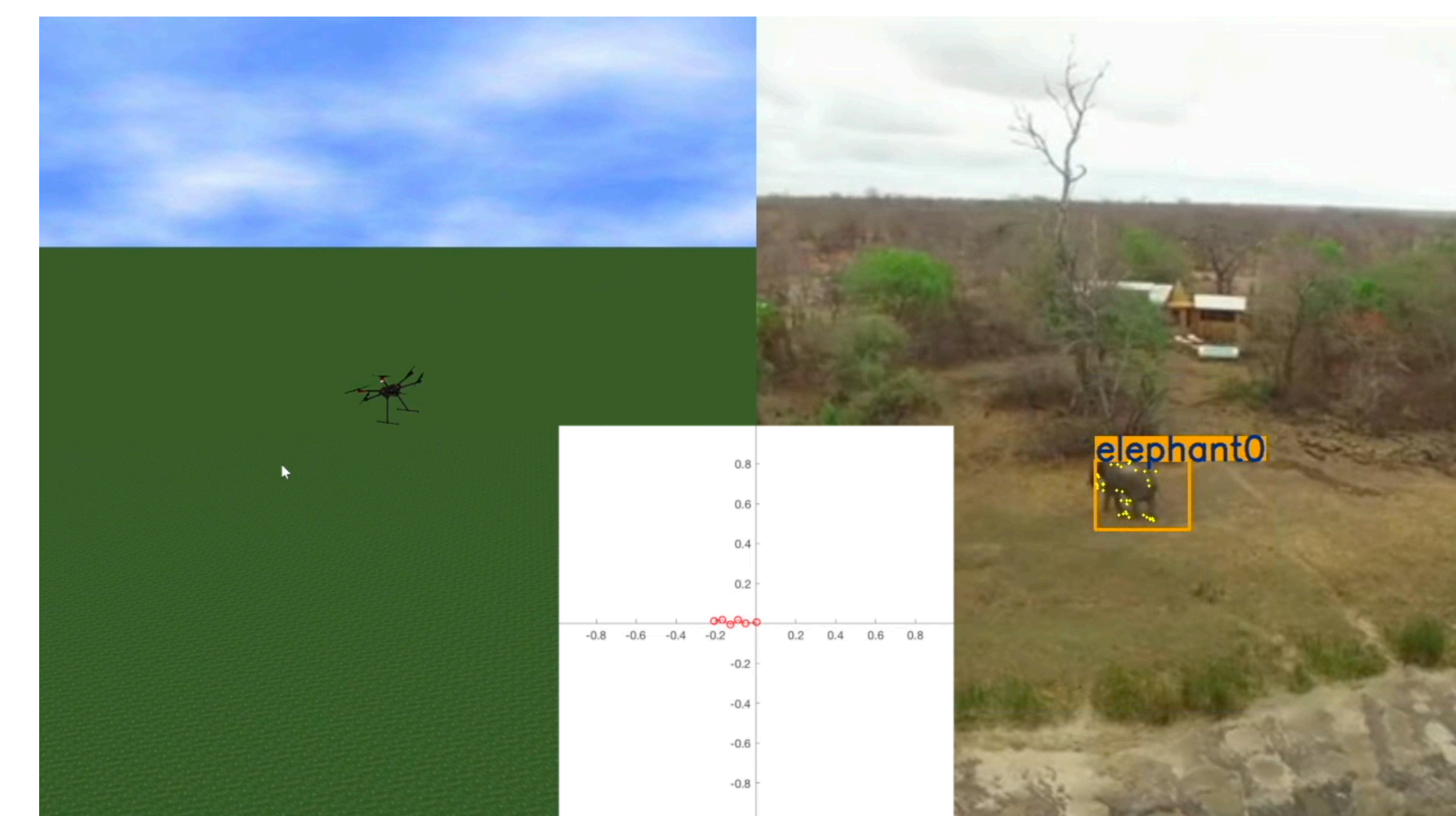
- Neural network-based elephant detection
- Optical flow for real-time elephant tracking
- Localization data fed into a control algorithm to herd the elephant away

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