----------PROJECT RECON------------

Sova’s dart in the game uses a radar-like mechanism to detect enemy positions. In real life, this can be mimicked using a combination of sensors, drones, and wireless communication technology.

**Radar/Ultrasound/LiDAR:**

* Use **LiDAR (Light Detection and Ranging)** or **ultrasound sensors** to detect objects or people in the environment.
* **Radar modules** like mmWave can also be used to detect movement and provide a “scan” of the area, similar to how Sova’s dart pings enemies.

**c. GPS and Localization:**

* The dart would need to track its own position and be aware of its surroundings. **GPS modules** or **local positioning systems** could be implemented.

**d. Bluetooth/Wi-Fi Transmitter:**

* To simulate the "recon" ability, the dart could send data to a receiver (e.g., a smartphone or computer) wirelessly using **Bluetooth** or **Wi-Fi**. This would allow real-time mapping of scanned data.

**e. Camera for Real-Time Imaging:**

* A small **camera** with **infrared or thermal sensors** could provide visual or thermal feedback, allowing detection of humans in dark or hidden environments.

**f. Battery and Power Supply:**

* Lightweight but powerful **batteries** are essential to ensure the dart can function for a sufficient period.

**g. Microcontroller:**

* You would need a **microcontroller** (e.g., Arduino or Raspberry Pi) to process data from sensors and control the dart's scanning behavior.

**3. Challenges:**

* **Durability:** The device needs to survive being launched, especially if it’s not a drone but a projectile.
* **Range and Accuracy:** The sensors should have enough range and sensitivity to detect people or objects at a distance.
* **Weight:** Keeping the weight light enough for flight but still strong enough to hold all the necessary components.

**4. Programming and Data Visualization:**

* You could write code (e.g., in Python) to process the data from the sensors and visualize the scanned area on a display.
* The visual could represent something akin to Sova’s in-game pings, showing heatmaps or enemy positions based on sensor data.

**Application:**

* Real-life recon for search and rescue, military or police operations, and exploring unknown environments.

Components required:

* A lightweight, durable material for the dart (such as carbon fiber or reinforced plastic) to handle the impact on landing.

**b. Sensors:**

* **LiDAR Module:** Used for object detection and mapping.
  + Example: Slamtec RPLIDAR A1/A2, Garmin LiDAR-Lite
* **Radar Module (Optional):** Can detect the movement of objects or people.
  + Example: Texas Instruments mmWave Sensors
* **Ultrasonic Sensor (Optional):** For proximity detection.
  + Example: HC-SR04 Ultrasonic Sensor
* **Infrared/Thermal Camera (Optional):** To detect heat signatures of humans.
  + Example: FLIR Lepton Thermal Camera, Seek Thermal CompactPRO

**c. Microcontroller / Processor:**

* **Microcontroller:** To handle sensor inputs, processing, and communication.
  + Example: Arduino Nano, ESP32, Raspberry Pi Pico
* **Single-board Computer (if more complex processing is needed):**
  + Example: Raspberry Pi 4, Nvidia Jetson Nano

**d. Communication Module:**

* **Wi-Fi/Bluetooth Module:** To wirelessly transmit sensor data to a receiver (e.g., laptop, smartphone).
  + Example: ESP8266, ESP32 (built-in Bluetooth and Wi-Fi)

**e. Power Supply:**

* **Battery:** Lightweight rechargeable batteries to power the microcontroller and sensors.
  + Example: Li-Po Batteries (7.4V or 11.1V for drones)
* **Voltage Regulators:** To ensure proper voltage levels for different components.

**f. Camera (Optional):**

* **Real-time imaging or video feed:** A small camera module that can provide visual feedback.
  + Example: Raspberry Pi Camera Module, or a mini wireless camera.

**g. GPS/IMU Module (Optional):**

* For accurate localization of the dart or drone.
  + Example: NEO-6M GPS Module, MPU-6050 Accelerometer/Gyro

**h. Protective Casing:**

* A case to house all electronics, sensors, and batteries. Must be durable and lightweight to withstand shock.

**2. Software Requirements**

**a. Programming Language:**

* **Python** or **C++**: For microcontroller or single-board computers like Arduino and Raspberry Pi.
  + Libraries: OpenCV for image processing, PySerial for communication with sensors.

**b. Sensor Data Processing:**

* **LiDAR/Ultrasonic/Radar Data:** Code to interpret the distance data and map objects around the dart.
  + Example: Use SLAM (Simultaneous Localization and Mapping) algorithms for real-time mapping.

**c. Visualization Software:**

* If you want to visualize the data on a computer or smartphone, you can use:
  + **Python** with visualization libraries like Matplotlib or Plotly.
  + **Mobile App Development** (for Bluetooth/Wi-Fi connection) using **Flutter** or **React Native**.

**d. Real-Time Data Transmission:**

* Use protocols like **MQTT** or **WebSocket** to transmit data from the dart to a receiver.
  + Use **Flask** for web-based interfaces, or Bluetooth terminal apps for mobile devices.

**a. Mechanical Design:**

* **3D CAD Modeling Software:** If you want to design the dart body or sensor mounts, you can use:
  + Example: Fusion 360, SolidWorks, or FreeCAD (open-source).
* **3D Printing:** For custom parts like sensor housings or protective casings.
  + Example: PLA/ABS plastic for strength and lightweight properties.

**b. Assembly:**

* Basic knowledge of electronics and soldering to connect wires, sensors, and modules.
* Use of **hot glue** or **epoxy resin** for attaching and securing components.

**c. Testing and Calibration:**

* **Test environment:** For testing sensor accuracy and range in controlled environments.
* **Calibration procedures** for each sensor (e.g., calibrating LiDAR for distance accuracy).

**4. Other Requirements**

**Budget and Cost Estimation:**

* **LiDAR sensors:** $100–$200
* **Microcontroller (Arduino/Raspberry Pi):** $10–$50
* **Drone frame/projectile material:** $50–$200 (depending on complexity)
* **Battery and power system:** $30–$80
* **Camera (optional):** $50–$200
* **Miscellaneous components (sensors, wiring, mounts):** $50–$100
* **PC with high computational power in both ram and VRAM**