NERO SENSE - SYSTEM B: OPERATIONAL GUIDE

Advanced Capabilities & User Manual

1. System Philosophy

The **Nero Sense System B** is not just a distance sensor; it is a **Tactical Environmental Awareness Unit**. Unlike simple ultrasonic sensors, it provides a high-resolution, 180-degree cross-section of the world, visualized in real-time with a "Tron-inspired" aesthetic. It bridges the gap between raw sensor data and human-readable tactical information.

2. Visual Interface: How to Read the Screen

The circular display is designed for instant readability:

- **The Cyan Wall (Contours)**:
  - This continuous blue line represents physical obstacles.
  - **Smooth Curves**: Indicate flat walls or large objects.
  - **Jagged Edges**: Indicate complex geometry or scattered objects.
  - *Capability*: Allows you to instantly see the shape of a room or corridor.
- **The Shadow Zone (Dark Navy)**:
  - The dark lines extending from the "Wall" to the edge of the screen represent **Occluded Space**.
  - This is the "Unknown" area behind an object.
  - *Capability*: Helps in understanding blind spots. If a shadow moves, the object is moving.
- **The Scanner (Red Laser)**:
  - Shows the current active measurement angle.
  - *Capability*: Verifies that the system is live and scanning.

- **The Dashboard**:
    - **Center**: Exact distance in millimeters to the object at the current angle.
    - **Bottom**: Current Angle (0-180°).
    - **Status Dot**: Green (Networked) / Red (Standalone).

3. Operational Modes

A. Standalone Mode (Red Dot)

- **Description**: The unit operates without WiFi.
- **Use Case**: Handheld scanning, field deployment, or visual-only monitoring.
- **Capability**:
    - **Portable Scanner**: Power via USB power bank. Walk around a room to "see" in the dark.
    - **Alignment Tool**: Use the precise mm readout to align objects or measure gaps.

B. Networked Mode (Green Dot)

- **Description**: The unit connects to the "Nero Network" (FRITZ!Box) and broadcasts data.
- **Use Case**: Robotics integration, remote monitoring, home automation.
- **Capability**:
    - **IoT Sensor**: Can trigger events in Home Assistant (e.g., "If distance < 50cm, turn on light").
    - **Remote Eyes**: View the radar data on a PC dashboard (via `TRON_Radar.html`).

4. Integration & API (For Developers)

The true power of Nero Sense lies in its **WebSocket API**. It broadcasts raw data in real-time, allowing external systems to "tap in".

Connection Details:
* **IP**: `192.168.178.71`
* **Port**: `81`
* **Protocol**: WebSocket (WS)

Data Format (JSON):

```
{
  "angle": 45,      // Current Servo Angle (0-180)
  "distance": 1250  // Distance in millimeters
}
```

Python Integration Example

You can control a robot based on this data. Here is a snippet for a "Collision Avoidance" script:

```
import websocket
import json

def on_message(ws, message):
    data = json.loads(message)
    angle = data['angle']
    dist = data['distance']

    # Simple Logic: If obstacle ahead is close, STOP.
    if 70 < angle < 110 and dist < 300:
        print(f"CRITICAL: Obstacle at {dist}mm! STOP ROBOT!")
        # robot.stop()

ws = websocket.WebSocketApp("ws://192.168.178.71:81/", on_message=on_message)
ws.run_forever()
```

5. Advanced Use Cases

1. Hexapod Navigation (SLAM)

Mount the Nero Sense on the **Nero Hexapod**.
* **Capability**: The robot can scan its environment to build a 2D map.
* **Logic**: Combine the Radar Angle + Robot Rotation to create a 360° map (SLAM).

2. Security Tripwire

Place the unit facing a doorway.
* **Capability**: Detect intruders.
* **Logic**: If the "Wall" suddenly changes distance (e.g., from 2000mm to 500mm), someone has walked through.

3. Object Profiling

Place an object on a turntable in front of the sensor.
* **Capability**: 3D Scanning (Basic).
* **Logic**: Record distance profiles as the object rotates to reconstruct its shape digitally.

Nero Robotics - Advanced Systems Division