

Bed Exit Alert System Product Specification

(Model: HLC-AI-I/Plus I)

Version	Date	Description	Author
V1.0	20251210	Bed Exit Alert System Product Specification (Model: HLC-AI-I/Plus I)	HYD AI

1. Product Overview

Bed Exit Alert System is a privacy-protected indoor human activity status detection and security alarm product, specifically designed for scenarios such as homes, nursing care facilities, and medical institutions. The product innovatively integrates a LiDAR Vision sensing module with an edge intelligent computing module, achieving indoor human counting, spatial positioning, trajectory tracking, and body posture detection through 3D spatial data acquisition and AI behavior analysis technology.

This product overcomes the privacy limitations of traditional video surveillance products for patients. By analyzing 3D point cloud data without color information, it completes behavioral monitoring related to human activity status, such as smart recognition and alarm for safety events including loitering, falling, and climbing, while completely protecting personal privacy. By establishing an active AI autonomous care mechanism, it solves the industry pain points of high consumption, low efficiency, and multiple vulnerabilities in traditional manual care models, providing a precise and efficient intelligent assistant tool for nursing work.

1.1 Product Appearance

Bed Exit Alert System adopts a wall-mounted design with a semi-elliptical structure. The overall product dimensions are Length × width × thickness 186mm×132mm×80mm. The front of the product integrates a ToF optical sensor, the top is equipped with network and power interfaces, and built-in WiFi and speaker. The product appearance is illustrated below:



Model: HLC-AI-I/Plus I

1.2 Module Layout

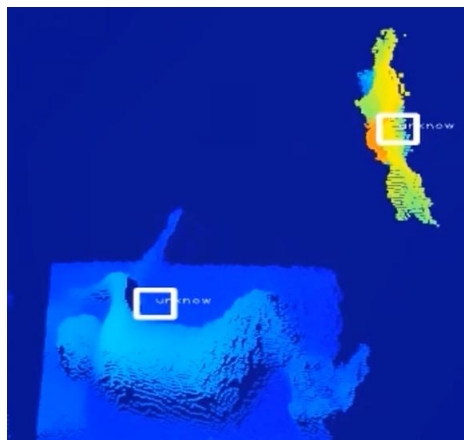
The device adopts a modular design internally, consisting of three core components:

- **LiDAR Vision Module:** 3D spatial point cloud data acquisition and output
- **Computing Module:** Integrated CPU, GPU, NPU, and memory units for local data processing, intelligent analysis, and data storage
- **Communication Module:** Gigabit Ethernet interface, WiFi module

2. Technical Principles

2.1 LiDAR Vision Detection Technology

Bed Exit Alert System employs ToF (Time-of-Flight) active optical measurement technology. By emitting and receiving near-infrared laser signals, it real-time acquires 3D coordinate data within the detection area. The device uses 940nm non-visible laser as the detection light source, compliant with IEC 60825-1:2014 Class 1 eye safety standard, ensuring biological safety during use.



Compared with traditional vision technology, this product offers three major technical advantages:

- **Privacy Protection:** The collected 3D point cloud data contains only spatial coordinate information without any color or texture data, fundamentally avoiding personal privacy leakage risks
- **Environmental Adaptability:** Unaffected by ambient lighting conditions, it operates normally in complete darkness or strong light environments with stable detection accuracy
- **Measurement Precision:** 3D coordinate data achieves centimeter-level accuracy, enabling precise capture of human posture changes and spatial position movements

2.2 Intelligent Analysis Principles

Intelligent analysis is based on the computational capability of the high-performance computing module, integrating neural networks and intelligent recognition algorithms to complete autonomous care functional services.

The high-performance computing module integrates a 64-bit 8-core processor, with integrated GPU and NPU, providing 6 TOPS computing power. It offers powerful local data processing capability. The product integrates 3D point cloud recognition algorithms optimized for indoor scenarios and neural networks, achieving the following core functions:

- **Human Body Geometric Feature Extraction:** Real-time calculation of human body height, posture parameters, and spatial coordinates
- **Motion Feature Analysis:** Identification of human movement speed, direction, and trajectory changes
- **Posture Recognition:** Through skeletal keypoint modeling, accurately determining standing, sitting, lying, and other postures
- **Event Detection:** Based on sequential data comparison, intelligently recognizing abnormal events such as falls and prolonged immobility
- **Data Localization:** The device adopts a “data localization” privacy protection architecture, where all raw data is processed locally, and only analysis results are uploaded to the server, ensuring data security

3. Application Functions

Function Category	Function List	Function Description
Event Detection	Fall Detection	Identifies sudden human falling posture
	Bed Exit Timeout Detection	Identifies bed exit status of patients in bed. If they do not return beyond the set time (customizable), an alarm is triggered

Function Category	Function List	Function Description
	Prolonged Immobility Detection	Identifies when a person remains stationary in the same position beyond the set time (default 30 minutes, customizable), triggering a reminder
	Climbing Detection	Identifies dangerous behaviors such as climbing on furniture
Intelligent Learning	Model Continuous Optimization	The product has recognition model continuous optimization function. Adapts to human behavior characteristic changes in different scenarios
System Functions	Data Visualization	The product provides daily activity trajectory and activity heatmap output functions. Supports viewing via APP
	Multi-level Alarm	The product provides event-based alarm message sending function. Supports defining alarm levels by event type. Notifications through APP push, SMS, and other channels
	Blind Zone Settings	Supports shielding specific areas

4. Installation and Deployment

4.1 Installation Requirements

Bed Exit Alert System is suitable for areas ranging from 2 m² to 10 m², such as hospital bed positions and small bedrooms. Adopts wall-mounted installation:



Installation Recommendations:

1. **Installation Location:** It is recommended to install above the bed head to ensure the detection range covers the entire bed and activity monitoring area
2. **Installation Height:** Optimal height is 2.2m - 2.6m, maximum not exceeding 3m, minimum not lower than 2.2m
3. **Installation Space:** No obstructions within 1 meter below the sensor to avoid detection blind spots

4.2 Coverage Area

Bed Exit Alert System adopts ceiling-mounted installation. At heights between 2.2-3m (7.2-9.8ft) , the detection coverage is as follows:

Installation height		Ground area length		Ground area width	
(m)	(ft)	(m)	(ft)	(m)	(ft)
2.2	7.2	1.9	6.3	1.7	5.7
2.3	7.5	2.2	7.2	2.1	6.8
2.4	7.9	2.5	8.1	2.4	7.9
2.5	8.2	2.7	9.0	2.8	9.1
2.6	8.5	3.0	9.9	3.1	10.2
2.7	8.8	3.3	10.8	3.5	11.3
2.8	9.2	3.6	11.7	3.8	12.5
2.9	9.5	3.8	12.6	4.2	13.6
3	9.8	4.1	13.5	4.5	14.8

4.3 Electrical and Communication Requirements

1. **Power Input:** DC 24V, maximum power consumption 60W
2. **Wired Communication (Standard):** 1 × Gigabit Ethernet port (RJ45)
3. **Wireless Communication:** Built-in WiFi module, supporting 802.11b/g/n/ac/ax protocol
4. **Operating Temperature:** -10°C ~ +50°C
5. **Relative Humidity:** ≤90% (non-condensing)

4.4 Installation Procedure

The product installation steps are recommended as follows:

1. **Step 1:** Determine installation location and mark drilling points
2. **Step 2:** Secure device base to wall
3. **Step 3:** Connect power and network cables (optional)
4. **Step 4:** Adjust device levelness and secure
5. **Step 5:** Power on the device
6. **Step 6:** Complete device activation and configuration through graphical tool software

5. Technical Specifications

Model: Bed Exit Alert System

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5.1 Computing Module Parameters

No.	Parameter	Specification
1	CPU	Quad-core 2.2GHz and Quad-core 1.8GHz
2	GPU	G52 MC3 @ 1GHz
3	NPU	6 TOPS
4	Communication Interface	1 × RJ-45 Gigabit Ethernet, WiFi
5	System Environment	Ubuntu 22.04

5.2 LiDAR Vision Module Parameters

No.	Parameter	Specification
6	Laser Wavelength	940 nm
7	Laser Safety	Class 1 (IEC 60825-1:2014) Eye Safety Level
8	Detection Angle	Horizontal FOV 120°, Vertical FOV 70°

No.	Parameter	Specification
9	Detection Frequency	20Hz
10	Installation Height	2.2m - 3m
11	Detection Range	2 m ² -16 m ² (Under unobstructed conditions)
12	Detection Accuracy Deviation	1 Standard Deviation < 3cm

5.3 Intelligent Recognition Performance

No.	Parameter	Specification
13	Data Processing Latency	< 100 ms
14	Target Detection Output	ID, Coordinates, Region, Direction, Count, Posture
15	Region Identification	Multi-region identification (up to 2 regions), customizable region range
16	Target Type Recognition	Human body, Objects. Supports maximum 8 human target recognition
17	Event Recognition	Prolonged immobility, Bed exit timeout, Fall, Climbing, etc.
18	Event Customization	Supports event rule customization (optional service)

5.4 System Functions

No.	Parameter	Specification
19	Operation Tools	Web-based graphical operation interface (multi-language support)
20	Supported Protocols	TCP/IP Protocol IPv4/IPv6
21	Account Management	Support for multiple account settings
22	Log Management	Provide device operation and account maintenance logs

5.5 Other Characteristics

No.	Parameter	Specification
23	Dimensions	Length × width × thickness:186mm×132mm×80mm
24	Operating Temperature	-10°C ~ +50°C
25	Power Input	DC 24V, 2.5A
26	Installation Method	Wall-mounted

6. Product Models

Product model list is as follows:

No.	Product Name	Model	Product Description
1	Bed Exit Alert System	HLC-AI-I/Plus I	LiDAR Vision detector. Integrates LiDAR vision module, computing module, data transmission module, power supply module, including mounting bracket. Main technical specifications: • Installation height: 2.2m-3m. • Laser light source: 940nm wavelength. • Laser safety: Compliant with IEC 60825-1:2014, Class 1 eye safety. • Detection frequency: 20FPS. • Detection FOV: Horizontal 120°, Vertical 70°. • Detection range: 2.7m×2.8m (at 2.5m height). • Detection accuracy deviation: 1 standard deviation <3cm. • Communication interface: 1000Mbps Ethernet port, WiFi. • Voice prompt: 4Ω 3W speaker. • Operating temperature: -10°C - +50°C. • Power input: DC 24V, 2.5A. Product integrates intelligent analysis algorithms, suitable for indoor open area human target detection, posture detection, trajectory tracking, quantity recognition, boundary detection, and other scenarios. Product provides data integration interface, supporting third-party management system integration.