

3D Vision Passage Detection Module Technical Specification

PASINS 3D Technical Specification

Shenzhen Hongyida Technology Co., Ltd.

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1. Scope

1.1 Document Definition

Document Name: 3D Vision Passage Detection Module (PASINS 3D) Technical Specification

1.2 Document Description

This document primarily describes the hardware configuration and functions of the self-service gate 3D vision passage detection module.

2. Product Overview

3D Vision Passage Detection Module (PASINS 3D) is a passenger passage behavior detection product applied to self-service gate systems. The product integrates 3D DToF module, passage logic control board, and indicator lights.

The 3D Vision Passage Detection Module applies 3D D-ToF vision technology to achieve stereoscopic or distance perception of targets through three-dimensional laser scanning. 3D vision technology collects and outputs three-dimensional vector information of “human body, objects, and space,” providing position coordinate information, depth data information, morphology and pose information of objects within the field of view. This solves the insufficiency of traditional detection technology in sensing motion information within the gate passage space, achieving three-dimensional data acquisition of gate passage areas and data-based perception of target movement.

3D vision perception is a key fundamental common technology in the era of artificial intelligence, providing precise three-dimensional data for self-service gate passage services and enabling intelligent identification and service for self-service gates.

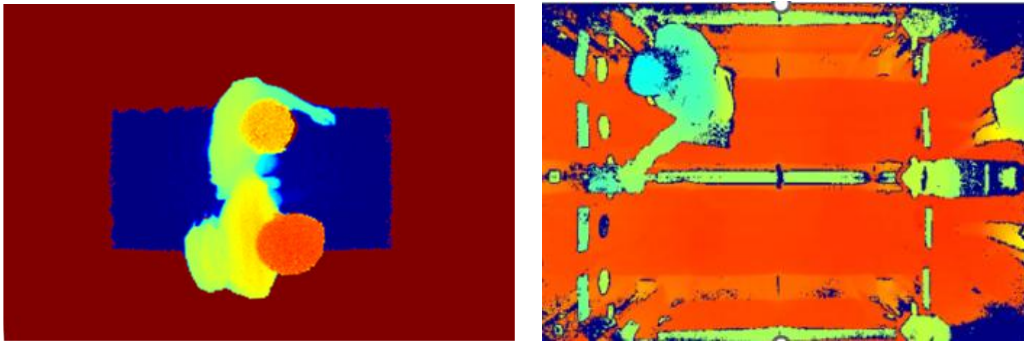


Figure 1: Technical Principle Diagram

The 3D Vision Passage Detection Module is deployed above the passage area of the self-service gate. Using the integrated 3D ToF module, it achieves spatial three-dimensional data acquisition of the self-service gate passage area. Using the integrated intelligent recognition algorithm, it completes passage status detection of the self-service gate passage area, including: passenger type, quantity, position, direction, etc. At the same time, for behaviors of unauthorized passage, the product records tailgating passage incidents.

The 3D Vision Passage Detection Module communicates with the control host of the self-service gate through TCP/IP protocol, outputting detection results to the self-service gate control host to achieve linkage applications for different passenger passage behaviors.

The 3D Vision Passage Detection Module completes passenger passage behavior detection for self-service passages, achieving three-dimensional recognition detection from two-dimensional plane identification to motion process. It solves the insufficiency of detection range and recognition capability of traditional infrared detection technology, comprehensively improving the passage experience of self-service gates.

2.1 Product Appearance

The panel layout of the 3D Vision Passage Detection Module is shown in the figure below.

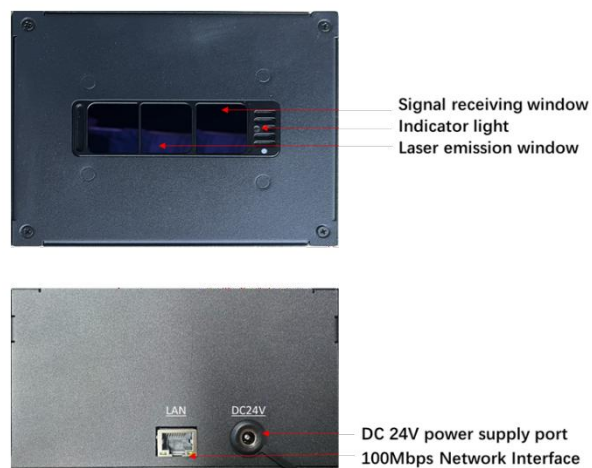


Figure 2: PASINS 3D/M1 and PASINS 3D/M2 Product Appearance Diagram-

2.2 Materials and Manufacturing Process

The shell of the 3D Vision Passage Detection Module is made of alloy sheet metal processing, with surface treatment using powder coating process, providing corrosion resistance. Standard parts are used for all structural components: black-plated screws (M3X8). The whole device adopts passive heat dissipation, using a

combination of air convection and shell heat dissipation, with excellent heat dissipation capability.

2.3 Product Functions

The 3D Vision Passage Detection Module integrates a 3D ToF sensor to achieve three-dimensional information acquisition of the self-service gate passage area. Through the integrated intelligent analysis algorithm, it achieves sequential analysis of spatial point clouds. Combined with intelligent ground extraction algorithms, it obtains target height and width information. Combined with target determination algorithms to analyze pedestrian behavior trajectories, it precisely calculates the number of people in the passage and motion status. It achieves identification of target behaviors related to gate authorization status in the passage area, including: passenger type, passenger tailgating, passenger counting, passenger rushing, reverse crossing, continuous passage, etc. (see Chapter 4 Passage Detection Functions). Through the data communication interface defined by the product's business software, it achieves automatic linkage and alarm with the self-service gate control host.

2.4 Product Specifications

2.4.1 Overall Hardware Composition

The overall hardware composition of the 3D Vision Passage Detection Module is shown in the figure below:

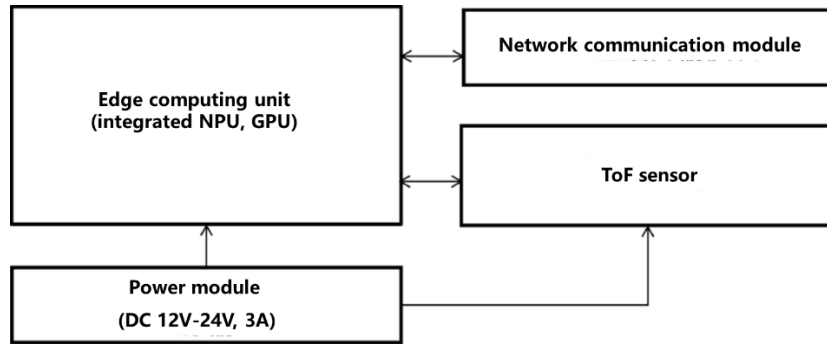


Figure 3 Hardware Connection Diagram

2.4.2 Specifications

No.	Item	Specification
1	Optical Characteristics	940nm wavelength
2	Optical Safety Level	Class 1 (IEC 60825-1:2014) Eye Safety Level
3	Detection Field of View Angle	Model: PASINS 3D/M1: H90°×V70° Model: PASINS 3D/M2: H120°×V70°
4	Acquisition Frequency	30 FPS
5	Detection Frequency	15 FPS

No.	Item	Specification
6	Power Supply	DC 24V, 2A
7	Communication	1000M Ethernet RJ-45 port
8	Dimensions(Length * Width * Thickness)	125mm × 98mm × 75mm
9	Operating Temperature	-10°C ~ +50°C

3. Installation and Deployment

The 3D Vision Passage Detection Module adopts ceiling-mounted installation. The device is installed directly above the passage area of the self-service gate, 2.2m - 3.2m from the ground. The installation position is at the center line of the self-service passage area. Longitudinal allowed installation deviation is $\pm 10\text{mm}$, and lateral allowed installation deviation is $\pm 50\text{mm}$. Ensure the device is level, with horizontal error offset less than 5° .

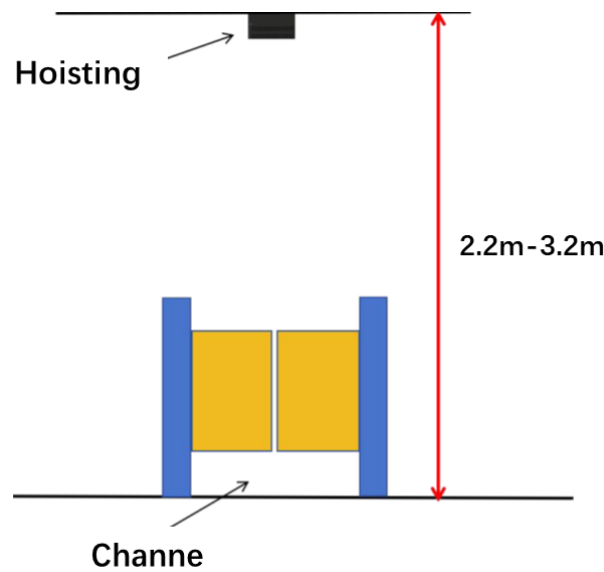


Figure 5: Device Deployment Diagram

Under the above installation method, the passage area detection range examples of the 3D Vision Passage Detection Module for self-service gates are as follows (Note: based on detecting human body height of 1.8m):

Model	PASINS 3D/M1	PASINS 3D/M2
Detection Surface Height from Ground (m)	Coverage Length (m)* Width (m)	Coverage Length (m)* Width (m)
2.2	-	1.4*0.6

Model	PASINS 3D/M1	PASINS 3D/M2
2.3	1.0*0.7	1.7*0.7
2.4	1.2*0.8	2.0*0.8
2.5	1.4*1.0	2.4*1.0
2.6	1.6*1.1	2.7*1.1
2.7	1.8*1.3	3.1*1.3
2.8	2.0*1.4	3.5*1.4
2.9	2.2*1.5	3.8*1.5
3	2.4*1.7	4.1*1.7
3.1	2.6*1.8	4.5*1.8
3.2	2.8*2.0	4.8*2.0
3.3	3.0*2.1	5.2*2.1
3.4	3.2*2.2	5.5*2.2
3.5	3.4*2.4	5.9*2.4

4. Passage Detection Functions

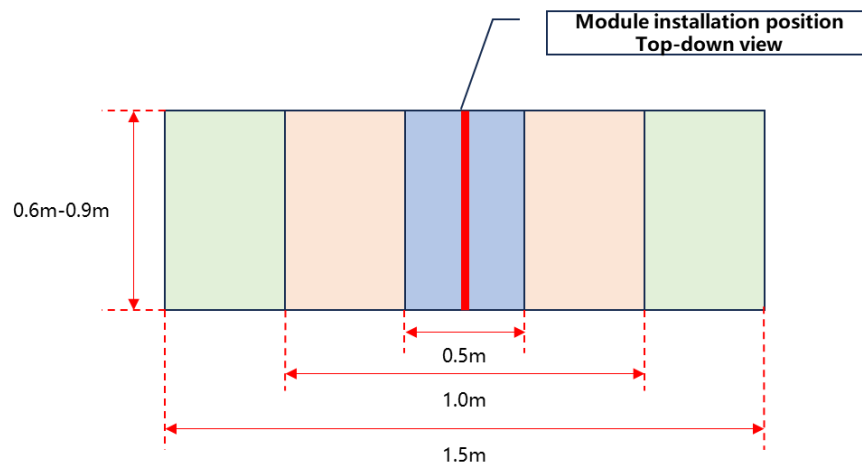
4.1 Detection Function List

No.	Function Name	Function Description
1	Tailgating Detection	In an authorized passage area, after pedestrian A is authorized, pedestrian B is not authorized, and A and B enter the detection area together. Detection scenarios include: 1) Pedestrian A and B walk normally front and back .2) Pedestrian A and B walk side by side, with arms around each other. 3) Pedestrian A and B walk front and back, with B's hand on A's shoulder. 4) Pedestrian A walks normally, B squats and follows closely behind A (squatting human body is not obscured) .5) The minimum passage interval between adult tailgating pedestrians' torsos is not more than 10cm. 6) The minimum passage interval between adult and child tailgating pedestrians' torsos is not less than 20cm
2	Intrusion (Unauthorized Entry) Detection	In an authorized passage area, pedestrians enter the detection area without authorization. The system judges this as intrusion. Detection scenarios include: 1) Pedestrian enters the detection area from the front direction .2) Pedestrian enters the detection area from the reverse direction
3	Rushing Detection	In an authorized passage area, after pedestrian A is

No.	Function Name	Function Description
		authorized, unauthorized pedestrian B rushes into the detection area first. The system judges this as rushing (sneak-through)
4	Anti-Pinch Detection	An anti-pinch area is set within the detection range. If pedestrians or objects exist in the anti-pinch area, the system can accurately detect people or objects
5	Climbing Over Detection	In an authorized passage area, there is a gate blocking between two areas. Pedestrians cross from one area to another without authorization. The system judges this as climbing over
6	Reverse Direction Detection	After pedestrian A is authorized in the forward direction, pedestrian B enters the detection area from the reverse direction. The system judges this as reverse direction
7	Height Detection	Pedestrians pass through the gate box area for body height detection. Detection area range is 1.5m, with height detection accuracy of $\pm 3\text{cm}$ to $\pm 5\text{cm}$ (Note: detection accuracy deviation range within the area is shown in Appendix 1)
8	Left-Behind Object Detection	Pedestrians pass through the detection area with authorized items. After the pedestrian has left the detection area, if carried items are left in the detection area, the system judges that there are left-behind objects in the area. Left-behind object volume range is not less than $25\text{cm} \times 25\text{cm} \times 25\text{cm}$ (Note: recognition area and size accuracy deviation range are shown in Appendix 2)
9	Passenger Flow Counting	1) Pedestrians pass through the detection area in the forward direction, and the background accumulates passage count 2) Pedestrians pass through the detection area in the reverse direction, and the background accumulates passage count
10	Adult and Child Recognition (Child height not less than 1m, not higher than 1.4m)	1) Adults pass through the detection area normally, and the background shows the passing pedestrian is an adult 2) Children pass through the detection area normally, and the background shows the passing is a child
11	Stroller Detection	Adults push strollers (height below 90cm) or adults pull strollers in front or behind, passing normally
12	Wheelchair Passage Detection	Adults in wheelchairs can pass safely, and wheelchair users require normal identification and

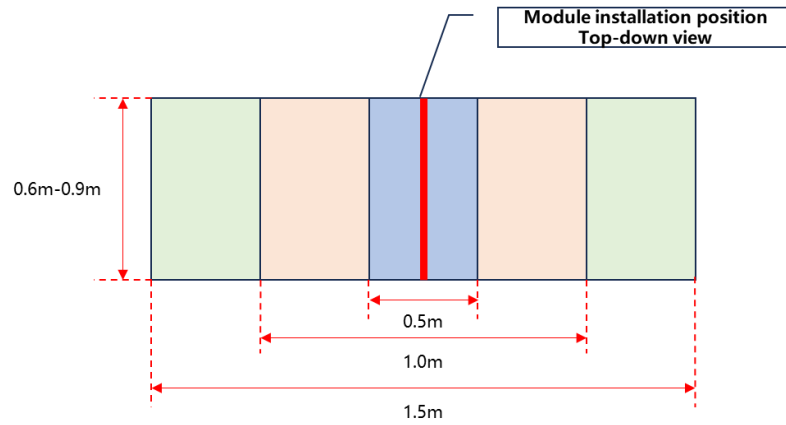
No.	Function Name	Function Description
		authorization
13	Small Luggage Passage Detection	Normal passage
14	Hat Wearing Detection	Passengers wearing hats (hat diameter not more than 40cm), normal passage
15	Target Tracking Quantity in Detection Area	Maximum tracking of 8 targets within the detection range

Appendix 1 - Height Detection Accuracy Description



Visual Passage Detection Module			
Installation Height	2.6m - 3.2m		
Measurement Area Range (see figure above)	0.5m	1m	1.5m
Measurement Deviation	±2cm	±3cm	±4cm

Appendix 2 - Left-Behind Object Detection



Object Size	$\geq 25\text{cm} \times 25\text{cm} \times 25\text{cm}$		
Installation Height	2.6m - 3.2m		
Measurement Area Range (see figure above)	0.5m	1m	1.5m
Presence Detection Accuracy Rate	100%	100%	100%

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