YDLIDAR

YDLIDAR HP60C
DATA SHEET

Shenzhen EAI Technology Co.,Ltd.

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CONTENTS

1 PRODUCT DESCRIPTION AND PRODUCT FUNCTION

1.1 Product Description

YDLIDAR HP60C (hereinafter referred to as HP60C) original deep camera uses structured light 3D imaging technology to obtain deep images, which meets different human-computer interaction functions such as robot navigation, obstacle avoidance, depth information modeling, gesture control, human body scanning and motion capture. The built-in HD RGB camera meets the needs of texture mapping, object recognition, video surveillance and other applications.

HP60C original deep camera is compact, USB 2.0 standard output interface, easy to integrate, providing flexibility for system integrators, can be adapted to indoor complex environments such as strong light and weak light.

1.2 Product Function and Features

- ➤ The range measurement accuracy is high
- ➤ Strong perception
- ➤ Depth and RGB images merge seamlessly
- ➤ Deep image level for a large FOV
- ➤ Multiple cameras work simultaneously
- ➤ High environmental adaptability

1) High ranging accuracy: 60cm wide baseline design, professional deep computing chip and algorithm, accuracy leading the industry level, improve the performance of robot small object detection, narrow channel obstacle avoidance and other performance;
2) Strong perception ability: the algorithm optimizes the perception performance of black objects, highly reflective objects and semi-transparent objects to lead the industry;
3) Seamless fusion of depth and RGB images: temporal and spatial alignment of depth map and RGB images to meet the intelligent detection requirements of multi-scene image fusion;
4) Multi-camera work at the same time: 640*480/160*120@5/8/10/15/20 fps depth image output, which occupies less bandwidth and makes multiple cameras work at the same time;
5) **Deep image horizontal large FOV: depth image horizontal direction FOV 73.8° to meet the requirements of robot large FOV;**
6) High environmental adaptability: -10~50℃ wide temperature working, 940nm wavelength, good resistance to environmental light and dust interference performance.

1.3 Safety Instructions

1. This product is a precision device, which should avoid collision, fall and vibration to avoid the motherboard components or damage inside the lens components, resulting in functional problems or affecting the performance of the product.
2. Optical components of the product need to be protected during packaging and transportation, such as using bubble bag or pearl foam package. Avoid hand or other items with dust and water stains directly contact the surface of the component, so as not to affect the product accuracy or performance.

3. This product shall avoid the unprotected exposure to the environment that the human body can directly contact with, so as to prevent the electrostatic hazards caused by the human body touch.

4. The product and the customer's equipment shall be equipped with a grounding protection device.

5. All the constituent materials of this product are in accordance with the ROHS 2.0 certification.

6. Meet the IEC 60825-1:2014 Class 1 laser safety standard.

2 TERMS

CHART 1 TERMS

Baseline	Baseline: The distance between the imaging center of the infrared camera and the optical projection center of the infrared projector
Depth	Depth: Similar to color video streaming, the difference is depth image each pixel has a value representing the distance from the camera, called depth
FOV	Field of view angle (Field of Vie w): describes the angular range of the camera imaging. Including the horizontal FOV (HFOV: H orizontal Field of View), vertical FOV (VFOV: Vertical Field of View), and diagonal FOV (DFOV: D iagonal Field of View)
Depth processor	Deep computing chip, a dedicated A SIC chip used to realize depth computing and output depth images
IR camera	Infrared camera
RGB camera	Color camera
Dot Projector	The lattice projector projects the invisible infrared laser lattice into the scene, and calculates the depth information of the scene according to the relative shape variables of the laser lattice
Lens	Optical lens set: used for imaging in the infrared camera, color camera. For the projection in the laser projector
ISP	Image signal processor, Image Signal Processor: a unit for signal processing of the front-end image sensor output. You can match the image sensors from different manufacturers. Can achieve such as automatic exposure, automatic focus, automatic white balance and other functions
MIPI	The MIPI Alliance, or the Mobile Industry Processor Interface (Mobile Industry Processor Interface). The MIPI Alliance initiated an open standard and a specification for mobile application processors
SoC	Chip-level system, System on Chip. Is an integrated circuit with dedicated objectives, which contains the complete system and has the entire content of the embedded software.
I2C	The I2C bus is a simple, two-way second-line synchronous serial bus. It requires only two wires to transmit information between devices connected to the bus
HDR	High dynamic range images, High-Dynamic Range
PCBA	Printed Circuit Board Assembly, Bearing depth computing processor, memory and other electronic device components
Plane accuracy	Measure the specific plane, obtain the plane depth, cut off 5% of the depth up, bottom, left and right respectively, take the area of the middle 81% to fit the plane, and calculate the root mean square value of the distance between the pixels of the depth map and the fitted plane
Filling rate	Measure the specific plane, obtain the plane depth, cut off 5% of the depth up, bottom, left and right, take the middle 81% of the area, and take the effective depth point as a percentage of the total pixels
UVC	USB Video Class USB video, is a protocol standard defined for USB video capture devices

3 INTRODUCTION TO THE ORIGINAL DEEP CAMERA TECHNOLOGY

3.1 Imaging Technique

The original deep camera mainly includes an infrared camera (IR camera), a dot-matrix projector (Dot projector), and a deep computing processor (depth processor). The dot matrix projector is used to project a structured light pattern (speckle pattern) to the target scene (Scene). The infrared camera collects the infrared structured light image of the target. The depth computing processor receives the infrared structured light image and performs the depth computing algorithm and outputs the depth image of the target scene.

Depth calculation processor in the depth calculation, the pre-calibration of infrared reference pattern and the current acquisition of infrared real-time pattern comparison calculation, according to the relative displacement between the two, can obtain the pixel deviation between the image (d), then based on the structure light triangulation principle, calculated by the deviation value d distance, namely "depth".

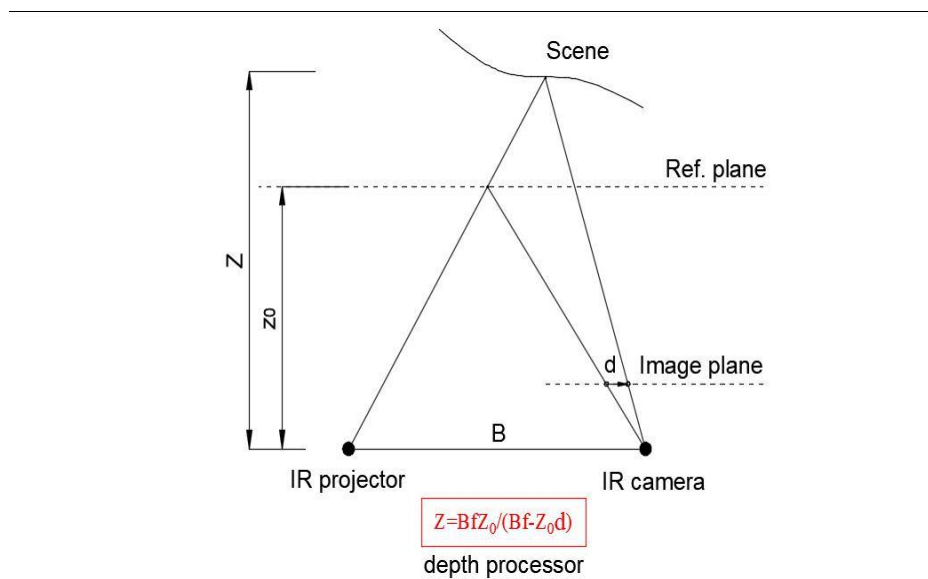$$Z = BfZ_0 / (Bf - Z_0 d)$$

FIG 1 SCHEMATIC DIAGRAM OF THE MONOCULAR STRUCTURAL OPTICAL IMAGING PRINCIPLE
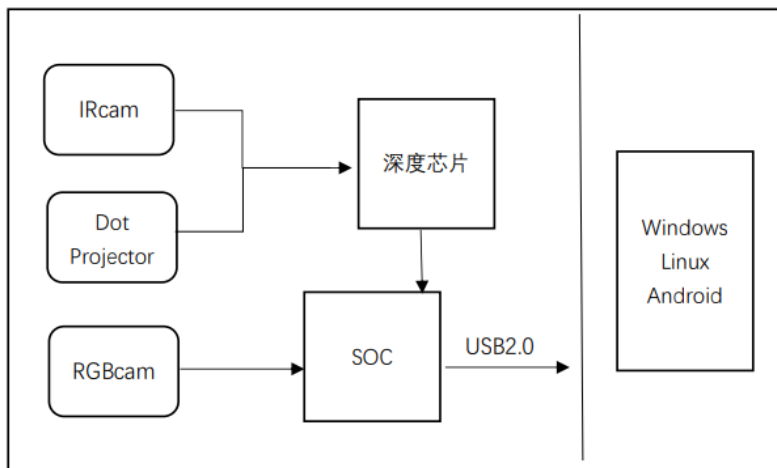
3.2 System Framework

FIG 2 SYSTEM FRAMEWORK DIAGRAM

4 SPECIFICATION AND PARAMETERS OF THE ORIGINAL DEEP CAMERA

4.1 Physical Products

FIG 3 PHYSICAL PICTURE

3.2 System Framework

4.2 Product Specifications

CHART 2 PRODUCT PARAMETER

Item		Specifications	Unit
Essential parameter	Product size	89.8*19.0*25.0	mm
	Power dissipation	< 2	W
	Joggle	Type C USB 2.0	/
	Operating distance	0.2~4 (within 2m)	m
	Working temperature	-10~50	℃
	Storage temperature	-30~80	℃
	Working humidity	0~90	%RH
	Power supply mode	USB	
	Vbus	4.75~5.25	V
Deep precision	Plane accuracy	< 2@1m	mm
	Filling rate (middle 81% area)	> 99.5%@1m	/
Deep image	Resolution / frame rate	640×480@20fps(Max)	/
	Fov	73.8×58.8×86.4 (H*V*D)	Deg
	Transfer image format	RAW16	/
RGB picture	Resolution / Frame rate	1920×1080@20fps (Max) Recommended: 640×360@20fps, 640×480@20fps	/
	Fov	80.9×51.7×88.9 (H*V*D)	Deg
	Transfer image format	RGB888	/
After depth map and RGB map alignment, depth map FOV	RGB resolution 640*360 condition	73.8×51.7 (H*V)	Deg
	RGB resolution at the 640*480 condition	64.4×51.7 (H*V)	Deg

CHART 3 PRODUCT SPECIFICATIONS

Item		Specifications
Safety standard	ESD	±8kV (contact discharge) > ±15kV (air discharge)
	EMI/EMC	Meet the 3C certification performance standards
	Laser safety	Class 1
Development platform	Windows	Support
	Android	Support
	Linux	Support

5 ORIGINAL DEEP CAMERA SYSTEM COMPONENTS

5.1 Table of System Components

CHART 4 TABLE OF SYSTEM COMPONENTS

Original deep camera model	HP60C
Laser lattice projector (Dot Projector)	√
Infrared camera (IR Camera)	√
Color Camera (RGB Camera)	√
Deep Computing Chip (Depth Processor)	√

5.1.1 Laser Spot Matrix Projector (Dot Projector)

The laser lattice projector obtains the texture by projecting a speckle pattern. The laser lattice projector meets the class Class l laser safety standard under normal operation.

CHART 5 SPECIFICATION OF LASER LATTICE PROJECTOR

Attribute	Description
Encoding type	Scatter encoding
Laser chip type	Multi-lattice vertical cavity laser emitter
laser wave length	940nm
wavelengths of temperature drift	0.07nm /°C
Field of view angle (FOV)	>90°
Laser safety level	Class 1

5.1.2 The Infrared Camera

Infrared camera is mainly used to collect the laser lattice array projected by the laser lattice projector.

CHART 6 INFRARED CAMERA SPECIFICATIONS

Attribute	Description
Effective resolution	1280×960
Focus mode	Fixed focus
Shutter type	Global exposure
Angle of field	73.8°×58.8°×86.4° (H*V*D)
Filter	940nm narrow band filtering

5.1.3 The Color Camera

Color cameras are mainly used to collect visible light images.

CHART 7 COLOR CAMERA SPECIFICATIONS

Attribute	Description
Effective resolution	1920×1080
Focus mode	Fixed focus
Shutter type	Curtain exposure
Angle of field	80.9°×51.7°×88.9° (H*V*D)
Filter	Infrared cutoff filter

5.2 Interface Description

The HP60C original deep camera uses the USB 2.0 transmission interface. Image communication is performed for the standard UVC protocol. The interface form is in the standard Type C form.

CHART 8 TYPE C USB2 DEFINITION OF TYPE C USB2.0 INTERFACES

Pin#	Joggle	Description
A1	GND	Signal ground
A4	VBUS	The power supply is 5V
A5	CC1	NC
A6	DP1	The data line is
A7	DN1	Data line negative
A8	SBU1	NC
A9	VBUS	The power supply is 5V
A12	GND	Signal ground
B12	GND	Signal ground
B9	VBUS	The power supply is 5V
B8	SBU2	NC
B7	DN2	Data line negative
B6	DP2	Data line positive
B5	CC2	NC
B4	VBUS	The power supply is 5V
B1	GND	Signal ground

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6 STRUCTURAL DESCRIPTION

6.1 Structural Drawings
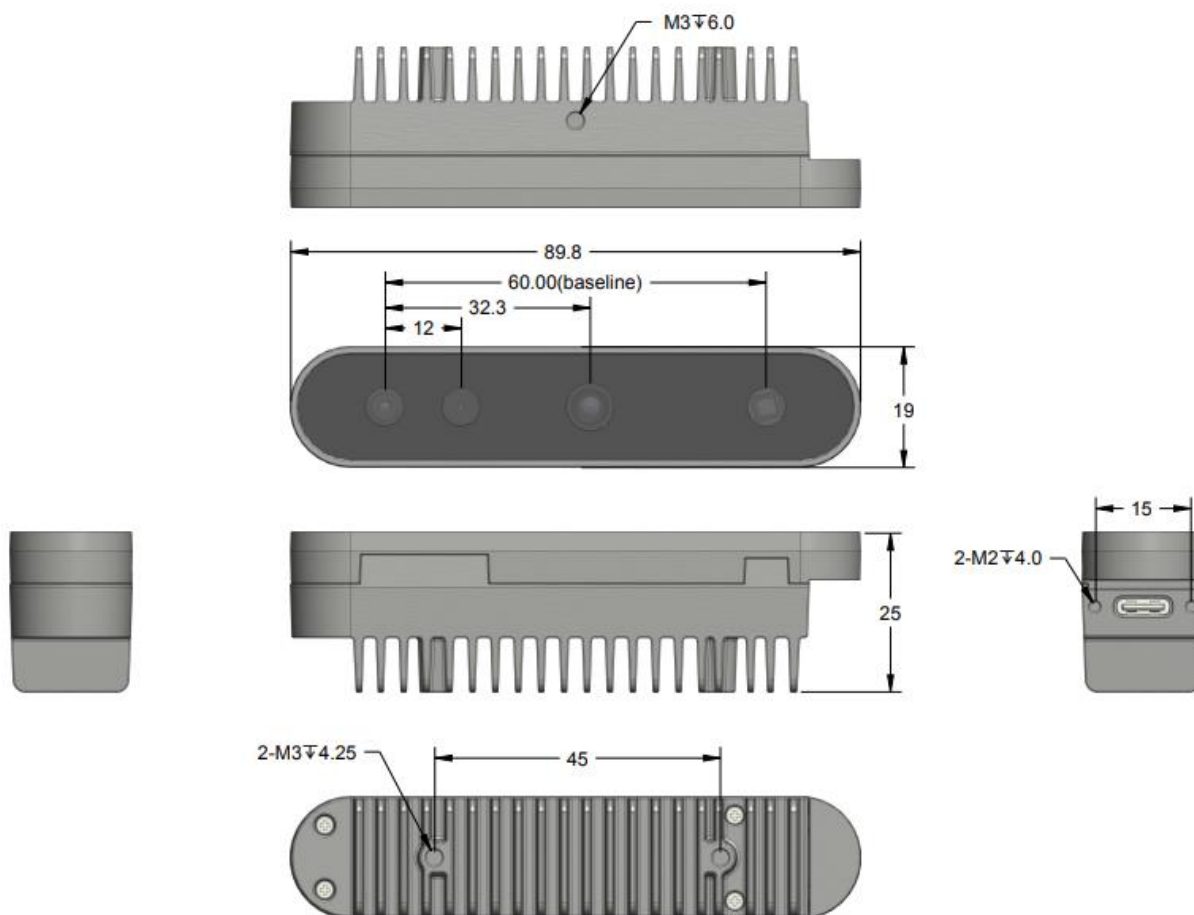

<div align="center">FIG 4 STRUCTURAL DRAWINGS</div>

6.2 Installation Recommendations

The installation recommendations for the HP60C original deep camera are as follows:

1. The front and back of the original deep camera are pressed by foam, and the side is closely coordinated with the stuck position structure.
2. Reserve 2 M3 screw holes on the back side.
3. One M3 grounding treatment is reserved on the side.

6.3 Heat Dissipation Recommendations

Heat dissipation recommendations are as follows:

1. Connecting the bracket of the original deep camera with the metal part of the whole machine is conducive to reducing the ambient temperature of the hardware work.
2. Try to increase the space around the original deep camera, so that the original deep camera has more space for conventional heat dissipation.

6.4 Optical Requirements for The Protective Cover Plate

The HP60C is integrated into the whole machine, and it is prohibited to cover the glass or other shielding objects in front of the original deep camera. If additional protective cover must be added, anjiang shall be notified to remove the glass cover plate of the original deep camera, and the following requirements should be met.

1. The front protection cover plate of the whole machine shall meet the following requirements:
   a) Protective cover plate material: glass or PC / PMMA.
   b) The light transmission area on the protective cover plate corresponding to the Dot projector and infrared camera needs to screen the window. The size can refer to the FOV of each device in the drawing provided by our company, or according to the actual product structure, the unilateral expansion is 0.5mm on the basis of meeting the field Angle of the device.
   c) Opal pass rate:
      i. Dot projector Transmission area: 800-1050nm band, global minimum transmittance Tmin 92%.
      ii. Infrared camera light transmittance area: 800-1050nm band, global minimum transmittance Tmin 92%.
      iii. Color camera light transmission area: 400-780nm band, global minimum transmittance Tmin 92%.
   d) It is suggested to conduct AF coating treatment on the outer surface of the protective cover plate to prevent the fingerprint and oil pollution in the actual use scenario from affecting the product effect.
2. Structural dimension requirements of the protective cover plate:
   a) When the material is PC / PMMA, the thickness design is above 1.5mm to prevent force deformation.
   b) When the material is glass, the thickness design needs to be at 0.3-1.0mm.
   c) The air clearance between the protective cover plate and each optical device is <0.5mm.
   d) Plane requirement of protective cover plate: <0.005mm.
3. Instructions for fingerprint and oil prevention:
   a) In the process of assembling HP60C into the whole machine, the surface of each optical device should pay strict attention to dust prevention and antifouling.
   b) When the whole machine is used, the outer surface of the protective cover plate should be clean, so as not to affect the product effect.
4. If there is a protective film on the outer surface of the protective cover plate, it is necessary to hollow out the window area of the corresponding two devices on the protective film, otherwise the light transmittance will be seriously affected.

7 ELECTRONIC DESIGN

7.1 Power Supply and Power Consumption

HP60C original deep camera product is powered by USB, the laser peak current is high, must be powered by USB interface above 5V/1.5A. A current below 5V/1.5A may cause a failure to start the device. When the original deep camera is working, ensure that the pressure drop of the USB data line is <0.3V.

Suggestion: The client motherboard reserves the power supply of the 3D original deep camera up to 5V/2.5A design to ensure the later adaptation and product life cycle.

CHART 9 POWER CONSUMPTION TABLE

Precondition	Work average power consumption	On standby	Unit
Power dissipation	1.5 （Max）	0.5	W
Voltage	5.0	5.0	V
Current	0.30 （Max）	0.1	A

7.2 ESD Handling Recommendations

The original deep camera belongs to an ESD sensitive device, and ESD protection should be done in the process of production, transportation, assembly and use, as follows：

1. Operators are recommended to wear the ESD antistatic bracelet throughout the production process.
2. The original deep camera is recommended to be placed in an ESD antistatic bag for transport or transfer.

7.3 Wire Material Recommendations

The communication of the original deep camera relies on the high-speed USB 2.0 signal. In order to ensure the stability and reliability of the signal transmission, it is suggested that the client make the wire according to the requirements.

Shielding: the first layer of shielding, the outer shielding metal net needs to wrap the whole line, it is recommended that the density is not less than 7 mesh, and connected with the metal shell of the two interfaces. The second layer of shielding, it is recommended that there is a layer of aluminum foil wrapped in the outer shielding metal net, aluminum foil and the metal mesh contact conduction.

Transmission line material: outer metal shielding network, USB 2.0 group inland line and other signal transmission line material recommendations are tin copper.

Thickness of transmission line: USB signal line recommended to use 28 # line, not less than 30 #, power line and ground line recommended to use 22 #, not less than 24 #.

8 SOFTWARE SDK

Provided Android, Windows, Linux platform related SDK.

Please contact the relevant sales staff for the latest SDK.

9 APPENDIX

Connect the original deep camera to the client motherboard. Note:

1. It is suggested that the USB power supply interface of the customer motherboard connected to the original deep camera should be reserved for greater than 5V&2.5A. In this way, it can be used normally under peak conditions, and it is also conducive to the compatibility of later product iteration.
2. For the selection of USB wire, the client needs to carefully evaluate the wire to ensure that there will be no unstable factors caused by the length, material and thickness of the wire. Please refer to the wire recommendations in the product specification for more details.
3. Structural design, heat dissipation design, and electronic design (including electromagnetic interference, etc.) please communicate with relevant engineers of Anjiang in advance in order to improve the product design.
4. The client motherboard is recommended to choose 4 cores (Cortex-A17, main frequency 1.8GHz) or above. Recommended for 2GB RAM or above.

10 REVISION

Date	Version	Content
2022-06-30	1.0	The 1st release