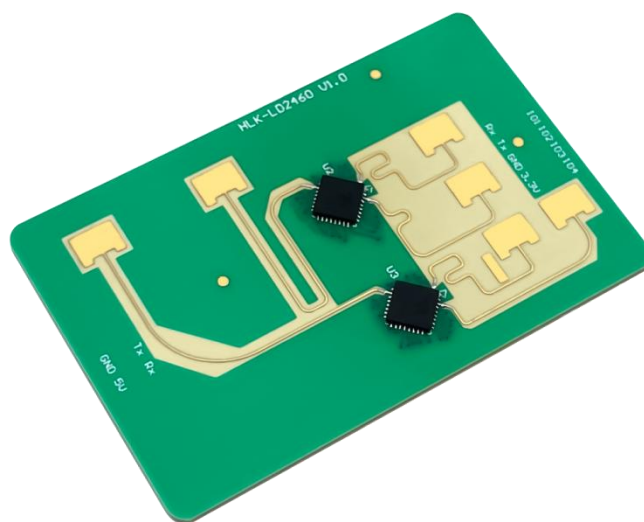




Shenzhen Hi-Link Electronic Co.,Ltd

HLK-LD2460

**Multi target trajectory tracking
module
instructions**



1. Product Overview

HLK-LD2460 is a 24GHz millimeter wave radar product used for human perception, with both distance and angle testing functions. It consists of two 1-transmitter and 2-receiver millimeter wave radar chips, a high-performance microstrip antenna, a high-performance MCU, a high-performance Bluetooth SOC, and peripheral auxiliary circuits; By using FMCW waveform, 3-5 human targets can be accurately identified and their positions can be estimated. This product can be used in home, office, hotel and other scenarios to achieve precise sensing of multiple movements, micro movements or stationary human bodies.

2. Specification Parameters

2.1. function characteristics

Serial Number	project	Function Description	index
1	Number of people tested	The number of people that this module can detect	When a person maintains a sitting or standing position within the radar field of view, at least 3 people can be detected; Sports human body, can detect up to 5 people
2	Detection range	The detection distance and conditions of this module in bare board state	① Dynamic human body: within $\pm 50^\circ$, distance $\geq 6\text{m}$; $\pm 50^\circ \sim \pm 60^\circ$, distance $\geq 5.5\text{m}$ ② Static human body: Within $\pm 50^\circ$, distance $\geq 5\text{m}$; $\pm 50^\circ \sim \pm 60^\circ$, distance $\geq 4.5\text{m}$
3	range resolution	The minimum distance distinguished by this module	0.75m
4	distance accuracy	The absolute error of this module in distance	$\leq 0.3\text{m}$
5	Horizontal detection angle	The maximum horizontal angle that this module can detect	120°
6	Vertical detection angle	The maximum vertical angle that this module can detect	90°
7	angular	The minimum angle	40°

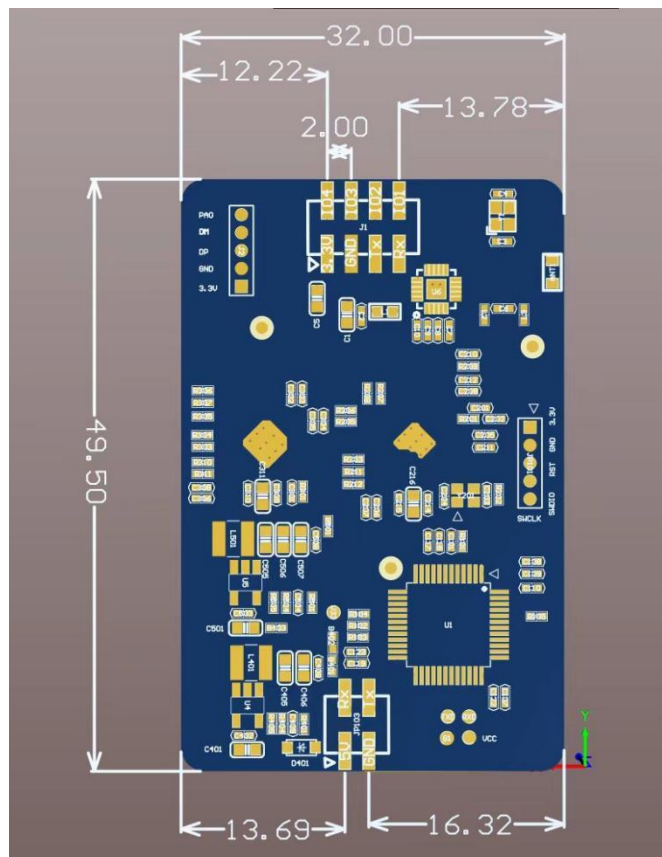
	resolution	distinguished by this module	
8	Angle accuracy	The absolute error of this module in terms of angle	$\leq 5^{\circ}$
9	OTA function	Online upgrade function	support
10	Motion trigger time	Refers to the detection time during human movement	0.5s
11	Existence of perception time	Refers to the detection time when a person is stationary	$\leq 30s$

2.2. Electrical characteristics

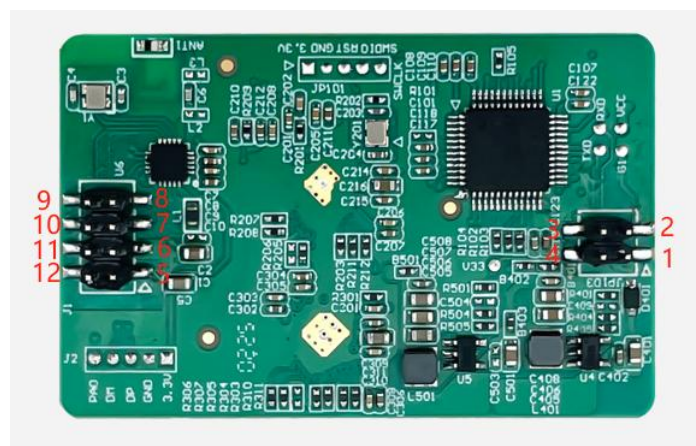
Serial Number	project	index
1	Working frequency band	24GHz -24.25GHz
2	Working bandwidth	250Mhz
3	EIRP	13dBm
4	Modulation Type	FMCW (Frequency modulated continuous wave)
5	working voltage	5V
6	average current	$\leq 250mA$
7	operation temperature	-40°C~85°C
8	storage temperature	-40°C~85°C

3. Module size and pin specifications

3.1. Module dimension annotation



3.2. Pin Description



Module pin definition

PIN Serial Number	name	IO Type	function	describe
1	5V	PWR	power input	DC5V
2	GND	GND	GND	GND
3	Tx1	O	Serial port 1 output	-
4	Rx1	I	Serial port 1 input	-
5	VDD33	PWR	power input	3.3V/NC, Not connected during non debugging
6	GND	GND	GND	GND
7	Tx2	O	Serial port 2 output	Radar data reporting and command response
8	Rx2	I	Serial port 2 input	Command reception
9	IO1	I/O	GPO1/Reserved	-
10	IO2	I/O	GPO2/Reserved	-
11	IO3	I/O	GPO3/Reserved	-
12	IO4	I/O	GPO4/Reserved	-

Table 1 Definition of Radar Pin

In order to receive serial data normally, the serial port needs to be grounded together with the module.

3.3. Using a wiring diagram

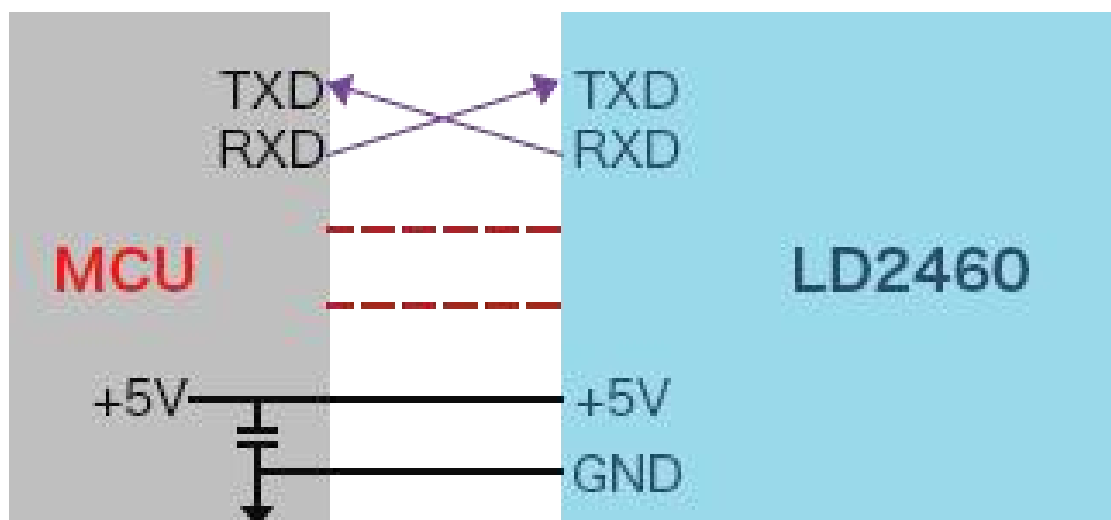


Figure 4 Schematic diagram of the connection between the radar module and peripherals

4. Main functions and performance

4.1. Working range of radar module

The beam coverage range of HLK-LD2460 radar module is shown in Figure 5. The radar coverage range is a three-dimensional fan-shaped area with a horizontal angle of 90° and a vertical angle of 50° .

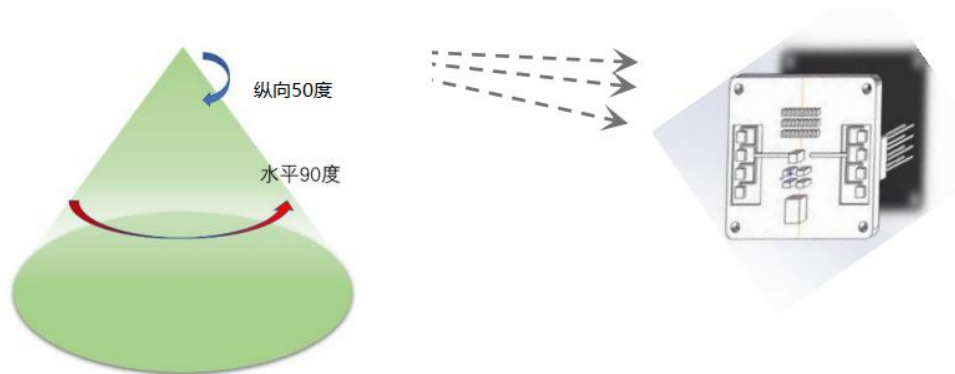
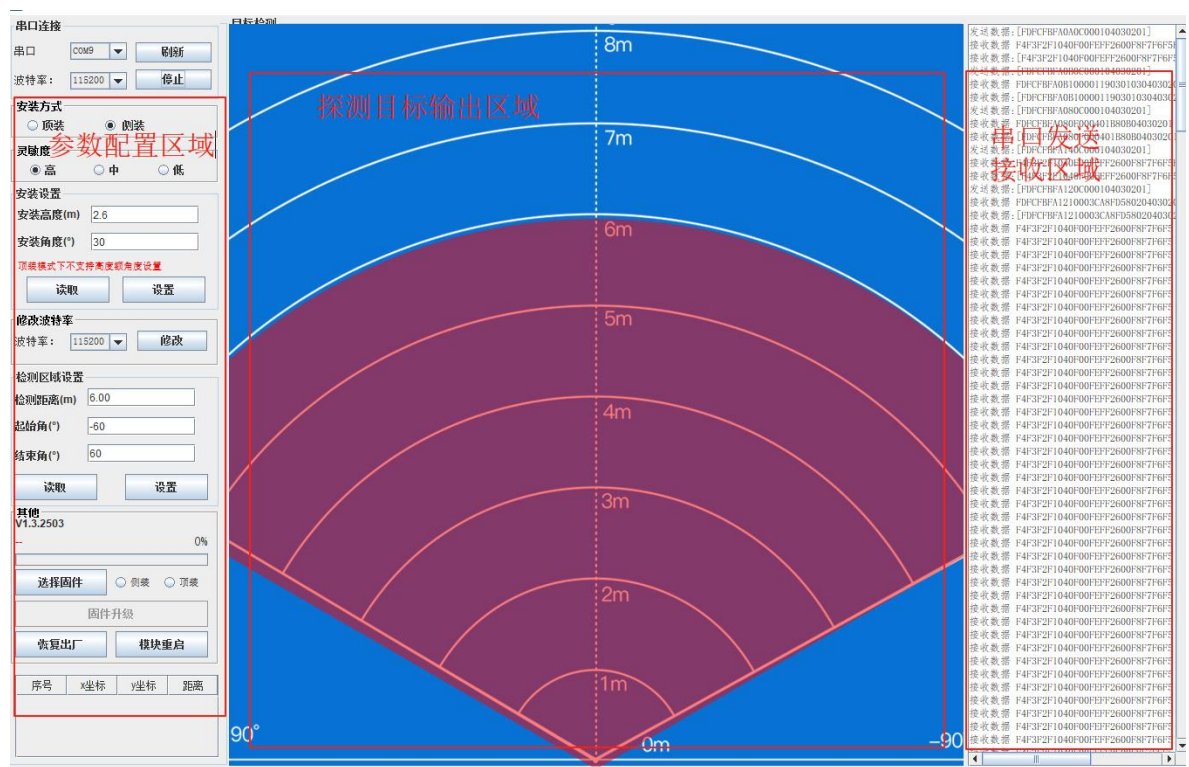


Figure 5

Schematic diagram of HLK-LD2460 radar coverage area

4.2. Main functions

Testing the radar separately requires the use of TTL serial port tools and testing upper computer software. The upper computer can display relevant information such as the number and location of detected targets.



The detection data and parameter configuration of the upper computer tool synchronization module are mainly divided into the following three parts

1. Radar parameter configuration

Installation method: Top mounted/Side mounted

Set according to the actual placement of the module to make the detection more accurate (refer to the installation method diagram below)

Sensitivity: high, medium, low

Configure the radar detection sensitivity level, the higher the sensitivity. If false targets or poor detection results occur during use, adjustments can be made appropriately

Installation settings: Unique parameters for side installation, actual installation height and angle during module side installation (recommended installation height of 2.6m, installation angle of 30 °)

Serial port baud rate: Configure module serial port baud rate

Detection area setting:

(1) Detection distance, the farthest detection distance of the radar is up to 6m

(2) Starting angle, radar detection range setting, used together with the ending angle below

(3) End angle, radar detection range setting, used together with upper beam angle

OTA upgrade: Upgrade the top and side firmware of the radar

Factory reset: Reset radar parameters (sensitivity, installation height, detection range, baud rate, etc.)

Module restart: Module restart

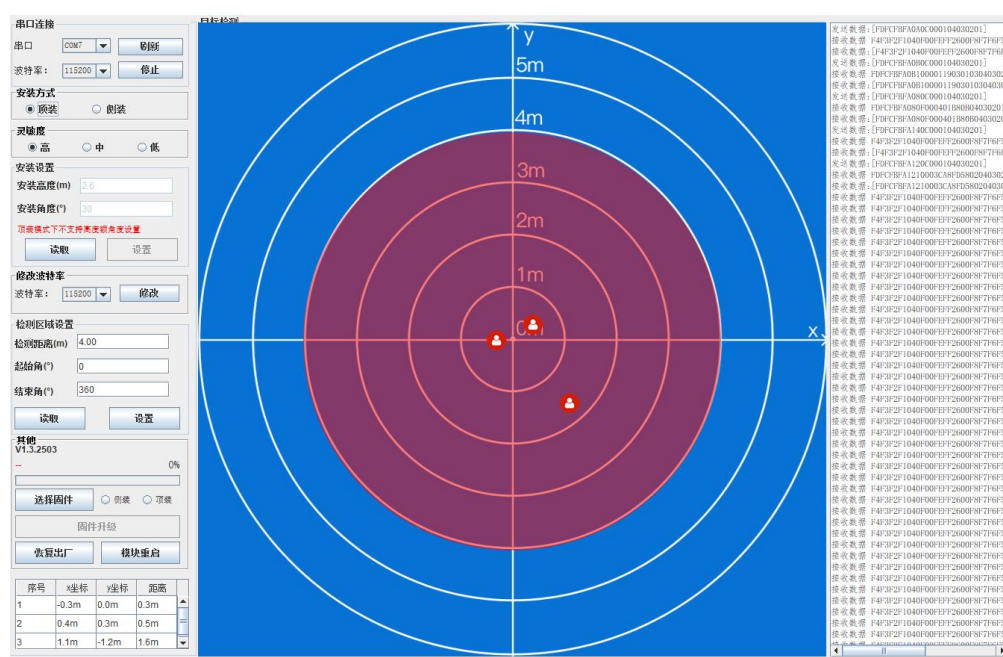
2. Target detection output

Display the current detection range map of the radar, as well as the number and location of detected targets.

3. Serial port receiving&sending

Printing of data received and sent through the serial port section facilitates troubleshooting.

Top mounting method tool diagram:



5. Communication Protocol

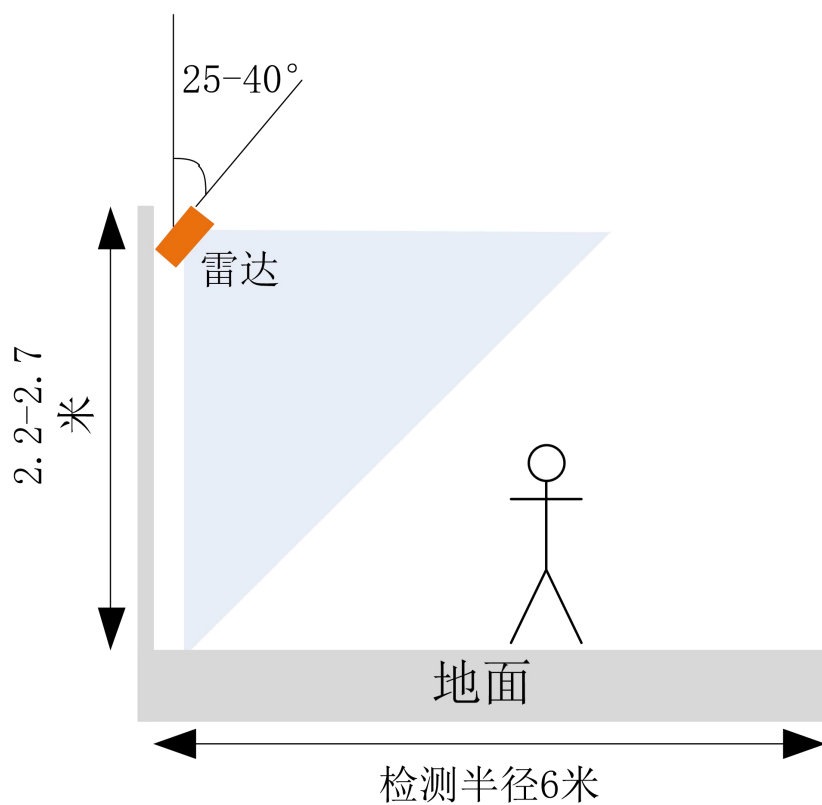
This product outputs monitoring status information through a serial port, with a transmission baud rate of 115200bps, data bits of 8, stop bits of 1, and checksum and flow control of NONE. The transmission data length is variable and varies based on the number of detected targets. For details, please refer to the HLK-LD2460 Serial Port Protocol.

6. Radar installation method

There are two recommended installation methods for this radar module: side mounted installation and top mounted installation.

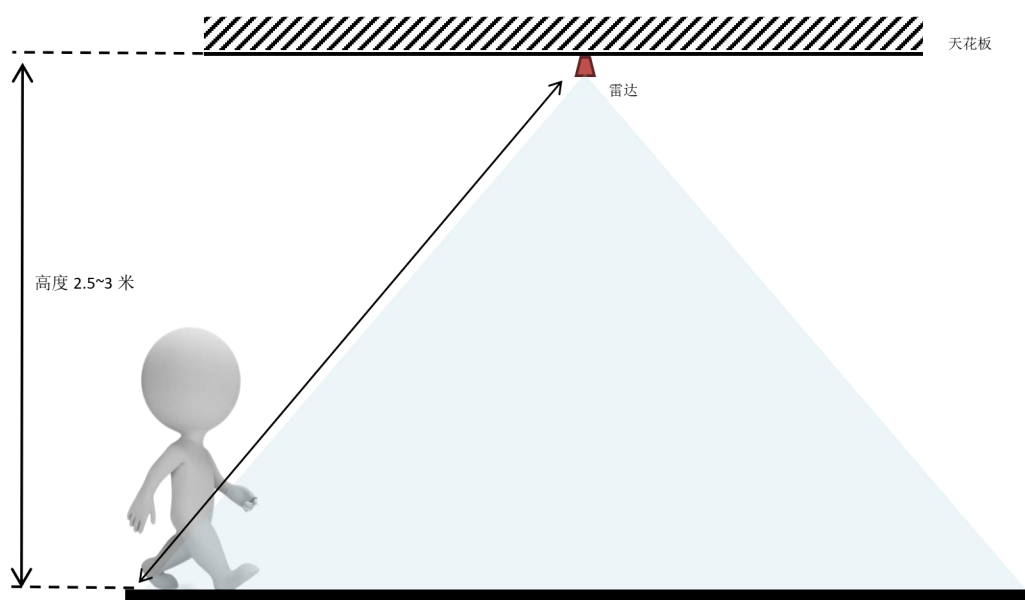
6.1. Side Hanging Installation

The side hanging installation method is shown in the following figure. The recommended angle between the module and the wall is 25-40 °, and the recommended installation height is 2.2-2.7 meters. Note that the radar parameters need to be configured through the upper computer based on the actual installation height and angle.



6.2. Top installation

The side hanging installation method is shown in the following figure, with the module horizontal to the wall. It is recommended to install it at a height of 2.5-3m.



7. Explanation of Coordinate System

7.1 Explanation of Side mounted Coordinate System

When installed on the side, the X-axis range is $[-6,6]$, the Y-axis range is $[0,6]$, the front of the radar antenna surface is in the positive Y-axis direction, and the right side of the radar antenna surface is in the positive X-axis direction. The normal direction is 0 degrees, the negative X direction is a negative angle, the positive X direction is a positive angle, and the angle range is $[-60^\circ, 60^\circ]$. The schematic diagram of the side mounted coordinate axis is shown in Figure 8.

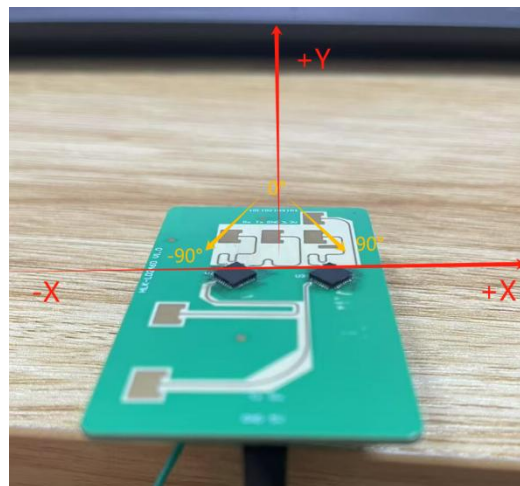


Figure 8.

Schematic diagram of side mounted radar coordinates

7.2 Explanation of Top mounted Coordinate System

When installed on top, the X-axis range is $[-4,4]$, the Y-axis range is $[-4,4]$, the right side of the radar antenna surface is the positive X-axis direction, and the lower side of the radar antenna surface is the positive Y-axis direction. The positive direction of X is 0 degrees, and the angle range is $[0^\circ, 360^\circ]$. The schematic diagram of the top mounted coordinate axis is shown in Figure 9.

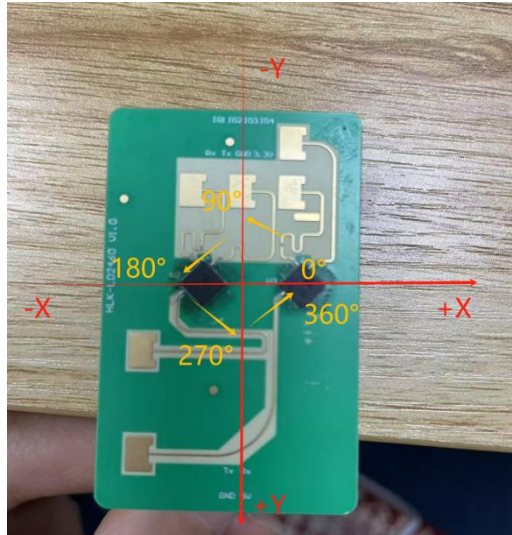


Figure 9.

Schematic diagram of top mounted radar coordinates

8. Typical application modes

8.1. Smart Home Appliance Applications

The radar is installed inside household appliances and can monitor the real-time status of personnel within the detection range of the radar; The device adjusts its working mode (working, low power consumption, standby, shutdown, etc.) in real-time or quasi real time based on radar detection results (manned/unmanned), achieving home appliance intelligence.

Conventional household appliances include:

- ✧ Smart TV
- ✧ Smart speaker
- ✧ Intelligent air conditioning
- ✧ Intelligent toilet
- ✧ Intelligent door lock
- ✧ Other smart home appliances

8.2. Home Place Applications

For home, hotel, office, bathroom and other places, this product detects in real time whether there are moving targets, the direction of personnel movement (approaching or away), and whether there are personnel in the place, thereby achieving functions such as security, electrical control, and personnel monitoring. This scheme has high sensitivity and effectively avoids privacy issues; By using IoT transmission methods and means, combined with relevant IoT support platforms, effective applications can be achieved in relevant places.

Typical application scenarios include:

- ✧ Home security
- ✧ Hotel management and monitoring
- ✧ Monitoring of community healthcare personnel
- ✧ Office monitoring

8.3. Application of energy-saving control

Based on functions such as motion target detection and biometric detection, this product can be applied to energy-saving control. The main scenarios are as follows:

- ✧ Energy saving household appliances
- ✧ Office electrical energy-saving control
- ✧ Energy saving control of street lamps

9. Precautions

9.1. Start time

When this module is initially powered on, it is necessary to initialize the internal registers and fully evaluate the environmental noise. Therefore, the stable startup time of the module is about 1 second.

9.2. Effective detection distance

The detection distance of the radar module is related to factors such as target size, motion mode, and usage environment, so fluctuations in the actual detection distance within a certain range are a normal phenomenon.

9.3. Radar Biological Detection Performance

Due to the fact that human respiration and heartbeat belong to ultra-low frequency physical signals, and the human body has weaker reflection of radar signals compared to furniture and appliances, occasional detection failures of radar are a normal phenomenon.

9.4. Power Supply

The radar module has higher requirements for power quality than conventional low-frequency circuits. When supplying power to the module, it is required that the power supply has no obvious burrs or ripples. In order to ensure the normal operation of the VCO circuit inside the module, the input voltage range of the power supply is 4.2V~5.4V, the power supply ripple should be within 100kHz without obvious spectral peaks, and the peak current

can support 180mA.

10. Common Problems

Interference factor: Radar belongs to electromagnetic wave detection sensors, and active non living organisms can cause false alarms. Usually, the movement of objects such as electric fans, pets, vegetation, curtains, and internal motors of air conditioners can cause misjudgment.

Non interfering factors: Radar electromagnetic waves can penetrate human clothing, curtains, thin wooden boards, and glass.

11. Disclaimer

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