Gravity: Digital 10.525GHz Microwave Sensor

Overview

The digital microwave sensor uses doppler radar to detect moving objects using microwaves. This differs from the method used by a regular infrared (IR) sensor as the microwave is sensitive to a variety of objects that can reflect it's wavefpr,, and its sensor readings are not affected by ambient temperatures.
This type of sensor is widely used in industrial, transportation and civil applications such as measuring a vehicle's speed, measuring liquid levels, automatic door motion detection, automatic washing, production line material detection, car reversing sensors, etc.
The microwave detection method has the following advantages compared with other detection methods:

Able to detect objects without physical contact
Readings not affected by temperature, humidity, noise, air, dust or light - suitable for harsh environments
Strong resistance to radio frequency interference
Low output, not harmful to the human body
Microwaves have a wide detection range and velocity equal to the speed of light
Supports non-life-class object detection

Order Code

Order Code	Brand	Description
E33005-001	DFRobot	Gravity: Digital 10.525GHz Microwave Sensor

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Specification

- Working Voltage: 5V +/- 0.25V
- Working Current(CW): 60mA max., 37mA typical
- Size: 48.5x63mm
- Emission:
- Detection Distance: 2-16M continuously adjustable
- Emission Frequency: 10.525 GHz
- Precision Frequency Setting: 3MHz
- Output Power (Minimum): 13dBm EIRP
- Harmonic Emission: < -10dBm
- Average Current: 2mA typ.
- Pulse Width (Min.): 5uSec
- Load Cycle (Min.): 1%
- Reception:
- Sensitivity (10dB S/N ratio) 3Hz to 80Hz bandwidth: -86dBm
- 3Hz to 80Hz Bandwidth Clutter: 10uV
- Antenna Gain: 8dBi
- Vertical 3dB Beam Width: 36 degrees
- Level 3dB Beam Width: 72 degrees

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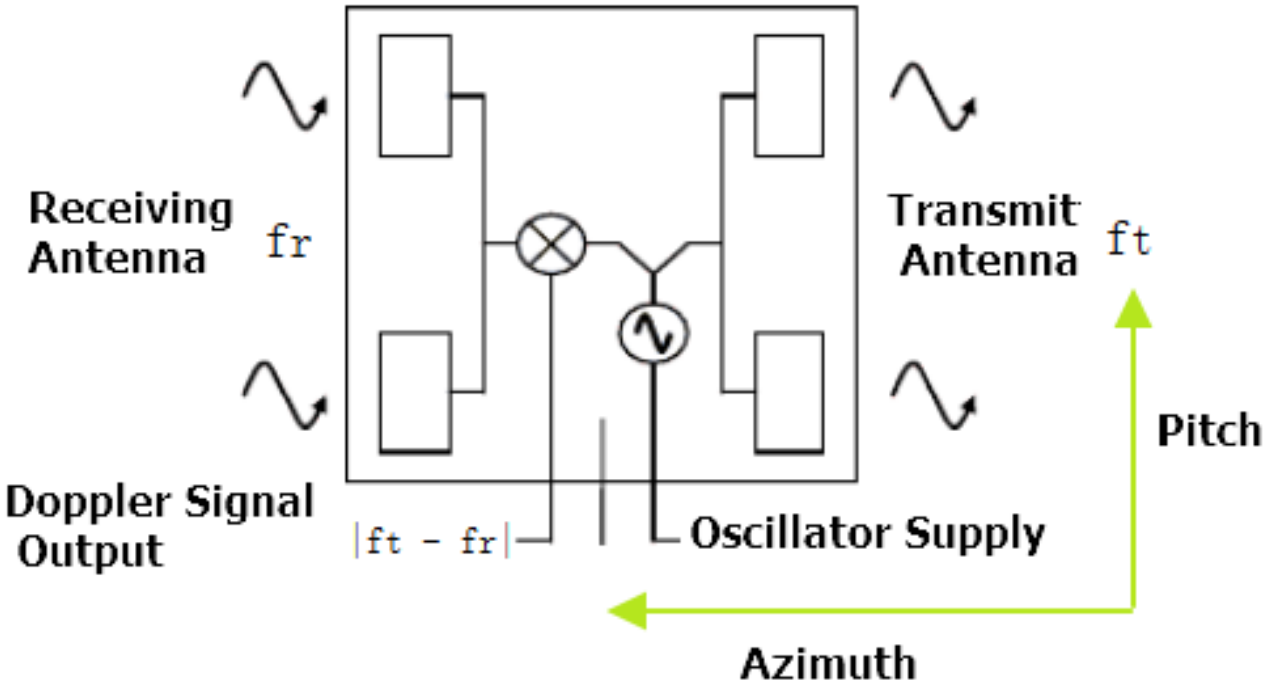
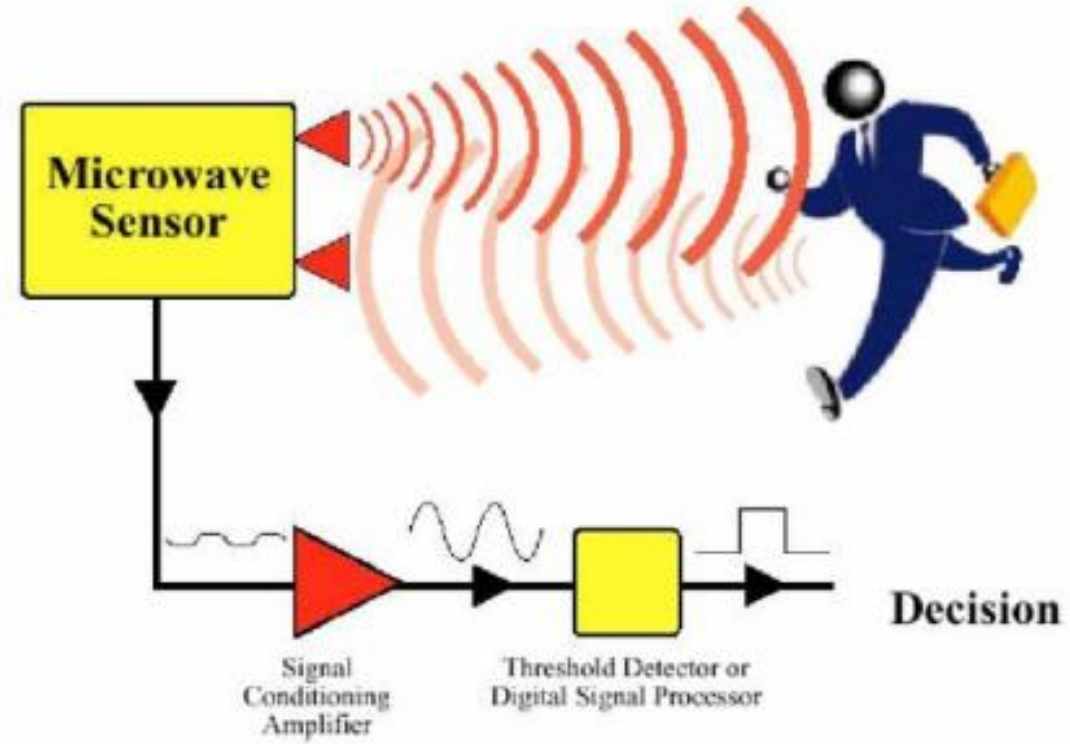
Antenna



Signal processing

The following diagram demonstrates the working principle of the sensor module. It works by amplifying a tiny signal which is received by the microwave sensor, and then through the comparison circuit it converts the signal into a square signal with a digital output of 0 or 1 which an Arduino or other micro controller can easily handle.



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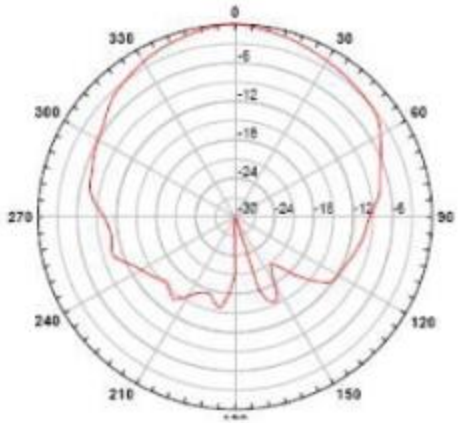
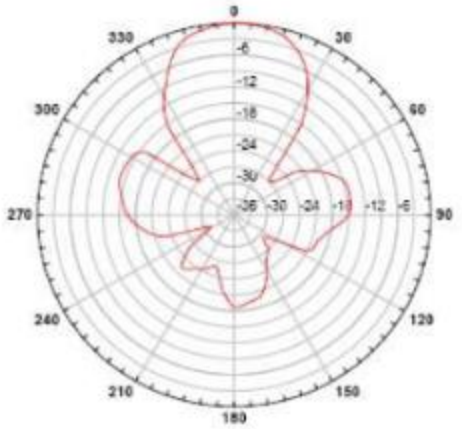
Signal detection range

Detection Angle: The angle of detection is 72 degrees with the antenna in a parallel direction (azimuth) The vertical (pitch) direction of the antenna is 36 degrees.



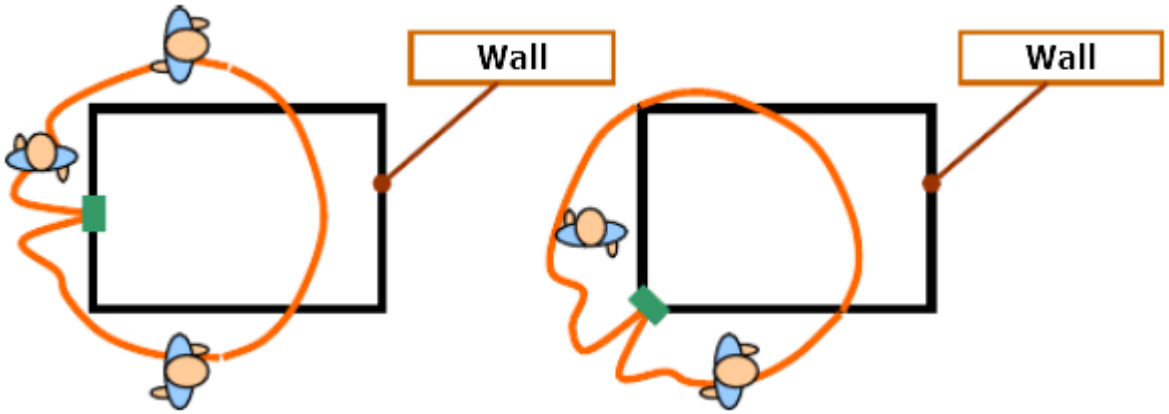
Azimuth



Pitch

Install

Microwaves can penetrate through walls. So sometimes it has inaccuracies when microwaves penetrate through outside walls and detect moving objects in non-target areas. Be sure to choose an installation location to avoid this!



Indicator and output status

When the microwave sensor does not detect moving objects, the indicator LED remains off. When the sensor detects moving objects, the LED will turn on and the output level will be change from HIGH to LOW. The LED will automatically turn off about after 0.5s and the output level will change from LOW to HIGH. If the microwave sensor detects continuously moving objects the LED will keep flashing on and off. The output level will fluctuate between HIGH and LOW until the object stops moving.

Distance Adjustment

The microwave sensor has a distance range of 2-16m. The detection distance can be adjusted using the potentiometer. If it is turned in the direction on MIN, the detection distance decreases. If it is turned in the opposite direction, the range increases.

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Comparison with IR sensor

Microwave Sensor	IR Sensor	
Trigger Mode	Movement	Infrared Reflection
Temperature Influence	No Influence	Over 40 degrees C can inhibit function
Object Penetration	Able to penetrate any non-metallic object	Unable to penetrate
Ambient Environmental Requirements	No requirements	Dusty or brightly lit environments can inhibit function
Working Life	more than 100,000 hours	about 1000 hours
Stability	Very reliable and stable	Induction distance will shorten over time

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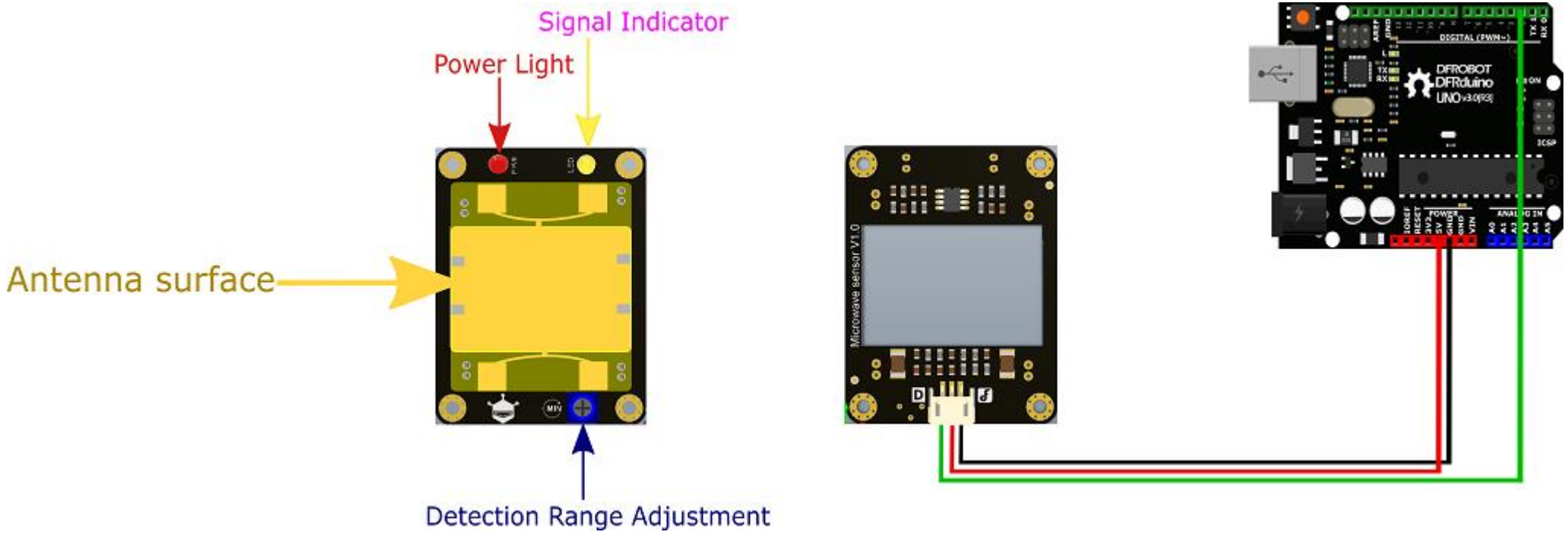
Connection Diagram



Revision History

Date	Revision	Change description
30/10/2025	1.0	Initial release