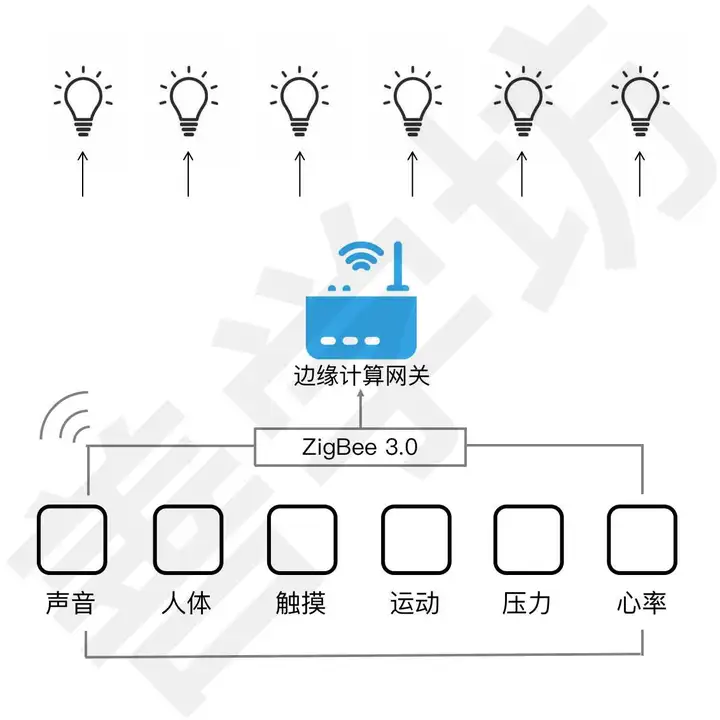
**9.17.2. Multi-sensor detection and lighting alarm system based on ZigBee**

https://zhuanlan.zhihu.com/p/394980004  
  
**1. Field of focus**

[This solution is aimed at smart homes, industrial Internet of Things, smart cities, smart agriculture](https://zhida.zhihu.com/search?content_id=175903731&content_type=Article&match_order=1&q=%E6%99%BA%E6%85%A7%E5%86%9C%E4%B8%9A&zd_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ6aGlkYV9zZXJ2ZXIiLCJleHAiOjE3MjgwNjYxMDcsInEiOiLmmbrmhaflhpzkuJoiLCJ6aGlkYV9zb3VyY2UiOiJlbnRpdHkiLCJjb250ZW50X2lkIjoxNzU5MDM3MzEsImNvbnRlbnRfdHlwZSI6IkFydGljbGUiLCJtYXRjaF9vcmRlciI6MSwiemRfdG9rZW4iOm51bGx9.R8V91up0JHu7ENAxZMEnYUq0NicyKhFU0lGlOZbnPzM&zhida_source=entity) and other fields that have high requirements for communication stability, response speed and communication distance.

**2. Brief description of the technical solution principle**

The technical solution [schematic](https://zhida.zhihu.com/search?content_id=175903731&content_type=Article&match_order=1&q=%E5%8E%9F%E7%90%86%E5%9B%BE&zd_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ6aGlkYV9zZXJ2ZXIiLCJleHAiOjE3MjgwNjYxMDcsInEiOiLljp_nkIblm74iLCJ6aGlkYV9zb3VyY2UiOiJlbnRpdHkiLCJjb250ZW50X2lkIjoxNzU5MDM3MzEsImNvbnRlbnRfdHlwZSI6IkFydGljbGUiLCJtYXRjaF9vcmRlciI6MSwiemRfdG9rZW4iOm51bGx9.5IuTvS3yORA43UzYEQevA6txkXSmp04W07ljBykw0Yo&zhida_source=entity) is shown below:



**Technical principle overview:**

[The human-computer interaction](https://zhida.zhihu.com/search?content_id=175903731&content_type=Article&match_order=1&q=%E4%BA%BA%E6%9C%BA%E4%BA%A4%E4%BA%92&zd_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ6aGlkYV9zZXJ2ZXIiLCJleHAiOjE3MjgwNjYxMDcsInEiOiLkurrmnLrkuqTkupIiLCJ6aGlkYV9zb3VyY2UiOiJlbnRpdHkiLCJjb250ZW50X2lkIjoxNzU5MDM3MzEsImNvbnRlbnRfdHlwZSI6IkFydGljbGUiLCJtYXRjaF9vcmRlciI6MSwiemRfdG9rZW4iOm51bGx9.PfzG8HDS6fpxlXDPLhdxbPFiItmlC2P_nx5-f0QjHAk&zhida_source=entity) device is equipped with sound sensors,[human infrared sensors](https://zhida.zhihu.com/search?content_id=175903731&content_type=Article&match_order=1&q=%E4%BA%BA%E4%BD%93%E7%BA%A2%E5%A4%96%E4%BC%A0%E6%84%9F%E5%99%A8&zd_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ6aGlkYV9zZXJ2ZXIiLCJleHAiOjE3MjgwNjYxMDcsInEiOiLkurrkvZPnuqLlpJbkvKDmhJ_lmagiLCJ6aGlkYV9zb3VyY2UiOiJlbnRpdHkiLCJjb250ZW50X2lkIjoxNzU5MDM3MzEsImNvbnRlbnRfdHlwZSI6IkFydGljbGUiLCJtYXRjaF9vcmRlciI6MSwiemRfdG9rZW4iOm51bGx9.c7RauTPXk31dEILlsDxIWMMLNWun-4O1EY3RfEmUUGk&zhida_source=entity) , touch buttons, pressure sensors, heart rate sensors, and motion sensors. It can sense sound, human body, touch, pressure, heart rate, and motion, and complete the recognition process, and send the recognition results to the edge computing gateway through ZigBee wireless communication.

The ZigBee gateway is equipped with a ZigBee 3.0 module and multiple LED lights, which can receive the identification results sent by the human-computer interaction device and make corresponding responses based on the identification results. The response methods are:  
1. If the sound sensor detects a loud sound in the environment, the light will turn on, and if there is no sound for 10 seconds, the light will turn off;  
2. If the human body sensor detects that someone is approaching, the light will turn on, and if no one is approaching for 10 seconds, the light will turn off;  
3. In the light-off state, if the touch button is pressed, the light will turn on, and if it is pressed again, the light will turn off;  
4. In the light-off state, if the pressure sensor is pressed once, the light will turn on, and if it is pressed again, the light will turn off;  
5. If the heart rate is detected to exceed the specified threshold, the light will turn on, and if it is lower than the specified threshold, the light will turn off; 6. If the motion sensor detects that the human-computer interaction device changes from a static or uniform motion state to a general motion state, the light will turn on, otherwise the light will turn off.

**3. Main hardware components and related technical parameters of edge computing gateway**

**Main hardware components**

Zigbee wireless MCU: TI CC2530F256

USB to [serial port chip](https://zhida.zhihu.com/search?content_id=175903731&content_type=Article&match_order=1&q=%E4%B8%B2%E5%8F%A3%E8%8A%AF%E7%89%87&zd_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ6aGlkYV9zZXJ2ZXIiLCJleHAiOjE3MjgwNjYxMDcsInEiOiLkuLLlj6Poiq_niYciLCJ6aGlkYV9zb3VyY2UiOiJlbnRpdHkiLCJjb250ZW50X2lkIjoxNzU5MDM3MzEsImNvbnRlbnRfdHlwZSI6IkFydGljbGUiLCJtYXRjaF9vcmRlciI6MSwiemRfdG9rZW4iOm51bGx9.rloi7e7o-eNcm_EvloHczRAzIkFbtHKEIdVJwWAZ3rQ&zhida_source=entity) : CH340

**Main technical parameters**

ZigBee wireless communication distance: The communication distance between adjacent nodes in open space is about 150 meters

ZigBee wireless communication rate: 240kb/s (theoretical value)

ZigBee electromagnetic wave frequency: 2.4GHz

ZigBee [application protocol](https://zhida.zhihu.com/search?content_id=175903731&content_type=Article&match_order=1&q=%E5%BA%94%E7%94%A8%E5%8D%8F%E8%AE%AE&zd_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ6aGlkYV9zZXJ2ZXIiLCJleHAiOjE3MjgwNjYxMDcsInEiOiLlupTnlKjljY_orq4iLCJ6aGlkYV9zb3VyY2UiOiJlbnRpdHkiLCJjb250ZW50X2lkIjoxNzU5MDM3MzEsImNvbnRlbnRfdHlwZSI6IkFydGljbGUiLCJtYXRjaF9vcmRlciI6MSwiemRfdG9rZW4iOm51bGx9.CfZMZ1CxJQmXGw-SkCiwnCLIk8GGTmA7UgZhcoYQii8&zhida_source=entity) version: ZigBee 3.0

ZigBee core protocol version: ZigBee 2007 Pro

ZigBee wireless communication delay: <= 1 second

**4. Main hardware components and related technical parameters of terminal equipment**

**Main hardware components**

Zigbee wireless MCU: TI CC2530F256

USB to serial port chip: CH340

Sound sensor: Shanxuefang SY01

Human infrared sensor: HC-SR501

Touch Button: TTP223 1-bit Touch Sensor Module

Pressure sensor: BE120-3AA foil resistor

Heart rate sensor: Shanxuefang XL01

[Motion sensor](https://zhida.zhihu.com/search?content_id=175903731&content_type=Article&match_order=3&q=%E8%BF%90%E5%8A%A8%E4%BC%A0%E6%84%9F%E5%99%A8&zd_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ6aGlkYV9zZXJ2ZXIiLCJleHAiOjE3MjgwNjYxMDcsInEiOiLov5DliqjkvKDmhJ_lmagiLCJ6aGlkYV9zb3VyY2UiOiJlbnRpdHkiLCJjb250ZW50X2lkIjoxNzU5MDM3MzEsImNvbnRlbnRfdHlwZSI6IkFydGljbGUiLCJtYXRjaF9vcmRlciI6MywiemRfdG9rZW4iOm51bGx9.mIDrH9HRcWA1r4FlA_DegrNh4xvQgmhao9BDWto8ghQ&zhida_source=entity) : To be determined

**Main technical parameters**

ZigBee wireless communication distance: The communication distance between adjacent nodes in open space is about 150 meters

ZigBee wireless communication rate: 240kb/s (theoretical value)

ZigBee electromagnetic wave frequency: 2.4GHz

ZigBee application protocol version: ZigBee 3.0

ZigBee core protocol version: ZigBee 2007 Pro

ZigBee wireless communication delay: <= 1 second

Sound detection principle: vibration detection

Human body detection principle: Human body infrared detection, when a person enters its sensing range, it outputs a high level, and when a person leaves the sensing range, it automatically delays the high level and outputs a low level

Touch detection principle: capacitive

Pressure detection principle: varistor

Heart rate detection principle: photoelectric reflection

Motion detection principle: To be determined