VENUS TECHNOLOGY AI

AI mattress

Technical presentation

01/07/2021

Version 1.0

General presentation

1. Features

The intelligent vital signs monitoring mat uses multiple sensors to achieve high-precision human detection and monitoring. Our proprietary algorithm is able to monitor human vital signs, presence and movements although the user isn't in direct contact with the mat. We are currently recording: heartbeat, breathing, body movements, presence time, and apnea monitoring.

Sensors data are used to deliver information on the user sleep quality, work and rest habits. Those are essentials for the medical staff to have a better understanding of the patient's condition.

The smart vital sign monitoring mat is capable to transmit its data to a central server using tethered or wireless communication protocols.

2. Application field

Thanks to its mechanical properties and the fact it is sensitive enough to work contact less, the smart vital sign monitoring mat can fit in various monitoring scenarios. The mat can be placed either in bed or on a chair, the continuous health monitoring system will provide sleep analysis and also continuous mental stress analysis.

The system already include early warning and screening and has the possibility to be plugged to a centralized nursing monitor and a sending data or alerts to a remote healthcare platform.

The system's flexibility can meet a large variety of non-contact physical sign monitoring needs.

3. Where to find it

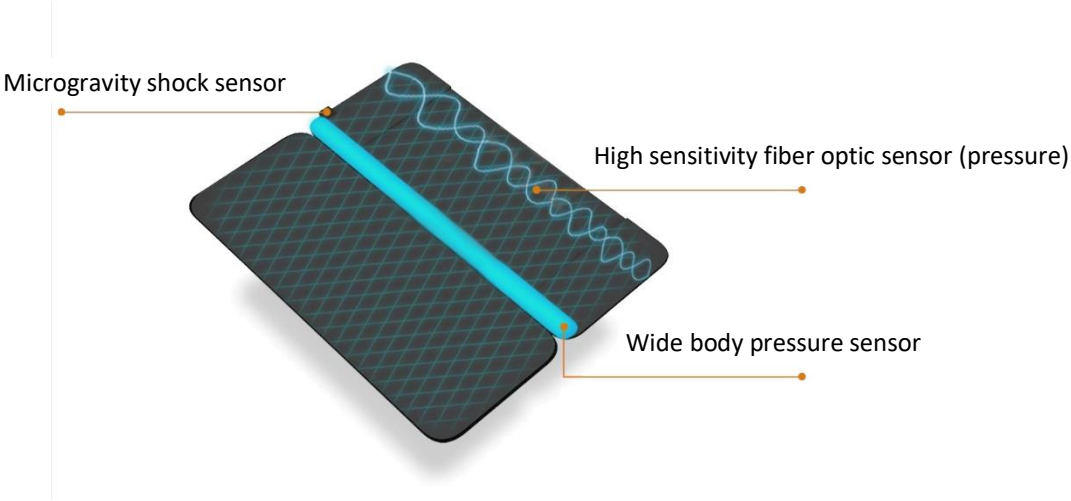
Our purpose is to be able to agglomerate and present global data to medical teams therefor the mat is designed to be placed in multiple daily furniture: sofa, chair, bed and bathroom. Personal or professional facilities can be easily equipped with it such as nursing home, home care for elderly or at risk patients, post-operation patient's bed, high-end offices and home.

Technical specification

1. Information journey

Patient → Array of sensors for data collection → Data transferred to a secure server → Application server or API → Data access / Data analysis → Medical team

2. Data collection



Heart pulse

1. Heart rate
2. Heart shock waveform
3. Alarm for abnormal heart rate changes
4. Cardiovascular disease analysis (in research)

Breathing

1. Respiratory waveform
2. Respiratory disease analysis (In research)

Behavior

1. Wake up and get out of bed alarm
2. Schedule
3. Sedentary and sitting posture
4. Turnover and coughing
5. Abnormal body movements

Others

1. Sleep analysis
2. Mental stress analysis
3. Bedsore reminder for pressure ulcer prevention
4. Health trend analysis

3. Data transfer

WiFi:

- All our products are equipped with
- 2.4G WIFI networking
- Transmission functionalities

Bluetooth:

- All our products are equipped with
- Bluetooth BLE transmission

UART:

- All our products can be modified to support
- UART transmission

Cellular:

- All our products can be set to use cellular network as a data transfer method

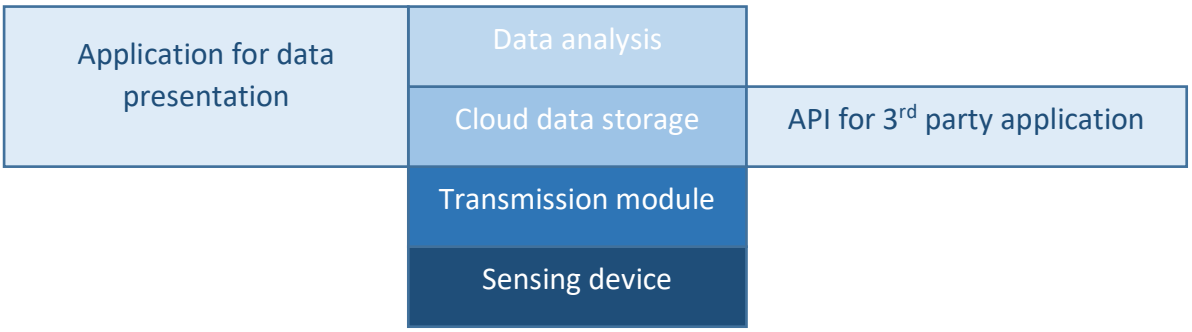
4. Data analysis and presentation

Different environment will challenge the sensor monitoring and data interpretation. In order to maintain a high level of accuracy we base our analysis on sensor data fusion and long term data monitoring.

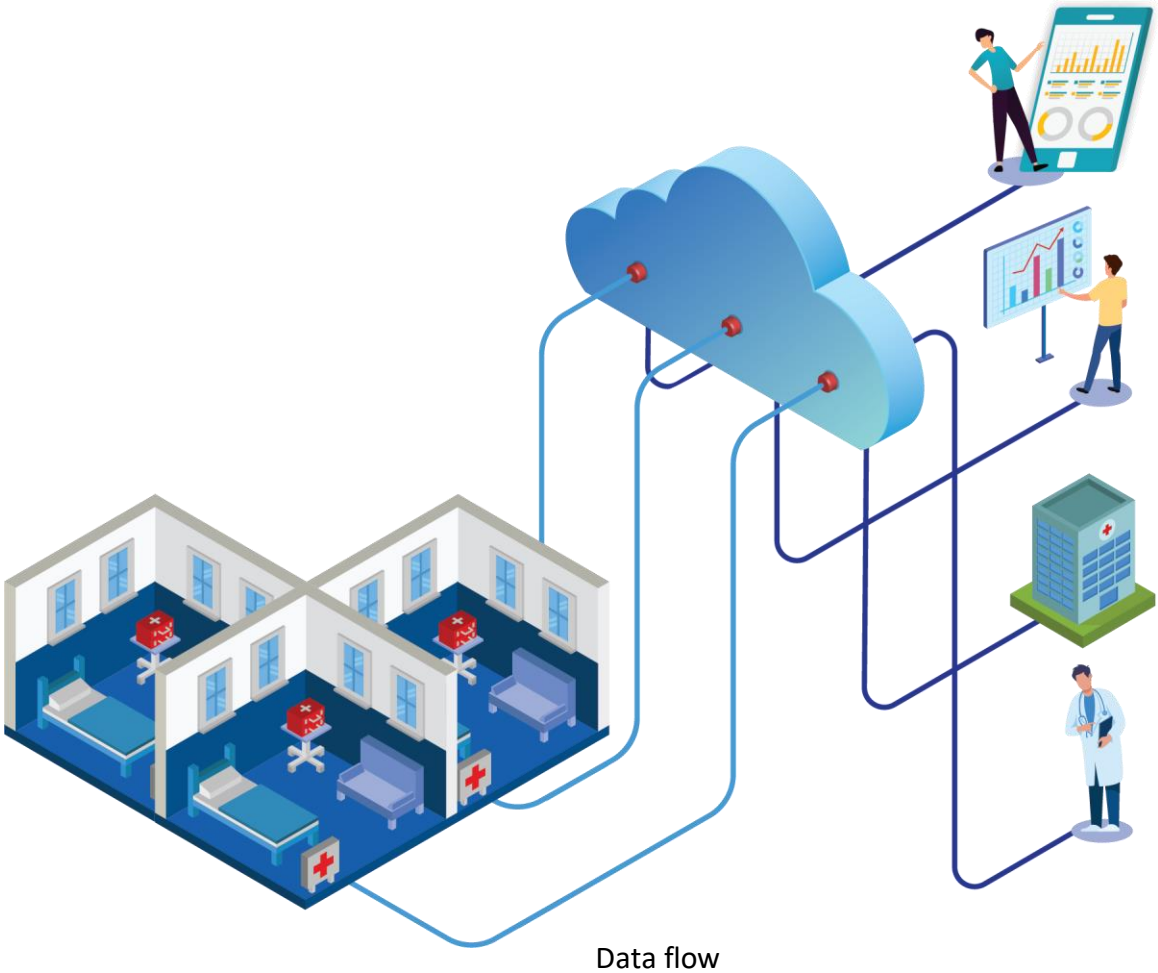
Angle adaptation, so we keep accurate record when the user is rocking on the bed.

Posture detection, different sleeping positions have been defined so the system keep accurate reading no matter how the user sleeps.

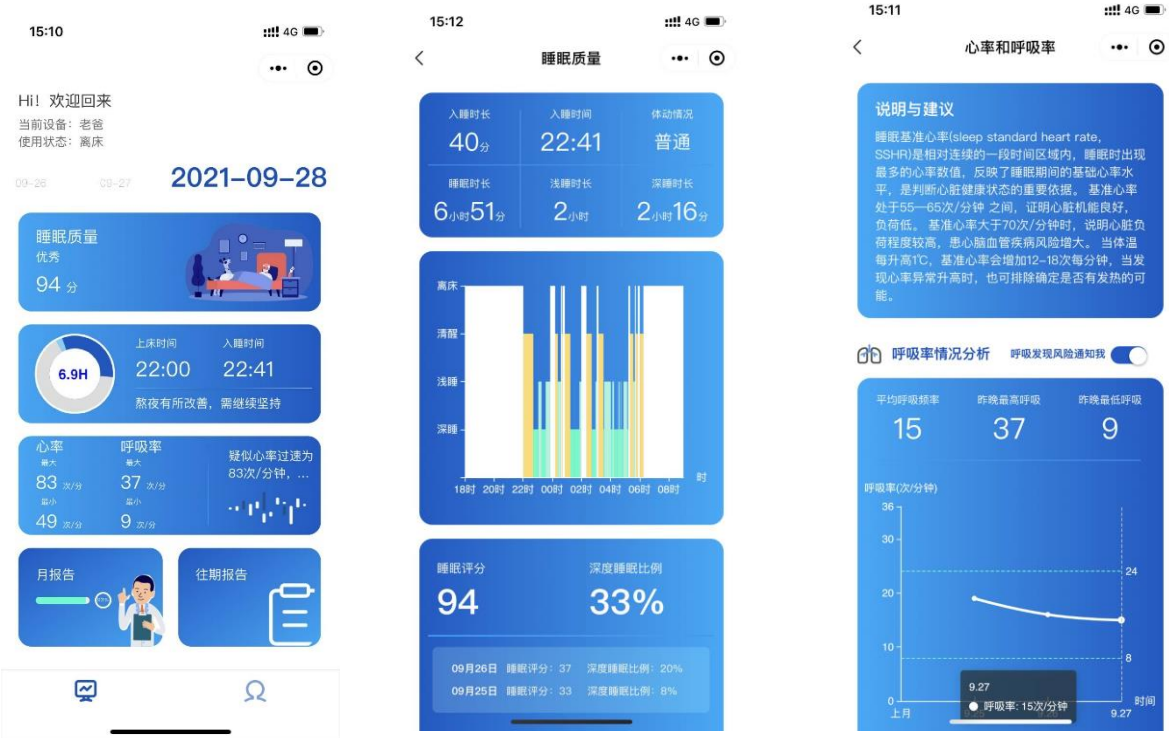
Morphology adaptation, we are able to accurately monitor vital signs for various body type weighting from 1.5kg to 200kg.



Applicative stacks provided



Data flow



Mobile application

Population targeted

1. Which institutions benefit from it

- Elderly pension
- Physical rehabilitation institution
- Psychiatric hospital
- Drug rehabilitation center
- Homecare
- Corporate Office
- Institutions

2. User population

- Elderly
- Bedridden
- Drug addicts
- Firefighters
- Coal miners
- Truck driver
- Military
- All other population that need constant activity monitoring

Benefits

1. Patient wellbeing

The system allows patient to go home earlier in their rehabilitation process thanks to the remote tracking. Therefore the cost of rehabilitation is lowered as hospital rooms are occupied for a short period of time.

2. Centralization

The platform will allow medical staff to monitor multiple patients' status at the same time, limiting the number of required staff per patients.

3. Information

Cloud data and long term monitoring give a better understanding of the patient behavior profile. A more efficient and customized care can be provided. Detecting micro episodic artefacts is critical for preventing major heart and brain blood pressure problems.

4. Reaction

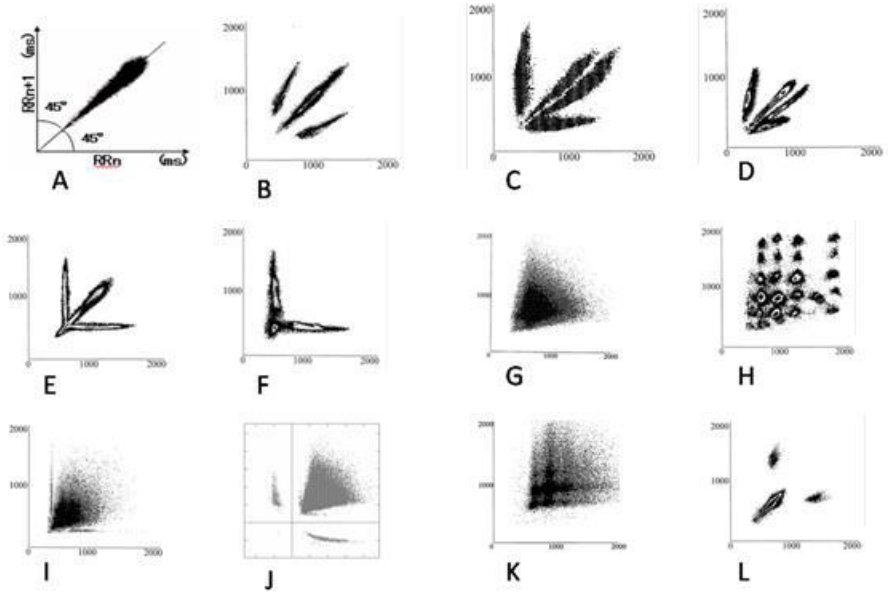
Designed in alarm system improve the intervention time in case a life threatening event occurs.

5. Implantation

Low cost and high accuracy of the sensors make the mat acceptance by the institution easy. Its mechanical design and adaptability to different scenario insure an easy deployment.

Medical data reference

1. Heart rate monitoring analysis

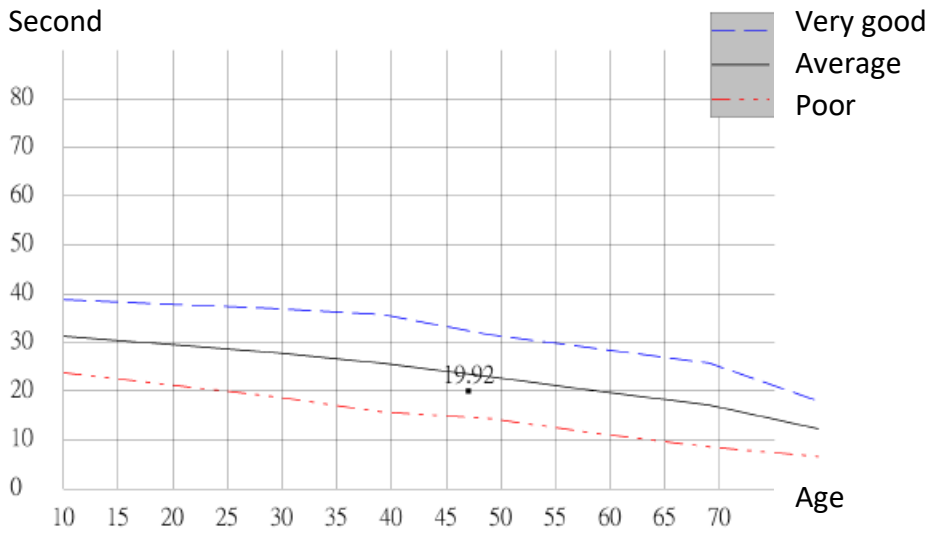


24-hour heart rate data

(A): Is a normal sinus rhythm
(B): Sinus combined with supraventricular premature beats
(C): Sinus rhythm with premature ventricular beats
(D): It is sinus rhythm with supraventricular premature beats with intraventricular differential conduction
(E): Is the sinus rhythm combined with ventricular premature beats triple rhythm
(F): Dual law of endless premature ventricular beats
(G): Is persistent atrial fibrillation
(H): It is a persistent atrial flutter, the atrioventricular conduction is in different proportions
(I): It is atrial fibrillation with short combined rhythm inter-period ventricular premature beats
(J): It is a four-quadrant figure, it is atrial fibrillation with indoor differential conduction
(K): Is atrial fibrillation with atrial flutter
(L): Sinus rhythm with second degree sinus block

2. Autonomic nervous system analysis

According to the average standard deviation of HRV (SDNN), sympathetic nerve activity (LF) and parasympathetic nerve activity HF) can reflect the body status and functions such as, mental stress, immune system and other conditions, specific conditions such as myocarditis, arrhythmia or sudden death, myocardial infarction, primary hyperemia pressure, coronary heart disease, diabetic nerve damage, etc., it can be used as a reference indicator for fatigue during driving.



Autonomic nerve and age relationship graph

AI mattress data sheets

1. Features

Function item	Monitoring range/specification	Output timeliness/sensitivity/specific description	Remark
Heartbeat frequency accuracy	Compared with medical monitors, the time deviation within ±5 is not less than 98%	The contrast scene is the subject lying flat and resting state	
Respiratory rate accuracy	Compared with medical monitors, the deviation within ±2 range of time is not less than 98%	The contrast scene is the subject lying flat and resting state	
Heartbeat frequency value	50～120 times/minute	The value is stable output within 40 seconds after the human body is stationary, and the update frequency can be adjusted from 5 seconds to 30 seconds.	Most of the data stabilization time is within 20-30 seconds, which is related to the user's heart condition and bed material.
Respiratory rate value	10～30 times/minute	The value is stable output within 40 seconds after the human body is stationary, and the update frequency can be adjusted from 5 seconds to 30 seconds.	Most of the data stabilization time is within 20-30 seconds, which is related to the user's breathing situation and the material of the bed.
Abnormal heartbeat frequency reminder	More than 110 or less than 60 times/minute	After satisfying the abnormal judgment logic, an abnormal signal will be sent out within 5 seconds	Part of the software version has canceled the device calculation reminder, which can be confirmed with the engineer.
Reminder of abnormal respiratory rate	More than 25 or less than 10 times/minute	After satisfying the abnormal judgment logic, an abnormal signal will be sent out within 5 seconds	Part of the software version has canceled the device calculation reminder, which can be confirmed with the engineer.
In-bed/out-of-bed detection	support	Response within 5 seconds	It should be noted that the meaning of getting out of bed is whether the human body is in the 10CM area outside the sensor.
Sleep distribution	Provide sleep staging and scoring rules	Implemented on the server side according to calculation rules	Provide analysis flow chart.
Body movement detection	Support, output 3 levels of body motion amplitude	Response within 5 seconds (weak, moderate, large)	

2. Technical specification

Project	Specification Description	Remark
Placement of the monitoring pad	The monitoring pad can be placed under the mattress and the position of the chest area of the human body according to the needs. Make sure that the surface of the sensor pad is flat	The location of the specific environment can be consulted by the engineering staff
Network button	Key WiFi version: short press 6 times to enter point-to-point AP mode Bluetooth version: invalid	It can be used with the debugging tool, which can be downloaded from the official website.
M button	In the unmanned state, press and hold for 5 seconds and then release to automatically adjust the sensitivity	After placing it for the first time, it can be calibrated in an unmanned state, and the sensitivity can also be adjusted through the background protocol.
Indicator light	Double lights off: no power, or automatically extinguished after 3 minutes in bed. M light is steady red: equipment failure, including failure of self-check of main board and sensor. M light is green steady: normal working, M light is blinking blue and green alternately: software upgrade The network light is steady red: not connected to the network; not connected to the Bluetooth host. The network light is steady blue: not connected to the server port (connected to the router). The network light is flashing blue: the network is in the process of connecting to the network. Light blue and red flashing alternately: in the point-to-point connection mode The network light is steady green: successfully connected to the network	
Power cord interface	Knob type separation connector, 2.5 meters in length	
Power Adapter	National standard two plugs, 220V AC to DC 5V±0.5V, 2.5A	
Working current	WiFi+IoT version: steady-state current 330～370mA, peak current 1500mA single WiFi version: steady-state current 150～180mA, peak current 800mA Bluetooth version: steady-state current 100～110mA, peak current 500mA	
Time synchronization	Time synchronization is issued in the background, the device does not store the time	Every time a host or network is connected
OTA upgrade	Support background or APP upgrade protocol	
Data network connection method	WIFI version: 802.11 bgn Internet of things version: support 11-bit, 13-bit Internet of Things card, network format: China Mobile/China Unicom Quad-band 850/900/1800/1900 MHz; China Mobile 4G LTE	Does not support telecom IoT

Project	Specification Description	Remark
RF receiving sensitivity	—93dBm	Operation box built-in antenna
Operating temperature	0℃～60℃	
Storage temperature	-15℃～60℃	
Relative humidity	15%～95%	
Sensor material	Silica gel	
Function extension	Customizable extension SOS button	Comes with public network data display interface
Packaging	Carton size: 23cm x 23cm x 32cm Weight: 1.8 net kg	

AI mattress for infant

The infant version of the mattress is able to detect and track infant movements and their amplitude on top of all other features. However it doesn't monitor the heartbeat at the moment.

The respiratory rate measurement range is 12 to 40 respiration per minute.

Actual setup for infant and adult hospital bed

Product integration mattress for infant

1. Features

The intelligent vital signs monitoring mat uses multiple sensors to achieve high-precision human detection and monitoring. Our proprietary algorithm is able to monitor human vital signs, presence and movements although the user isn't in direct contact with the mat. We are currently recording: breathing, body movements, presence time.

Sensors data are used to deliver information on the user sleep quality, work and rest habits. Those are essentials for the medical staff to have a better understanding of the patient's condition.

The smart vital sign monitoring mat is capable to transmit its data to a central server using tethered or wireless communication protocols.

2. Application field

Thanks to its mechanical properties and the fact it is sensitive enough to work contact less, the smart vital sign monitoring mat can fit in various monitoring scenarios. The mat can be placed either in bed or on a chair, the continuous health monitoring system will provide sleep analysis and also continuous mental stress analysis.

The system already include early warning and screening and has the possibility to be plugged to a centralized nursing monitor and a sending data or alerts to a remote healthcare platform.

The system's flexibility can meet a large variety of non-contact physical sign monitoring needs.

3. Product specifications

Function item	Monitoring range/specification	Output timeliness/sensitivity/specific description	Remark
Respiratory rate accuracy	Compared with medical monitors, the deviation within ±5 range of time is not less than 98%	The contrast scene is the subject lying flat and resting state	
Respiratory rate value	10～36 times/minute	The value is stable output within 40 seconds after the human body is stationary, and the update frequency can be adjusted from 5 seconds to 30 seconds.	Most of the data stabilization time is within 20-30 seconds, which is related to the user's breathing situation and the material of the bed.
Reminder of abnormal respiratory rate	More than 25 or less than 10 times/minute	After satisfying the abnormal judgment logic, an abnormal signal will be sent out within 5 seconds	Part of the software version has canceled the device calculation reminder, which can be confirmed with the engineer.
In-bed/out-of-bed detection	support	Response within 5 seconds	It should be noted that the meaning of getting out of bed is whether the human body is in the 10CM area outside the sensor.
Sleep distribution	Provide sleep staging and scoring rules	Implemented on the server side according to calculation rules	Provide analysis flow chart.
Body movement detection	Support, output 3 levels of body motion amplitude	Response within 5 seconds (weak, moderate, large)	

Project	Specification Description	Remark
Placement of the monitoring pad	The monitoring pad needs to be placed close to the human body and the chest area. It is necessary to ensure that the surface of the sensor pad is flat, and the distance between the sensor pad and the human body should not exceed 2CM thickness.	The location of the specific environment can be consulted by the engineering staff.
Network button	Bluetooth version: invalid	It can be used with the debugging tool, which can be downloaded from the official website.

M button	In the unmanned state, press and hold for 5 seconds and then release to automatically adjust the sensitivity	After placing it for the first time, it can be calibrated in an unmanned state.
Indicator light	Double lights off: no power, or automatically extinguished after 3 minutes in bed. M light is steady red: equipment failure, including failure of self-check of main board and sensor. M light is green steady: normal working, M light is blinking blue and green alternately: software upgrade The network light is steady green: successfully connected to the network	
Power cord interface	Knob type separation connector, 2.5 meters in length	
Power Adapter	USB type A, 5V±0.5V, 2.5A	
Working current	Bluetooth version: steady-state current 100～110mA, peak current 500mA	
Time synchronization	Time synchronization is issued in the background, the device does not store the time	Every time a host or network is connected
OTA upgrade	Support background or APP upgrade protocol	
Data network connection method	Bluetooth BLE 5.0	
RF receiving sensitivity	－93dBm	Operation box built-in antenna
Operating temperature	0℃～60℃	
Storage temperature	-15℃～60℃	
Relative humidity	15%～85%	
Sensor material	Silica gel	
Computing box	ABS plastic	
Packaging	Carton size: 35cm x 40cm	

4. Precautions

The sensor pad inside the physical sign monitoring pad is wrapped with silica gel. It is necessary to prevent heavy pressure when the pad is fold. Do not use sharp tools to scratch the surface or rub it strongly.

The upper and lower silica gel of the sensor uses a high-strength pressing process, and attention should be paid to prevent forced tearing force and long-term use or storage above the allowable temperature to avoid aging.

The cable of the physical sign monitoring pad should be protected from damage. When placing and using the cable, it should be noted that the connection between the cable and the monitoring pad is not pulled or bent by strong force to avoid cable damage.

Product integration pillow

Functions	Monitoring range, specification	Output timeliness, sensitivity
Heartbeat frequency	50-120 times min after the body is still	Stable value output within 20 seconds, within 30 seconds before updating every 5 seconds Value per second
Respiratory rate	10-30 times minutes after the body is still	Stable value output within 30 seconds, within 30 seconds before updating every 5 seconds
Abnormal heartbeat	Superior to 110 or inferior to 60 per minute	An abnormal signal is issued within 5 seconds
Abnormal breathing	Superior to 25 or inferior to 10 per minute	An abnormal signal is issued within 5 seconds
Presence detection	Supported	Fast mode: response within 120 sec Delay mode: response within 20 sec
Mental stress	Provide 9 mental stress and scoring rules	Implemented on the server
Data transmission	Serial (Bluetooth, POE, etc.)	Transfer to phone application or cloud
Power	6500mah	Optional 1.5m power cord
Size	300mm x 300mm x 3mm	Silicone material

Product integration toilet cushion

Functions	Monitoring range, specification	Output timeliness, sensitivity
Presence detection	Supported	Fast mode: response within 5 sec
Long-term monitoring	Monitor the length and number of times in the toilet	After a person enters or leaves the toilet seat Response within 5 seconds
Alarm output	Large jitter for a long time, overtime alarm	Preset values in background settings
Alarm	Red warning lights, high-decibel speakers	An abnormal signal is issued within 5 seconds
Alarm clear	Press the warning light or the remote app to clear the alarm	The alarm can be cleared from the background when the network is connected
Data transmission	WiFi, cellular data	Non-network delay Deliver in 5 seconds
Optical fiber extension cord	Between control box and monitoring pad 2 meters fiber optic cable	
Option	Customizable extension SOS button	
Power	MicroUSB 5V Power supply, or built-in rechargeable battery	The theoretical use time of a fully charged battery is 30 hours
Size	Can be customized according to different toilet seats	The surface of the monitoring pad can cover the toilet cover

VENUS TECHNOLOGY AI

Your health
is our priority

https://patvenusai.com