# SEDA Care Management Mattress System (SP-600)

# Instruction Guide

Development company：

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# 1. The introduction of SEDA Care Management Mattress System

In home and hospital environments, bed is a basic and core unit for care service. Bed monitoring could provide valuable information for nursing staff. The SEDA Care Management Mattress System including sensing care mattresses and a care management system has been developed for bed monitoring and health management in home and hospital applications. By adopting the soft sensing material and exclusive viscoelastic material with the mattress, the care mattress is comfortable and also capable of pressure ulcer prevention and motion sensing. Integrates with a care management system (CMS), the mattress system could facilitate advanced care assistance as following：

(1) Pressure ulcer prevention

(2) 3-stage early bed exit alerts (Sitting, bed edge and off bed)

(3) Sleep quality report

By building the SEDA Care Management Mattress System, nursing staff can easily understand current bed status and sleep quality of users, and further provide the necessary care for them. The mattress system not only provides a good sleep environment for users but enhances care service efficiency and quality in the place.

# 2. System introduction

In the system structure design, the bed is taken as the basic care unit. Figure 1 shows the system structure of the SEDA Care Management Mattress System. The system includes sensing care mattresses and a care management system (CMS). The CMS is formed with the data server, PC-based user interface and APP-based user interface for care services.

Sensing care mattresses are implemented in each user's room for bed monitoring. Through the Wi-Fi data transmission, collected data will be sent to the data server of CMS and stored (The data server application could be set as a local or cloud server depending on the user requirement). And Wi-Fi routers could be added depending on the transmission distance. Powerful algorithms are implemented in the data server of CMS, and the collected data are analyzed automatically. By displaying the analyzed results on information board of CMS (PC or APP), nursing staff could understand the real-time bed status and historical sleep data of users, and provide the service for them. The analyzed results are including the

real-time bed status data (on/off bed, movement in bed), sleep quality report, and 3-stage early bed exit alert.

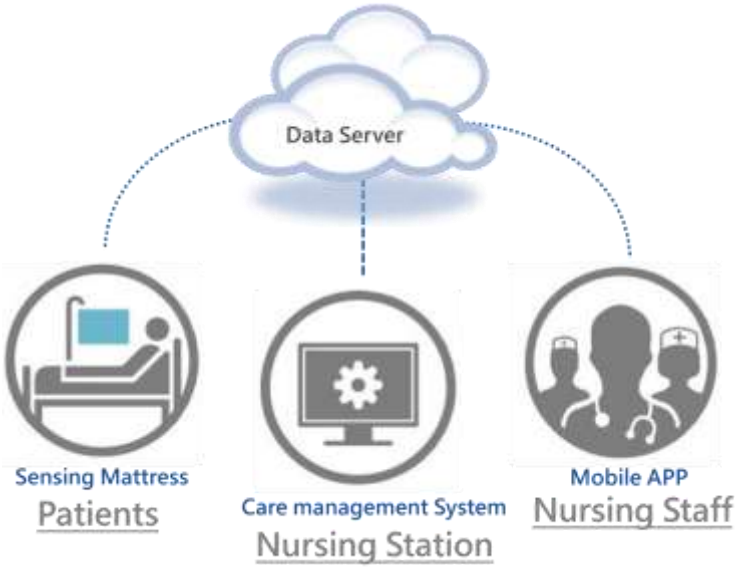



**Figure 1. The structure of SEDA Care Management Mattress System**

**Table1. The device list of SEDA Care Management Mattress System and system**

| Items | Description |
|---|---|
| Sensing care mattress | It is a motion-sensing mattress for bed monitoring, and the data transmission is by Bluetooth. As you put the battery into the data processor of the mattress, the mattress will work automatically without any setting. |
| Mattress data Gateway | It is a Bluetooth to Wi-Fi gateway for the data transmission from the mattress to the data server. And it has to be set to connect with a Wi-Fi gateway which is with the external network. |
| Cloud Server | In this case, the data server is set at Amazon Web Services (AWS) for data collection, storage, analysis, and transmission. And SEDA will be in charging of maintaining the cloud application |

| | |
|---|---|
| | services.<br><br>And the SEDA cloud is developed with a standard IoT data transmission protocol of the MQTT and API, so the further IoT application is very flexible to extend if you have needs. |
| PC-based user interface<br> | The PC-based UI displays monitoring results of the real-time bed status data (on/off bed, movement in bed), 3-stage bed exit alerts, and sleep quality report. And the care notification setting of user preference is set to be operated on this PC-based UI. |
| APP-based user interface<br> | The APP UI is developed for the early bed exit alerts application, and it will show the real-time bed status information of users and the abnormal event notifications. |

## 2.1 The introduction of the sensing care mattress

The sensing care mattress is an extremely comfortable mattress pad capable of motion sensing (Figure 2). Instead of adding sensing components into the bed, the mattress itself is designed into a sensor using textile-based sensing techniques. Sensing areas of mattress are with 30 sensing points for detecting body movements of the upper limbs, hip, lower limbs and bed edges. Table 2 describes the detail specification of sensing care mattress.

**Table 2. The specification of sensing care mattress**

| | |
|---|---|
| **Material** | Polyurethane and Conductive Polyurethane materials |
| **Size** | 195 *85 *5/12 cm (Size could be adjusted by applications) |
| **Composite** | Pressure-reduction layer、Sensing layer、Supporting layer (Layers are describing |

| | |
|---|---|
| **Structure** | from the top to the bottom) |
| **Mattress cover** | PU FIT POLYESTER FABRIC, Seamless, Waterproof-zipper, Anti-bacterial and Anti-fungus, Flame retardant |
| **Sensing range** | Allowed weight range of user: 30 ~ 150 Kg |
| **Data transmission** | Wi-Fi wireless data transmission |
| **Notes** | • The mattress is powered by 2 AA batteries<br>• The mattress data gateway is powered by the electric adapter 5V/1A (allowed input power ranges from 100V to 220V). And the mattress data gateway has to connect with a Wi-Fi router with the external network<br>• The use of the mattress is in a certain direction. The side of the cable line is the direction of the users' leg, and the mattress wears a cover printed LOGO which should be on the top surface. Figure 2 shows the direction for the use of mattress<br>• The mattress material is not washable. And the mattress could be exposed to the sunlight if the water runs inside<br>• The detergent being proportional to the water can be used to clean and sterilize the mattress cover<br>• The mattress measured up the standard of national electrical safety of Taiwan |

**Figure 2. The appearance of sensing care mattress**

## 2.2 The introduction of the Care Management System (CMS)

The information structure of SEDA Care Management Mattress System is shown in Figure 3, sensing care mattresses send the collected data to the cloud/local server of CMS with the default setting, and the server of CMS facilitates the data collection, analysis and storage. By implementing bed monitoring and sleep quality assessment algorithms, CMS could provide valuable bed information on the PC-based user interface and APP-based user interface for further care assistance.

The PC-based UI displays monitoring results of the real-time bed status data (on/off bed, movement in bed), 3-stage bed exit alerts, and sleep quality report; and the APP-based UI is developed for the early bed exit alerts application only. Notes of CMS operation are as following:

- The sensing care mattresses and mattress data gateway have to be powered on, and the gateway also has to connect to a Wi-Fi router with the external network for Internet transmission.
- The computers and mobile devices have to connect to the external network for Internet transmission too.
- In this case, the CMS database is on the cloud server of SEDA, and SEDA will be in charge of maintaining the services. The data transmission and system could be a local or cloud application depending on the need of users.
- The functions of CMS could be customized depending on applications.

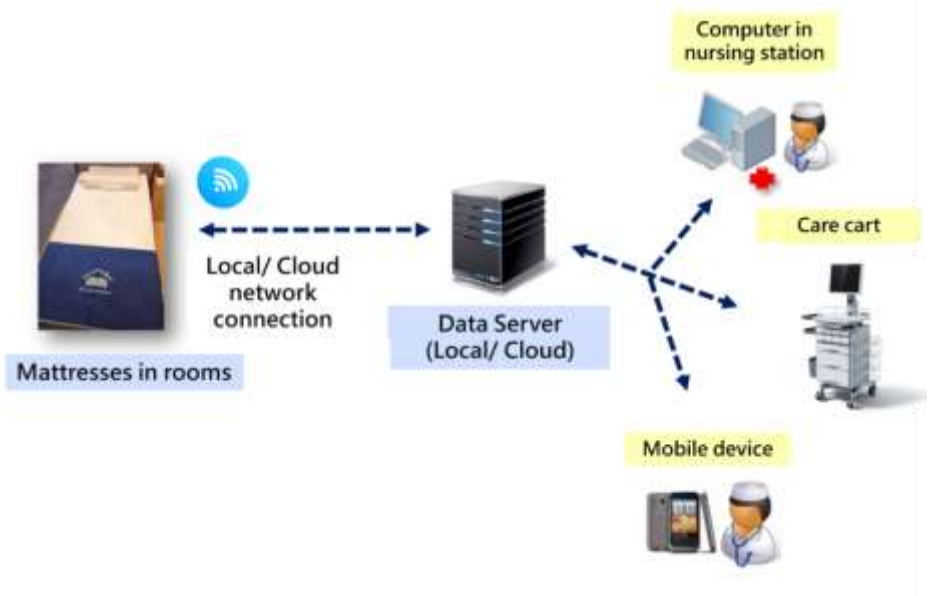



**Figure 3. The information structure of SEDA Care Management Mattress System**

# 3. The system operating instruction

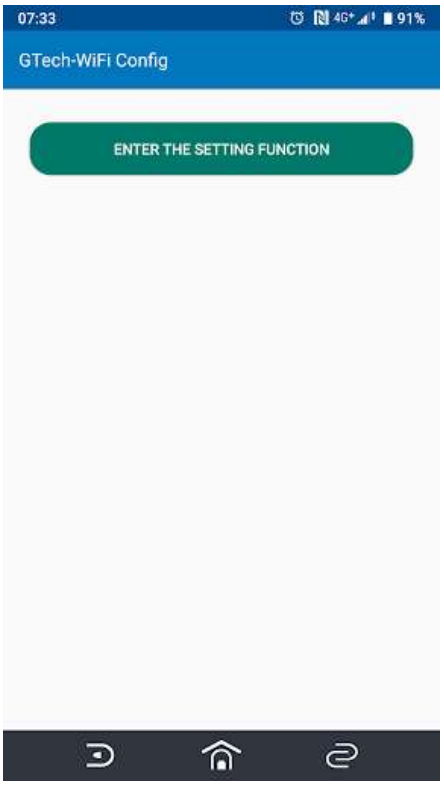
## 3.1 The mattress installation and internet connection setting

After powered on the mattress and connected the mattress gateway to the external network, the mattress could send the data to the cloud server (AWS) of CMS, and the analyzed data could be displayed and stored for further care applications. The operating instructions of mattress installation and internet connection setting are as following:

1. Put 2 AA batteries into the data processor of the mattress to enable the sensing function of the mattress. The mattress will works automatically without any setting after powered on.
2. Connect the mattress data gateway to the Wi-Fi router which is with the external network
   I. Power the mattress data gateway on.
   II. Reset the mattress data gateway. Keep pressing the reset button of the mattress data gateway for 15 seconds when the orange light is flushing (Figure 4).

**Figure 4. Press the reset button to reset the mattress data gateway**

   III. Open the Internet setting APP to start the internet connection process. And press the button "Enter the setting function" on the APP of the first page (Figure 5a). Then press the "Next step" on the APP of in the second page (Figure 5b).
   IV. Choose the device named "WhizCONNECT:xxxxxxxxxxxx", and press the button of "Next step" (Figure 5c).
   V. Enter the SSID and Password of Wi-Fi router which is with the external network and ready to connect with mattress data gateway (Figure 5d).



**(5a)** **(5b)**

**(5c)** **(5d)**

**Figure 5. The Internet connection setting process of the APP**

3. Go to the link of PC-based UI to check whether the mattress is connected. The mattress is set successfully and ready to use if the mattress color became blue or pink; If the color is gray, it represents the setting of the mattress is not full-done, and the mattress cannot work. Please do the internet connection setting again.

## 3.2 The operating instruction of PC-based UI

By integrating the sensing care mattress with a data server and user interfaces, the analyzed information are displayed on the computer and mobile devices for the advanced care service assistance. The user scenario is defined by the practical nursing care need and environment. In the design of PC-based user interface of CMS, the UI facilitates the real-time data monitoring and long-term record browse for the care service assistance. The UI link is (https://  /).

Figure 6 shows the main PC-based UI, the multi-person monitoring UI helps nursing staff understand the users' bed status and bed exit events immediately; the UI of left side(Green column) shows the bed number, body movement in bed, body position (flat, sitting, leaving and off bed); An "gear" item for the personal setting, including the personal information input and alert item setting, could be set according to the users' condition; If the alert item is activated, the UI of right side will alert the information of bed exit event by text and different voice. And a "Table" item could be clicked to browse the long-term record.

**Figure 6. The multi-person monitoring UI for the bed status and bed exit event.**

The content of long-term record browse is divided into 3 items which are the daily sleep report by text (Figure 7), bed status and sleep report by graph (Figure 8) and bed status by text (Figure 9). The long term record could be browsed by a specific date.

Figure 7 shows the daily sleep report by text, and its information is including the in-bed time, sleep time, sleep efficiency and times of bed exit. Figure 8 shows the historical data of users' bed status (Green column), sleep status (Red column) and body movement in bed (blue column); the bed status is determined as flat-lying, sitting, bed leaving and off-bed; the sleep status is determined as deep sleep, light sleep, and awake status; and the quantity of body movement in bed record. In the displaying graphic of body movement in bed, each bar represents a 10-minutes summary data which ranges from 0 to 600 times. Figure 9 is the text record of the bed status of the user, the information of each data includes the data, time, bed status, and body movement in bed. Through the long-term record browse, nursing staff can easily understand the users' activities in bed of daily living and abnormal events.

**Figure 7. The personal historical data- Daily sleep report**

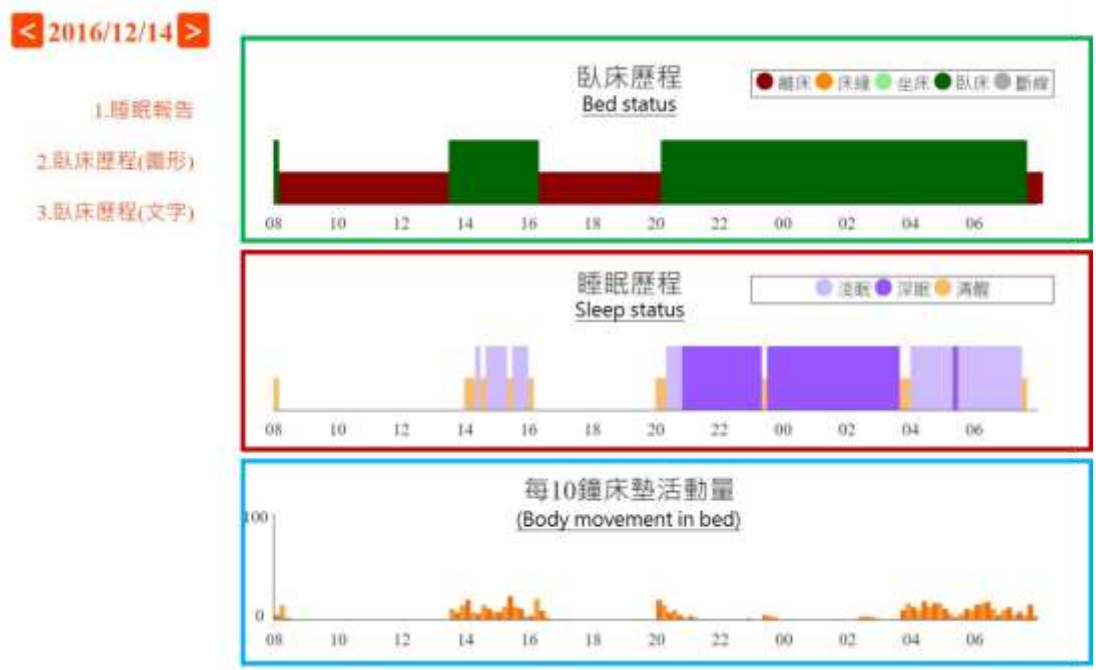



**Figure 8. The personal historical data - Graphic data**

**Figure 9. The personal historical data - Text data**

## 3.3 The operating instruction of APP-based UI

The APP-based user interface facilitates the real-time alert of the bed exit event for the prevention of fall events, and the icon of the APP is as figure 10 shows. The alert of the bed exit event has to be set on the PC based UI, then the APP-based user interface could be got the alert notification.

Here is the operating instruction of APP-based user interface of CMS：

1. Make sure of turning on the external network of the mobile device
2. Open the APP. And the main user interface is as Figure 11 shows. The displayed information is including room number and bed status.
3. Set the alert of bed exit event on the PC based UI first (Page 10)
4. If you like to get the notification on the APP-based UI, Please click the button to turn on the alert notification function on the right side of APP (Figure 12)
5. Then you will get the alert notification of off bed, bed edge or setting events if the event is true, and the screen is as Figure 13 shows. And the alert event will be notified by different colors and alarm voices on mobile devices; the red event represents the off bed event; the orange event represents the bed leaving event; the green event represents the setting event. If the APP is running in the background process of mobile devices, the bed exit event will pop out on the mobile screen.

**Figure 10. The icon of APP-based user interface**

**Figure 11. The main interface of APP. The left column is the room number which has been set on the PC based UI, and the middle column is the real-time bed status information.**

**Figure 12. Turning on the alert notification function on the right side of APP**

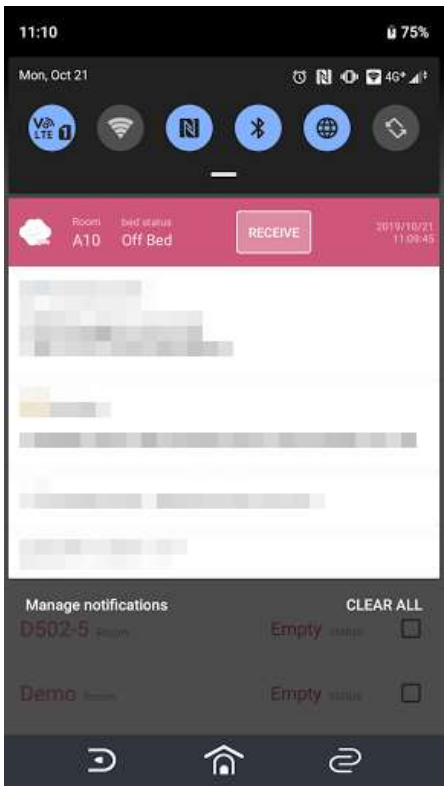



**Figure 13. The alert notification on the APP**

## 3.4 Troubleshooting

- **The sensing care mattress is always off-line on user interface of CMS:**
  1. Please check the mattress battery is on or working.
  2. Please check the gateway is powered on or working.
  3. Please check the Wi-Fi connection of the router is capable of external network.
  4. If the sensing care mattress is still off-line, please re-plug the power of the mattress gateway.
- **The user is not in bed, but the user interface of CMS shows the user is on bed:**
  1. Check the position of sensing care mattress is right.
  2. Check whether heavy stuff is atop the mattress, if yes, please remove it.
  3. If the problem is not solved after the above procedures, please re-plug the power of the mattress gateway.
- **The PC-based or APP-based user interface of CMS does not work normally:**
  1. Please check the Wi-Fi connection of the router is capable of external network.
  2. Please check if the web link is correct.
  3. Please refresh the UI again.

- **The APP of mobile device does not work:**

  1. Please check the external network of device is turned on and working.
  2. Check the OS version is above Android 4.0.

  Please contact us if the problem is not solved after above procedures.

Contact person: Wilson Liu

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# Notices

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

**FEDERAL COMMUNICATIONS COMMISSION INTERFERENCE STATEMENT**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/ TV technician for help.

**RF EXPOSURE WARNING**

The equipment complies with FCC RF exposure limits set forth for an uncontrolled environment. The equipment must not be co located or operating in conjunction with any other antenna or transmitter.

**CAUTION:**

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.