

Sensing system and sensing method of passive patch interface for gathering bioinformation

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Abstract— This paper describes a sensing system and a sensing method based on bio - information collection interface using passive patches. Especially, it is a research on sensing system and sensing method based on information gathering interface using passive patch which can be sensed by the activation of external power without internal battery. The subjects of this study are as follows. The first is to provide a passive patch based on an bioinformation gathering interface that can operate with external power without an internal battery. The second is to provide a passive patch based on an information collection interface that can sense the degree of action of the applied drug and display it to the patient or the user. The third is to provide a passive patch based on an information gathering interface that can inform the user or the patient when the degree of pharmacological action is out of the threshold and can lead the user or the patient to remove the patch attached. Finally, this study is to provide a sensing system and a sensing method using a passive patch based on an information collection interface capable of acquiring biometric information and providing it to an external network.

Keywords— Wearable system, Passive sensing, Patch interface, Sensing network

I. INTRODUCTION

With the development of various wearable devices, a method of monitoring a human body, analysing a bio-signal, evaluating a health condition of a user, and providing a healthcare service based on the evaluation has been continuously attempted. These efforts have had some fruitful consequences, and have become a future vision strategy that is important for the healthcare sector. This paper describes a sensing system and a sensing method based on bio - information collection interface using passive patches. Especially, it is a research on sensing system and sensing method based on information gathering interface using passive patch which can be sensed by the activation of external power without internal battery [1].

When a drug is administered to treat a patient, it is largely divided into oral administration and parenteral administration. In this case, the parenteral administration may be divided into mucosal administration methods such as ocular mucosal administration, nasal administration, sublingual administration and rectal administration, and injection administration methods such as intravenous injection and subcutaneous injection, and skin administration method [2-6]. Among them, the method of administering the drug through the skin is as shown in Fig. 1, using a paste, a patch, or a wetting agent.

Until now, digital patches have been used as means and methods for collecting human body information. These efforts contributed to the collection of various biometric information such as body temperature, sweat, humidity, respiration, pulse, and heart rate. Nevertheless, the types of sensors available for patching are limited and the amount of information that can be collected is limited. These attempts should continue to develop new sensors, patch structures, and bio-signal analysis.

The subjects of this study are as follows. The first is to provide an organization of a passive patch system based on an bioinformation gathering interface that can operate with external power without an internal battery. The second is to provide a passive patch based on an information collection interface that can sense the degree of action of the applied drug and display it to the patient or the user. The third is to provide a passive patch based on an information gathering interface that can inform the user or the patient when the degree of pharmacological action is out of the threshold and can lead the user or the patient to remove the patch attached. Finally, this study is to provide a sensing system and a sensing method using a passive patch based on an information collection interface capable of acquiring biometric information and providing it to an external network.

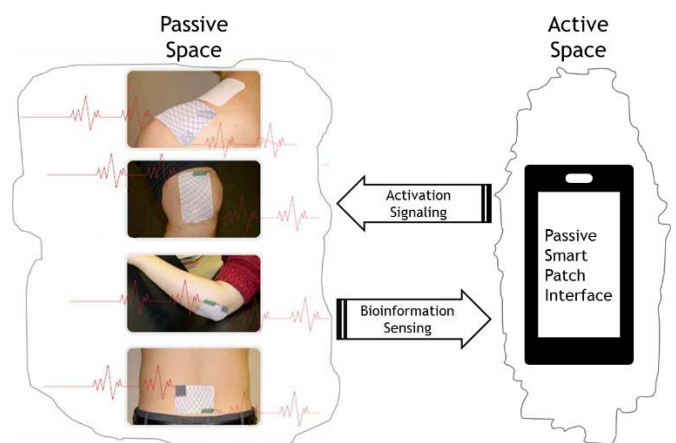


Figure 1. A Computing Domain Configuration for Wearable Bioinformation System

This study has the following contributions. The passive patch based on the proposed biometric information collection interface can operate with external power without built-in

battery, it is easy to miniaturize, shorten manufacturing process time, and reduce production cost. And, such a passive patch can measure the degree of action of the drug and induce removal of the patch when out of the threshold range. Additionally, it can transmit the biometric information of the patient to the outside and transmit the action information of the internal medicine of the patch used for the treatment to the outside, so that the transmitted data can be easily browsed.

Accordingly, the patient, the caregiver or the user (physician) can conveniently check the patient status, and can transmit a patch removal message or the like when the medicinal threshold of the passive patch attached for the patient treatment is out of the range. Finally, the sensing system using the passive patch based on the proposed bio-information collecting interface receives the biometric information transmitted from the passive patch and transmits the biometric information to the registered communication terminal when the biometric information is out of the threshold range, is.

II. ARCHITECTURE AND DESIGN OF PASSIVE PATCH SYSTEM

In this study, a passive patch attached to a patient and measuring the biometric information signal of a patient and transmitting it to the outside, and an active terminal connected to the passive patch, transmits an activation signal to the passive patch, and receives the biometric information signal as shown in Fig. 2. This passive patch constitutes an information collecting interface based passive patch sensing system characterized in that external power is temporarily supplied without operation of an internal battery.

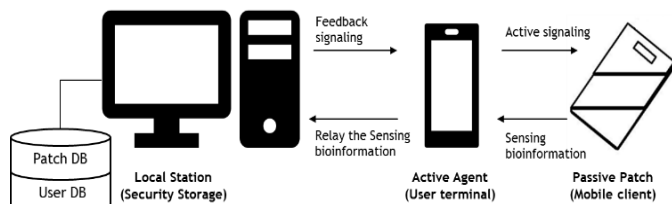


Figure 2. The wearable bioinformation system with a passive patch interface

In addition, the expansion system may further include an external server connected to the active terminal in a wireless or wired manner, and the external server may include a passive information collection interface-based patch sensing system capable of receiving a biometric information signal of a patient from an active terminal acting as a mobile agent.

Here, as shown in Fig. 3, the passive patch constitutes several layers of partial modules from the bottom to the top as follows. The first lower layer constitutes the drug application layer on which the drug is formed on the lower surface which is in close contact with the skin of the patient. The second layer is a supporting module formed on the upper part of the lower drug coating layer, and includes a biosensor module for measuring a biometric information signal of a patient and a drug action detection sensor module for generating a drug action signal by measuring the degree of the drug acting on the patient do. And a power supply module for operating the built-in circuit by receiving power from the outside. The third layer

includes a display module formed on the upper part and a control module for generating a patch removal inducing signal corresponding to the drug operation signal when the drug action signal is out of a predetermined threshold value range and transmitting the signal to the display module.

The sensing data transmission structure of the passive patch system is as follows. First, the active terminal performs an activation process to send an activation signal to the passive patch attached to the patient. Second, a passive patch that transmits an activation signal from the active terminal proceeds with a biological information sensing step of sensing drug and human body information. Third, the passive patch consists of a feedback step of feeding the sensed drug and human body information to the active terminal. Finally, the active terminal constructs a storage process for storing the sensed drug and human body information in the internal memory. At this time, the passive patch can be operated by temporarily supplying external power without an internal battery.

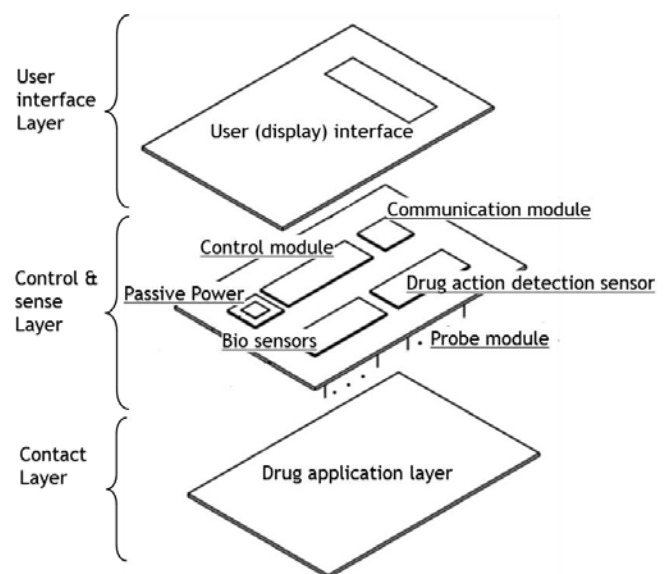


Figure 3. The Layered Architecture and Components of Passive Patch

Further, the drug information and the human body information stored in the active terminal can be further expanded to an external transfer process for transferring and storing the drug and the human body information to a database of the external server.

III. COMPONENT DETAILS AND ALGORITHM OF PASSIVE PATCH SYSTEM

The detailed components for implementing the passive patch biometric information system include a drug action detection sensing module, a biosensor module, a power supply module, a control module, a communication module, and a display module as follows.

The *drug action detection sensing module* can detect the drug application layer, or the concentration of the drug detected in the skin of the patient. Further, the drug action detection sensing module may generate a drug action signal through the detected signal and transmit the drug action signal to the control

module. Here, the *drug action detection sensing module* may be formed through at least one probe to contact the drug application layer or the skin of the patient.

The *biosensor module* can measure a bio-information signal including at least one of body temperature, pulse, blood sugar, skin humidity, electrocardiogram signal, and brain wave. In addition, since the biometric information signal measured according to the attachment position of the passive patch differs, the bio-sensing module can select a different type of sensor depending on the attachment position.

The *power supply module* may be formed to be able to receive power temporarily from the outside. To this end, the power supply module may configure a USB terminal or configure an electric wire or a pin to receive external power. At this time, the power supply module may be connected to the built-in circuit formed in the control module. That is, the power supply module can receive the power temporarily from the outside to operate the built-in circuit, whereby the passive patch can be operated. Meanwhile, the *power supply module* may receive power wirelessly. At this time, the wireless power supply may be an electromagnetic induction type, the power supply module may constitute a primary coil, and electromagnetic can be guided through a wireless supply device having a secondary coil to supply power to an internal circuit.

The *control module* may receive the drug action signal input from the drug action detection sensing module and compare the received drug action signal with a pre-set threshold value. Also, the control module may generate a patch removal inducing signal and display the patch removal inducing signal on the display module when the value included in the drug action signal is out of the threshold value range. For example, if the concentration of the drug contained in the received drug action signal is lower than the threshold value, the control module can generate a notification that the patient can remove the passive patch, that is, a patch removal inducing signal because the drug treatment effect is low. In addition, the control module can generate a patch removal inducing signal so that the patient removes the passive patch because the drug may cause side effects when the concentration of the drug contained in the received drug action signal is higher than the threshold value.

The *communication module* may transmit a biometric information signal or a patch removal inducing signal or a drug action signal to the outside of the passive patch. Further, the communication module may include wireless communication means capable of communicating at a short distance, such as Bluetooth. For example, the communication module can transmit a biometric information signal or a patch removal inducing signal or a pharmacological action signal to a nearby electronic communication terminal (for example, a smart phone) in a Bluetooth manner. At this time, the communication module may use a module to which the ZigBee communication method or the NFC (Near Field Communication) communication method other than the blue pitching method is applied.

The *display module* may be formed on the upper surface to display a signal informing of the removal of the patch. The display module also receives the patch removal induction signal

and displays the set colour or message to inform the patient or user of the patch removal.

As described above, the passive patch described in this study can be powered by external power supply without built-in battery.

In addition, biometric information of the patient can be transmitted to the outside, and action information of the internal medicine of the patch used for the treatment can be transmitted to the outside, so that the transmitted data can be easily browsed. In this study, an active terminal as an agent terminal can use a WIFI or Bluetooth network or the like, and thus can connect to an external server using such a communication network.

In addition, the active terminal and the external server can store the subscribed patient information. At this time, the patient information may be stored through one of the active terminal or the external server and shared with each other. In other words, when stored in the active terminal, the stored information is transmitted to the external server and stored in the external server, transferred from the external server to the active terminal upon storage, and transmitted to the active terminal.

Here, the reference health information may be reference health information classified according to the patient's age, sex, body shape or the like or pre-set reference health information (for example, blood pressure, pulse, blood glucose level, etc.).

This standard health information can be used by backing up the data stored in the existing hospital database for the recent health condition information and medical history information. If necessary, the patient can receive the data from the treated hospitals and store it on the active terminal or the external server is.

This is an extended feature of the sensing system using the passive patch based on the information gathering interface of the present invention, so that it is possible to manage the health and medical information according to each user, thereby enabling more efficient additional service support.

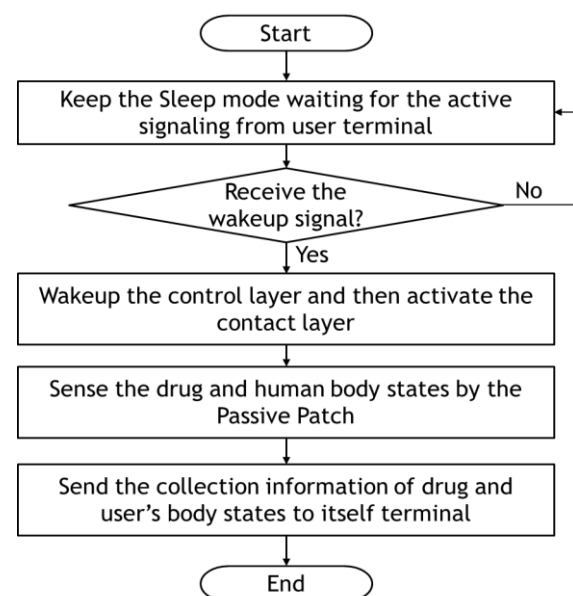


Figure 4. The Embedded Logic Sequences of Passive Patch

The following is a sensing method using passive patches based on the information collection interface of the present invention. Fig. 4 is a flow chart showing a sensing method using passive patches based on the information collection interface.

In Fig. 4, the sensing process using the passive patch is as follows. A process in which the terminal transmits an activation signal to a passive patch attached to the patient, a passive patch that transmits an activation signal from an active terminal senses drug and human body information, a process of feeding back the sensed drug and human body information to the active terminal, and the active terminal carries out a process of receiving the sensed drug and the human body information and storing it therein.

Fig. 5 is a flow chart showing the process of collecting sensing information received from a user mobile terminal and transmitting information to an external server as a mobile agent.

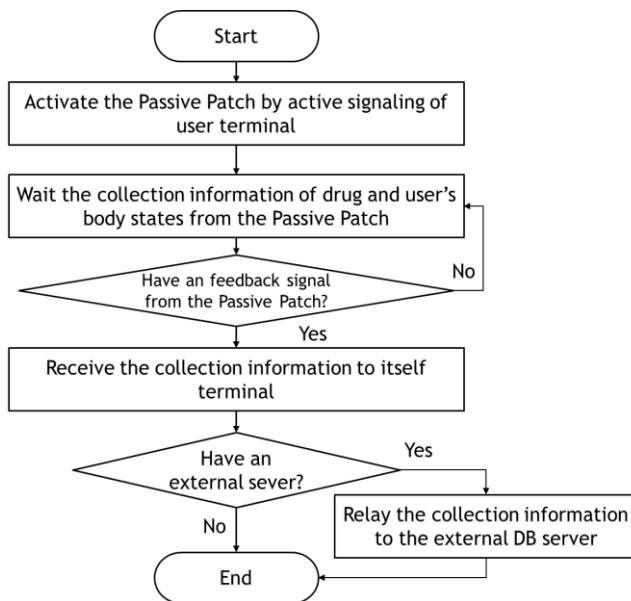


Figure 5. The Mobile Agent Logic Sequences of Terminal

In Figure 5, the user terminal initially activates the passive patch with an active signal. Next, the passive patch waits for receiving the bioinformation and the user's biometric information. If a feedback signal is detected, it stores the received information in its storage space. When the external server is interlocked, the information collected through the external communication channel can be transmitted and constructed as a database.

IV. CONCLUSIONS

This study first proposed a passive bioinformatics system. And, this configuration can be a good alternative to overcome the power consumption limitation of the digital patch. In addition, the cost of producing a digital patch is minimized, thereby maximizing the economic efficiency of the product. Ultimately, we expect the availability of passive digital patches to vary.

In the future, this study intends to expand the scope of research by constructing a distributed multi-digital patch system.

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