A wireless sensor device is disclosed. In a first aspect, the wireless sensor device comprises a housing unit and a patch coupled to the housing unit, wherein the patch includes a removable adhesive and is repositionable. In a second aspect, the wireless sensor device comprises a housing unit and a patch coupled to the housing unit, wherein the patch includes a plurality of removable adhesive layers that are each composed of removable medical grade silicone pressure sensitive adhesive (PSA).
MULTI-LAYER PATCH FOR WIRELESS SENSOR DEVICES

FIELD OF THE INVENTION

The present invention relates to wireless sensor devices, and more particularly, to a multi-layer patch for the wireless sensor devices.

BACKGROUND

Wireless sensor devices are used in a variety of applications including the health monitoring of patients. In many of these applications, a wireless sensor device is attached directly to the user’s skin (e.g. near the chest area) to measure certain physiological data. Conventional wireless sensor devices include attaching mechanisms that are cumbersome and utilize certain adhesives that cause irritation to the user’s skin. Therefore, there is a strong need for a cost-effective solution that overcomes the aforementioned issues. The present invention addresses such a need.

SUMMARY OF THE INVENTION

A wireless sensor device is disclosed. In a first aspect, the wireless sensor device comprises a housing unit and a patch coupled to the housing unit, wherein the patch includes a removable adhesive.

In a second aspect, the wireless sensor device comprises a housing unit and a patch coupled to the housing unit, wherein the patch includes a plurality of removable adhesive layers that are each composed of removable medical grade silicone pressure sensitive adhesive (PSA).
In a third aspect, the wireless sensor device comprises a housing unit that includes a sensor, a processor coupled to the sensor, a memory device coupled to the processor, wherein the memory device includes an application that is executable by the processor, and a transmitter coupled to the application, and a patch coupled to the housing unit, wherein the patch includes a plurality of removable adhesive layers that are each composed of removable medical grade silicone PSA.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying figures illustrate several embodiments of the invention and, together with the description, serve to explain the principles of the invention. One of ordinary skill in the art readily recognizes that the embodiments illustrated in the figures are merely exemplary, and are not intended to limit the scope of the present invention.

Figure 1 illustrates a wireless sensor device in accordance with an embodiment.

Figure 2 illustrates a wireless sensor device in a patch form factor in accordance with an embodiment.

Figure 3 illustrates a more detailed view of a patch platform of the wireless sensor device in accordance with an embodiment.

DETAILED DESCRIPTION

The present invention relates to wireless sensor devices, and more particularly, to a multi-layer patch for the wireless sensor devices. The following
description is presented to enable one of ordinary skill in the art to make and use the invention and is provided in the context of a patent application and its requirements. Various modifications to the preferred embodiment and the generic principles and features described herein will be readily apparent to those skilled in the art. Thus, the present invention is not intended to be limited to the embodiments shown but is to be accorded the widest scope consistent with the principles and features described herein.

Attaching a wireless sensor device to a user enables the accurate measurement and monitoring of various health related information and biometrics. If the attachment is uncomfortable, the user may not be able to tolerate the wireless sensor device for prolonged periods of time. Accordingly, a system and method in accordance with the present invention develops a wireless sensor device in a patch form factor with an attachment mechanism that results in a comfortable experience to the patients without jeopardizing the performance and the life expectancy of the wireless sensor device.

FIG. 1 illustrates a wireless sensor device 100 in accordance with an embodiment. The wireless sensor device 100 includes a sensor 102, a processor 104 coupled to the sensor 102, a memory 106 coupled to the processor 104, an application 108 coupled to the memory 106, and a transmitter 110 coupled to the application 108. In one embodiment, the wireless sensor device 100 is attached to a user via a multi-layer patch. The sensor 102 obtains data from the user and the data is then transmitted to the memory 106 via the processor 104 and in turn to the application 108. The processor 104 executes the application 108 to monitor
information regarding the user's health. The information is transmitted to the transmitter 110 and in turn relayed to another user or device.

In one embodiment, the sensor 102 is a microelectromechanical system (MEMS) tri-axial accelerometer and the processor 104 is a microprocessor. One of ordinary skill in the art readily recognizes that a variety of devices can be utilized for the sensor 102, the processor 104, the memory 106, the application 108, and the transmitter 110 and that would be within the spirit and scope of the present invention.

One of ordinary skill in the art readily recognizes that a variety of wireless sensor devices can be utilized in conjunction with the multi-layer patch including but not limited to a wireless sensor device in a patch form-factor, tri-axial accelerometers, uni-axial accelerometers, bi-axial accelerometers, gyroscopes, and pressure sensors and that would be within the spirit and scope of the present invention.

To describe the features of the present invention in more detail, refer now to the following description in conjunction with the accompanying Figures.

FIG. 2 illustrates a wireless sensor device 200 in a patch form factor in accordance with an embodiment. The wireless sensor device 200 includes a housing unit 202 coupled to a patch 204. In one embodiment, the patch 204 is one continuous unit with the housing unit 202. The housing unit 202 includes any of the sensor 102, the process 104, the memory 106, the application 108, and the transmitter 110. The patch 204 includes a plurality of removable adhesive layers 206.
In one embodiment, the plurality of removable adhesive layers 206 comprises three removable adhesive layers. In another embodiment, the plurality of removable adhesive layers 206 comprises five removable adhesive layers. In one embodiment, the removable adhesive is a removable medical grade silicone pressure sensitive adhesive (PSA).

In another embodiment, the silicone PSA is coated on a thermoplastic elastomer (TPE) carrier. Silicone PSA is a low trauma adhesive and does not damage dry and sensitive skin during the removal process of the wireless sensor device 200 from the user’s skin. In one embodiment, each of the plurality of silicone PSA layers of the patch 204 is supported by a layer of medical grade polyethylene (PE) film for added tensile strength and structure. Therefore, in this embodiment, each of the plurality of silicone PSA layers of the patch 204 is laminated to a layer of PE film. In another embodiment, the layer of PE film is 0.001” thick.

FIG. 3 illustrates a more detailed view 300 of a patch platform of the wireless sensor device 200 in accordance with an embodiment. In FIG. 3, the patch platform acts as a vehicle or place on which a sensor of the wireless sensor device 200 is mounted prior to attachment to a user. As aforementioned, the wireless sensor device 200 includes a housing unit 202 coupled to a patch platform 304. The patch platform 304 includes three removable adhesive layers 306a, 306b, and 306c. The three removable adhesive layers 306a, 306b, and 306c each have a corresponding tab 308a, 308b, and 308c positioned on the end of the patch platform 304 for easy access, removal and usage by the user of the wireless sensor device 200. In one embodiment, each corresponding tab 308a-c is made of a non-woven membrane with moderate tensile strength.
Each of the three removable adhesive layers 306a-c provides adherence to the user's skin for a predetermined time period. In one embodiment, the predetermined time period is 24 hours to minimize a high degree of adhesion between the wireless sensor device 200 and the user's skin. In another embodiment, the predetermined time period is 48 hours. After each predetermined time period interval, the patch platform 304 of the wireless sensor device 200 is removed from the user's skin and one of the three removable adhesive layers 306a-c is removed/peeled off to expose a new adhesive layer. Accordingly, in one embodiment, layer 306a is removed to expose new adhesive layer 306b and layer 306b is removed to expose new adhesive layer 306c.

In one embodiment, the three removable adhesive layers 306a-c are composed of a silicone adhesive that is gentle on the user's skin and does not cause irritation or discomfort while in contact with the user's skin. In one embodiment, the patch platform 304 of the wireless sensor device 200 is repositioned on the user's skin each time one of the three layers 306a-c is removed to add comfort. In another embodiment, the repositioning of the patch platform 304 occurs during the predetermined time period.

As above described, the system provides a wireless sensor device with a repositionable multi-layer patch platform to cater to a wide range of patients in different age brackets and with different skin sensitivity levels. The multi-layer patch platform adheres to the user's skin for a minimum of 3 days and minimizes the adverse reactions of the user's skin resulting from more aggressive attachment mechanisms (e.g. acrylic adhesives). Additionally, the multi-layer patch platform
can be removed from the user’s skin without causing skin trauma during the removal process.

Although the present invention has been described in accordance with the embodiments shown, one of ordinary skill in the art will readily recognize that there could be variations to the embodiments and those variations would be within the spirit and scope of the present invention. Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the appended claims.
CLAIMS

What is claimed is:

1. A wireless sensor device, comprising:
   a housing unit; and
   a patch coupled to the housing unit, wherein the patch includes a removable adhesive and is repositionable.

2. The wireless sensor device of claim 1, wherein the removable adhesive is a removable medical grade silicone pressure sensitive adhesive (PSA).

3. The wireless sensor device of claim 1, wherein the housing unit further comprises:
   a sensor;
   a processor coupled to the sensor;
   a memory device coupled to the processor, wherein the memory device includes an application that is executable by the processor; and
   a transmitter coupled to the application.

4. The wireless sensor device of claim 1, wherein the patch further comprises:
   a plurality of removable adhesive layers, wherein each of the plurality of removable adhesive layers is supported by a film for added tensile strength and structure.

5. The wireless sensor device of claim 4, wherein the film is a layer of medical grade polyethylene.

6. The wireless sensor device of claim 4, wherein each of the plurality of removable adhesive layers includes a corresponding selectable tab.
7. The wireless sensor device of claim 6, wherein each corresponding tab is located on the end of the patch for easy access and usage.

8. The wireless sensor device of claim 1, wherein the patch is one continuous unit with the housing unit.

9. The wireless sensor device of claim 1, wherein the patch is repositionable after each of the plurality of removable adhesive layers is removed.

10. The wireless sensor device of claim 4, wherein the plurality of removable adhesive layers adheres to a user’s skin for a predetermined time period.

11. The wireless sensor device of claim 10, wherein the predetermined time period is 24 hours.

12. A wireless sensor device, comprising:

   a housing unit; and

   a patch coupled to the housing unit, wherein the patch includes a plurality of removable adhesive layers that are each composed of removable medical grade silicone pressure sensitive adhesive (PSA).

13. The wireless sensor device of claim 12, wherein the housing unit further comprises:

   a sensor;

   a processor coupled to the sensor;

   a memory device coupled to the processor, wherein the memory device includes an application that is executable by the processor; and

   a transmitter coupled to the application.

14. The wireless sensor device of claim 12, wherein each of the plurality of removable adhesive layers is supported by a film for added tensile strength and structure.
15. The wireless sensor device of claim 14, wherein the film is a layer of medical grade polyethylene.

16. The wireless sensor device of claim 12, wherein each of the plurality of removable adhesive layers includes a corresponding selectable tab.

17. The wireless sensor device of claim 12, wherein the patch is repositionable.

18. The wireless sensor device of claim 17, wherein the patch is repositionable after each of the plurality of removable adhesive layers is removed.

19. The wireless sensor device of claim 12, wherein the plurality of removable adhesive layers adheres to a user's skin for a predetermined time period.

20. A wireless sensor device, comprising:

   a housing unit that includes a sensor, a processor coupled to the sensor, a memory device coupled to the processor, wherein the memory device includes an application that is executable by the processor, and a transmitter coupled to the application; and

   a patch coupled to the housing unit, wherein the patch includes a plurality of removable adhesive layers composed of removable medical grade silicone pressure sensitive adhesive (PSA).
Figure 1

Wireless Sensor Device 100

Sensor 102

Processor 104

Memory 106

Application 108

Transmitter 110
INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 14/49789

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A61F 5/0408; A61F 13/02, 13/505 (2014.01)


According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8): A61B 5/0408; A61F 13/02, 13/505 (2014.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where Practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 8325048 B2 (RANGANATHAM, S et al) December 4, 2012; figure 1, 3; column 3, lines 29-30; column 10, lines 44-59; column 11, lines 54-62</td>
<td>1-2, 1, 3-7, 9-11</td>
</tr>
<tr>
<td>Y</td>
<td>US 2007/0100219 A1 (SWEITZER, R et al) May 3, 2007; abstract; figure 1; paragraphs [0004], [0039]</td>
<td>1, 8</td>
</tr>
<tr>
<td>Y</td>
<td>US 6918901 B1 (THEEUWES, F et al) July 19, 2005; column 7, lines 54-57</td>
<td>1, 4, 10-11</td>
</tr>
<tr>
<td>Y</td>
<td>US 2006/0224072 A1 (SHENNB, A) October 5, 2006; figure 2-3; paragraphs [0034], [0046]</td>
<td>3</td>
</tr>
<tr>
<td>Y</td>
<td>US 6038464 A (AXELGAARD, J et al) March 14, 2000; abstract; column 3, lines 31-40; claims 1, 23</td>
<td>4-7, 9-11</td>
</tr>
<tr>
<td>Y</td>
<td>US 7294752 B1 (PROPP, DJ) November 13, 2007; column 7, lines 54-67; column 8, line 1</td>
<td>6-7</td>
</tr>
</tbody>
</table>

[ ] Further documents are listed in the continuation of Box C.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"Z" document member of the same patent family

Date of the actual completion of the international search
31 October 2014 (31.10.2014)

Date of mailing of the international search report
06 JAN 2015

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Authorized officer:
Shane Thomas
PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/2 10 (second sheet) (July 2009)
INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 14/49789

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group 1: Claims 1-11 are directed toward a wireless sensor device comprising a repositionable path.

Group 2: Claims 12-20 are directed toward a wireless sensor device comprising a memory, a transmitter, and a patch with a plurality of adhesive layers composed of removable medical grade silicone pressure sensitive adhesive (PSA).

...Continued Within the Next Supplemental Box...

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-11

Remark on Protest

☐ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/2 10 (continuation of first sheet (2)) (July 2009)
-Continued from Box No. III: Observations where unity of invention is lacking.-

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical features of Group I include wherein the patch is repositionable, which are not present in Group II; the special technical features of Group II include a memory device coupled to the processor, wherein the memory device includes an application that is executable by the processor, and a transmitter coupled to the application; and wherein the patch includes a plurality of removable adhesive layers composed of removable medical grade silicone pressure sensitive adhesive (PSA), which are not present in Group I.

The common technical features of Groups I and II are a wireless sensor device, comprising: a housing unit; and a patch coupled to the housing unit, and wherein the patch includes a removable adhesive.

These common technical features are disclosed by US 2009/0099469 A1 (FLORES). Flores discloses a wireless sensor device, comprising: a housing unit; and a patch coupled to the housing unit, and wherein the patch includes a removable adhesive (wireless ECG patient telemetry monitoring system with capsular housing and an adhesive parch secured to skin; claim 1).

Since the common technical features are previously disclosed by the Flores reference, the common features are not special and so Groups I and II lack unity.