Abstract: The present invention relates to a handheld device (11) comprising: - a heartbeat sensor (111) for monitoring a first heartbeat signal (s1) of a user of the handheld device, a communication unit (113) for receiving a second heartbeat signal (s2) of a user of another handheld device (12), a comparison unit (112) for comparing the first and second heartbeat signals so as to determine a level of coherence between them, and a decision unit (112) for indicating a potential lover if the level of coherence is above a given threshold.
Handheld device for indicating a potential lover to the user of the device

FIELD OF THE INVENTION

The present invention relates to a handheld device for indicating a potential lover to the user of the handheld device.

The invention also relates to a method of indicating a potential lover to the user of the handheld device, and to a computer program product for implementing such a method.

This invention may be used, for example, in mobile phones, personal digital assistants PDAs or game consoles.

BACKGROUND OF THE INVENTION

The market for mobile phones is not only huge but also very dynamic. Young people are the main customers and replace their phone on a regular basis. In such a competitive environment, specific features and design are very important and may strengthen the brand image of a mobile phone company.

An example of feature that could be attractive to a mobile phone user is to know the emotional or physiological state of another mobile phone user.

The patent US 2004/0147814 discloses a communication device capable of determining an emotional or physiological state of a user of the device which includes an input device that provides a signal indicative of one of an emotional and a physiological state of a user of the device. A controller receives the signal from the input device and interprets the signal into state data identifying one of an emotional and a physiological state of a user of the device. The device makes the state data available to be downloaded such that another communication device sending a communication can appropriately adapt its communication method and transport mode of user interface to suit the recipient's condition.

Such a device allows emotional information relative to a user of a mobile phone to be transmitted wirelessly to another mobile phone user.

SUMMARY OF THE INVENTION

It is an object of the invention to propose a handheld device comprising a feature which is more attractive than the one of the prior art.

To this end, the handheld device in accordance with the invention is characterized in that it comprises:
- a heartbeat sensor for monitoring a first heartbeat signal of a user of the handheld device,
- a communication unit for receiving a second heartbeat signal of a user of another handheld device,
- a comparison unit for comparing the first and second heartbeat signals so as to determine a level of coherence between them, and
- a decision unit for indicating a potential lover if the level of coherence is above a given threshold.

The invention is a very attractive feature to play with while somebody is with friends or among other people, known or unknown. It is based on the observations according to which the heartbeats of people who are in love and in each other's presence get into coherence.

According to an embodiment of the invention, the level of coherence is measured by a heartbeat sensor built into an earphone of the handheld device.

According to another embodiment of the invention, the comparison unit is adapted to compare the frequency and phase of the first and second heartbeat signals. Indeed, if not only the heart rate (i.e. frequency), but also the timing (i.e. phase) of the heartbeat signals of two persons is compared, the level of coherence can be monitored.

Still according to another embodiment of the invention, the handheld device comprises a user interface including a first user profile, the communication unit is adapted to receive a second user profile from the other handheld device, and the decision unit is adapted to indicate a potential lover if the level of coherence is above a given threshold and if the first and second user profiles match to each other. Thanks to the introduction of the user profile, false detections of a potential lover are decreased.

Beneficially, the communication unit is a wireless communication unit.

The present invention also relates to a method of indicating a potential lover to the user of a first handheld device, said method comprising:
- monitoring a first heartbeat signal of the user of the first handheld device,
- receiving a second heartbeat signal of a user of a second handheld device,
- comparing the first and second heartbeat signals so as to determine a level of coherence between them, and
- indicating a potential lover if the level of coherence is above a given threshold.

The invention finally relates to a computer program product comprising program instructions for implementing such a method when said program is executed by a processor.
These and other aspects of the invention will be apparent from and will be elucidated with reference to the embodiments described hereinafter.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The present invention will now be described in more detail, by way of example, with reference to the accompanying drawing, wherein:

- Fig. 1 shows a mobile phone comprising a love sensor arrangement in accordance with the invention.

**DETAILED DESCRIPTION OF THE INVENTION**

The present invention aims at providing a handheld device suitable for helping the owner of the handheld device to find a potential lover. This handheld device is in the following example a mobile phone. However, it will be apparent to a skilled person that this handheld device can be any other communication device such as, for example, a personal digital assistant PDA or a game console.

Referring to Figure 1, a mobile phone comprising a love sensor arrangement is depicted. Such a mobile phone 11 comprises:

- a first heartbeat sensor 111 for monitoring a first heartbeat signal s1 of the user of the mobile phone 11;
- a communication unit 113 for receiving a second heartbeat signal s2 of a user of another mobile phone 12, this another mobile phone 12 comprising a second heartbeat sensor 121 for delivering the second heartbeat signal;
- a processor 112 for comparing the first and second heartbeat signals so as to determine a level of coherence between them, and for indicating a potential lover if the level of coherence is above a given threshold;
- a user interface 114 for delivering the indication of the processor to the user via a specific ringing tone or via a given message on the screen of the mobile phone.

In more detail, the heartbeat signal is measured using any conventional heart rhythm (or electrocardiogram ECG) measurement sensor. It will be apparent to those skilled in the heart that the heartbeat sensor 111 or 121 does not need to detect a complete ECG. According to an embodiment of the invention, the heartbeat sensor comprises a simple electrode integrated into the earphone of a headset of the mobile phone, said electrode being suitable
for detecting the pulse (i.e. the stroke output) of the user of the mobile phone. Alternatively, the heartbeat sensor may comprise electrode(s) integrated into a bracelet or a belt such as the one used in the fitness and healthcare systems.

According to another embodiment of the invention, the heartbeat sensor 111 is adapted to monitor the complete heartbeat signal.

The communication unit 113 (respectively 123) must be suitable for receiving the second heartbeat signal (respectively the first heartbeat signal) from the mobile phone 12 (respectively 11) and for transmitting the first heartbeat signal (respectively the second heartbeat signal) to the mobile phone 12 (respectively 11).

To this end, according to an embodiment of the invention, the communication unit 113 or 123 comprises a radio frequency RF transceiver based, for example, on the GSM and/or UMTS standard.

According to another embodiment of the invention, the communication unit 113 or 123 includes a Bluetooth™ transceiver.

It will be apparent to a person skilled in the art that other implementations are possible based, for example, on Infra Red IR transmission or even wired transmission.

In order to measure the level of coherence between the first and second heartbeat signals, the phase and/or frequency of the two signals are measured and compared in real time. To this end, the mobile phone 11 (respectively 12) comprises a processor 112 (respectively 122).

According to an embodiment of the invention, the frequency of the heartbeat signals is measured locally in both mobile devices 11 and 12, the transmitted data being the frequency rate. The level of coherence is then determined by comparing the heartbeat frequencies. As an example, the level of coherence is:

\[
L_1 = \frac{1}{n} \sum_{t=1}^{n} \frac{f_1(t)}{|f_1(t) - f_2(t)|}
\]

where \(f_1\) is the frequency of the first heartbeat signal and \(f_2\) is the frequency of the second heartbeat signal, these frequencies being measured \(n\) times, where \(n\) is an integer, at successive time instants \(t\). This implementation is particularly cost effective.

According to a more sophisticated embodiment of the invention, the complete heartbeat signal is transmitted and the phase difference between the two heartbeat signals is
measured. Said phase difference is representative of the level of coherence. As an example, the level of coherence is:

\[
L_2 = \frac{1}{n \Delta t} \sum_{t=1}^{n \Delta t} \frac{|sl(t) - s2(t)|}{|sl(t)|}
\]  

(2)

where \( sl(t) \) is the first heartbeat signal at a time instant \( t \) and \( s2(t) \) is the second heartbeat signal at the same time instant \( t \), \( n \) is an integer and \( \Delta t \) is a time interval, the value of \( n \Delta t \) being at least equal to the duration of a heart cycle.

In order to measure a phase difference, a real-time transmission is necessary. This is achieved by using the Code Division Multiple Access CDMA standard, which provides a synchronization method from which the exact phase difference between the heartbeat signals coming from the two different sources is derived. It is to be noted that absolute phase differences can also be derived from Bluetooth transmissions with a sufficient accuracy.

It will apparent to those skilled in the art that the comparison of the two heartbeat signals may be based on a more sophisticated mathematical formula: e.g. it may be based on a correlation of the two heartbeat signals, the result of the inverse of the correlation being representative of the level of coherence.

When the level of coherence is above a given threshold (depending on the implementation, e.g. 50 in the case of the level of coherence \( L_1 \) as computed in equation (1)), indicating that the heartbeat signals are synchronized and thus that a potential lover has been found, a signal or a message is given to one or both users via user interfaces 114 or 124.

According to an embodiment of the invention, the detection of the synchronicity between the two heartbeat signals is done using digital circuits with zero crossing detection.

The heartbeat signals are compared either upon request of the mobile phone user or continuously between mobile phones carried by people passing by.

According to an embodiment of the invention, the mobile phone user interface 114 includes a user profile. The user profile includes, for example, conditions with respect to age, gender, type of relation, etc. In addition to the heartbeat signals, the user profiles are exchanged thanks to the communication units 113 and 123. If the heartbeat signals are synchronized, the processor is adapted to check if the user profiles match to each other. If this is the case, then a signal or a message is given to one or both users.

It should be noted that the above-mentioned embodiment illustrates rather than limits the invention, and that those skilled in the art will be capable of designing many alternative
embodiments without departing from the scope of the invention as defined by the appended claims. For example, the mobile phone may comprise additional emotion sensors (not represented) in order to provide additional emotional or physiological information. Examples of emotion sensors are skin resistance sensors and heart rate variance monitors.

In the claims, any reference signs placed in parentheses shall not be construed as limiting the claims. The word "comprising" and "comprises", and the like, does not exclude the presence of elements or steps other than those listed in any claim or the specification as a whole. The singular reference of an element does not exclude the plural reference of such elements and vice-versa. The invention may be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In a device claim enumerating several means, several of these means may be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.
CLAIMS

1. A handheld device (11) comprising:
   - a heartbeat sensor (111) for monitoring a first heartbeat signal (s1) of a user of the handheld device,
   - a communication unit (113) for receiving a second heartbeat signal (s2) of a user of another handheld device (12),
   - a comparison unit (112) for comparing the first and second heartbeat signals so as to determine a level of coherence between them, and
   - a decision unit (112) for indicating a potential lover if the level of coherence is above a given threshold.

2. A handheld device (11) as claimed in claim 1, further comprising an earphone in which the heartbeat sensor (111) is built into.

3. A handheld device (11) as claimed in claim 1, wherein the comparison unit is adapted to compare the frequency and phase of the first and second heartbeat signals.

4. A handheld device (11) as claimed in claim 1, further comprising a user interlace (114) including a first user profile, wherein the communication unit (113) is adapted to receive a second user profile from the other handheld device (12), and the decision unit (112) is adapted to indicate a potential lover if the level of coherence is above a given threshold and if the first and second user profiles match to each other.

5. A handheld device (11) as claimed in claim 1, wherein the communication unit (113) is a wireless communication unit.

6. A method of indicating a potential lover to a user of a first handheld device (11), said method comprising:
   - monitoring a first heartbeat signal (s1) of the user of the first handheld device (11),
   - receiving a second heartbeat signal (s2) of a user of a second handheld device (12),
   - comparing the first and second heartbeat signals so as to determine a level of coherence between them, and
   - indicating a potential lover if the level of coherence is above a given threshold.
A computer program product comprising program instructions for implementing, when said program is executed by a processor, a method as claimed in claim 6.
A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F17/00

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)
A61B G06F

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>Y</td>
<td>&quot;The Energetic Heart: Bioelectromagnetic Communication Within and Between People&quot; CLINICAL APPLICATIONS OF BIOELECTROMAGNETIC MEDICINE, EDITORS P. J. ROSCH AND M. S. MARKOV, 2004, pages 541-562, XP002394007 Marcel Dekker, New York * section titled &quot;Physiological Linkage and Empathy&quot;</td>
<td>1-7</td>
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Further documents are listed in the continuation of Box C

Date of the actual completion of the international search: 8 August 2006

Name and mailing address of the ISA/ European Patent Office, P B 5818 Patentlaan 2 NL- 2280 HV Rijswijk Tel (+31-70) 340-2040, Tx 31 651 epo nl, Fax (+31-70) 340-3016

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<th>Relevant to claim No.</th>
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<tr>
<td>A</td>
<td>FR 2 853 100 A (FRANCE TELECOM) 1 October 2004 (2004-10-01) the whole document</td>
<td>1-7</td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
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<tr>
<td>----------------------------------------</td>
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</tr>
<tr>
<td>US 2002143241 A1</td>
<td>03-10-2002</td>
<td>NONE</td>
</tr>
<tr>
<td>US 5720619 A</td>
<td>24-02-1998</td>
<td>NONE</td>
</tr>
<tr>
<td>FR 2853100 A</td>
<td>01-10-2004</td>
<td>NONE</td>
</tr>
<tr>
<td>P 1532926 A</td>
<td>25-05-2005</td>
<td>CN 1626029 A</td>
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<td></td>
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<td>JP 2005152054 A</td>
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<tr>
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<td>US 2005114142 A1</td>
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