

Description

The present invention relates to pagers and in particular to a pager with an automatically illuminated message display.

US-A-4,336,524 describes a display pager with a receiver, an address detector, and a display for the indication of the message in the received signal. It also includes a manually operated mechanical switch to trigger a lamp to illuminate the display. However, it is desired to effect the illumination automatically according to ambient lighting condition.

It is therefore an object of the present invention to provide a pager having a display which is illuminated automatically when external luminance is lower than a predetermined value. This object is solved by claim 1.

According to the invention, the pager includes a light sensor, such as phototransistor, which is sensitive to light externally illuminating the pager to generate a first signal when the sensed light is below the predetermined value. The first signal is supplied to a coincidence gate. A second signal to the coincidence gate is generated when there is a message on the display. Output from the coincidence gate is applied to a light source to illuminate the display to make it visible under poor lighting conditions.

The elimination of mechanical switch has brought about advantages in that the light sensor requires a smaller space than is required by mechanical switch, ensures an extended life time and waterproof construction.

The pager of the invention is further provided with a power saving feature that shuts off power supply to the light sensor in the absence of a message on display.

The present invention will be described in further detail with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram of a pager according to an embodiment of the present invention;

Fig. 2 is a perspective view of the pager;

Fig. 3 is a block diagram of a pager according to another embodiment of the invention; and

Fig. 4 is a flowchart describing the method of operation of the pager of the invention.

Fig. 1 is a block diagram of a pager embodying the present invention. In Fig. 1, an antenna 1 receives a signal that is coupled to a receiver 2 that supplies a demodulated output to a waveform shaper 3. The output of waveshaper 3 is coupled to a controller 4. The function of the controller not only controls switching on and off of receiver 2 and waveform shaper 3, it may also operate these circuits on an intermittent basis to extend the life of batteries in the pager. The controller includes a decoder and a central processing unit, the decoder being associated with an address PROM (programmable read-only memory) 5 and the CPU being associated with a message RAM (random access memory) 6. Decoder compares received address words with an address word stored in memory 5 to see if the

particular pager has been called. If controller 4 detects a call to this pager, an alert oscillator 7 feeds a speaker 8 to alert the user. A message word following the address word is placed into memory 6 for later retrieval upon operation of a button 30. The message word is also fed to an LCD driver 9 and thence to a liquid-crystal display 10.

The pager of the present invention further includes a phototransistor 11 having a collector coupled through a current limiting resistor 12 to a battery 19 and an emitter connected to the base of a transistor 14. Transistor 14 is biased into conduction in response to an emitter current being supplied from phototransistor 11 when it receives light rays from external source. Transistor 14 draws current through resistor 13 when the lighting condition has a luminance which is sufficient to illuminate the display 10. No current is thus generated in transistor 14 when display 10 is poorly lit and under this condition the potential at the collector of transistor 14 is raised to a logical 1 which enables an AND gate 15. A second input to AND gate 15 is supplied from the output of LCD driver 9 which is at a logical 1 when message is being displayed. The output of AND gate is at logical 1 when message is displayed while luminance is low and turns on a transistor 16, drawing a current through lamp 18 and resistor 17. Lamp 18 illuminates display 10 to compensate for the insufficient luminance.

Flashing indication is also given when flash oscillator 32 is activated in response to receipt of a call under the control of controller 4 and flashes lamp 33.

It would be useful to the user to read the displayed message while carrying a pager on his waist. In Fig. 2, display 10 is mounted on the top of a casing 31 which is formed on an opaque material such as ABS resin or polycarbonate and which is strapped to the waist of the user using a belt 20 and held in a position that makes display 10 visible from above. Phototransistor 11 is located in a position adjacent one end of display 10 and flash lamp 33 in a position adjacent the other end of display 10. This is to keep the flash lamp from interfering with phototransistor 11. The light receiving surface of phototransistor 11 is covered by a glass member which is sealed to the edge of a hole in the casing to make it waterproof. Since the phototransistor is compact, it occupies a very small area on the top of casing 31. It would be advantageous to allow the user to increase the contrast of the message which is displayed under a relatively high lighting condition. This is simply done by covering the window of phototransistor 11 with a finger.

In the above embodiment phototransistor 11 is constantly powered once the pager is turned on. For power saving purposes, it is advantageous to shut off power supply to phototransistor 11 when there is no message being displayed. The circuit of Fig. 3 provides a power shut-off feature. In Fig. 3, controller 4 comprises decoder 40, central processing unit 41 and input/output port 42. A

DC—DC converter 21 provides boost to the DC potential applied from batteries 19 to decoder 40 to a level appropriate for operating the CPU 41. Lamp 18 is coupled to an output port and the collector of phototransistor 11 is coupled through resistor 12 to an output port and the collector of transistor 14 is connected to an input port.

Fig. 4 is a block diagram of the method of operation of the display pager of Fig. 3. In Fig. 4, block 51 turns on the pager in response to the pressing on a power-on switch 22. Decision block 52 next tests for the presence of a message being displayed on display 10. If there is a message on display, execution block 53 applies a potential to phototransistor 11. Next follows a decision block 54 which checks the potential at the collector of transistor 14 to see if it is lower than a predetermined value. If display 10 is dimly lit under poor lighting condition, exit from decision block 54 is to block 55 that turns on lamp 18, illuminating display 10 and if it is brightly shone, exit from block 54 is to decision block 58. Block 58 tests the presence of the message on display 10 and detects when the message ceases to exist. If the message is still on display, exit from block 58 is to block 54 to loop around blocks 54 and 58 until the message disappears, whereupon block 59 is executed by removing the potential from phototransistor 11. With lamp 18 being turned on, control proceeds to decision block 56 which tests the potential at the base of transistor 14 to see if the ambient condition is still dim or has changed to a level sufficient to illuminate display 10. If ambient condition has changed to the high luminance, exit from block 56 is to execution block 57 that turns off lamp 18 and thence to decision block 58 to keep the message on display under external light as control loops around blocks 54 and 58.

Exit from decision block 56 is to decision block 60 if the poor lighting condition still prevails while message is being displayed. Block 60 tests for the presence of the message still on display. If present, control exits to block 56 and loops around blocks 60 and 56 until the message disappears, whereupon exit from block 60 is to execution block 61 that turns off phototransistor 11 and lamp 18 simultaneously.

Thus, power supply to phototransistor 11 is shut off during periods when no message is displayed, thus minimizing power consumption.

Claims

1. A pager comprising:
 - a) a receiver (2) for receiving a signal;
 - b) means for (4, 5, 6) detecting an address in the received signal;
 - c) means (10) for displaying a message in the received signal;
 - characterized by
 - d) a light sensor (11) for generating a signal indicating that the ambient light has a luminance lower than a predetermined value;
 - e) means (15) for detecting a coincidence

between the presence of said message on said display means and the signal generated by the light sensor (11);

f) a light source (18) for illuminating said display means (10) in response to the detection of said coincidence.

2. A pager as claimed in claim 1, further comprising indicator means (33) for giving a flashing indication in response to the detection of said address and a casing (31) having a top surface and means (20) for fastening said casing to a user so that said top is visible from above, wherein said display means (10) is located on the top of said casing (31), said light sensor (11) is located on said top adjacent to one of said display means (10) and said indicator means is located on said top adjacent to the other end of said display means (10).

3. A pager as claimed in claim 1 or 2, further comprising a casing (31) having an opening therein, wherein said light sensor (11) comprises a phototransistor located behind a transparent member which is fluid-tightly engaged in said opening to receive light through said transparent member.

4. A pager as claimed in any of claims 1 to 3, wherein said light sensor comprises:

a) a phototransistor (11) having first and second controlled electrodes;

b) a second transistor (14) having a control electrode connected through the first and second controlled electrodes of said phototransistor (11) to a voltage source (19), the second transistor (14) having a first controlled electrode connected to one terminal of said voltage source (19) and a second controlled electrode connected through a resistor (13) to the other terminal of said voltage source, a junction between said resistor (13) and said second electrode being connected to said coincidence detecting means (15).

5. A pager as claimed in any one of claims 1 to 4, further comprising means (41, 42) for shutting off power supply to said light sensor (11) in the absence of said message on said display means (10, Fig. 3).

6. A pager as claimed in claim 5, wherein said light sensor comprises:

a) a phototransistor (11) having a first controlled electrode connected to a first port and second controlled electrode;

a second transistor (14) having a control electrode connected to the second electrode of said phototransistor (11), the second transistor (14) having a first controlled electrode connected to a common ground and a second controlled electrode connected through a resistor (13) to said first port, a junction between said resistor (13) and said second electrode being connected to a second port,

b) means (41, 42) for coupling a voltage to said first port in response to the signal indicating the presence of said message on said display means and decoupling said voltage from said first port in response to the absence of the last-mentioned signal.



DC—DC converter 21 provides boost to the DC potential applied from batteries 19 to decoder 40 to a level appropriate for operating the CPU 41. Lamp 18 is coupled to an output port and the collector of phototransistor 11 is coupled through resistor 12 to an output port and the collector of transistor 14 is connected to an input port.

Fig. 4 is a block diagram of the method of operation of the display pager of Fig. 3. In Fig. 4, block 51 turns on the pager in response to the pressing on a power-on switch 22. Decision block 52 next tests for the presence of a message being displayed on display 10. If there is a message on display, execution block 53 applies a potential to phototransistor 11. Next follows a decision block 54 which checks the potential at the collector of transistor 14 to see if it is lower than a predetermined value. If display 10 is dimly lit under poor lighting condition, exit from decision block 54 is to block 55 that turns on lamp 18, illuminating display 10 and if it is brightly shone, exit from block 54 is to decision block 58. Block 58 tests the presence of the message on display 10 and detects when the message ceases to exist. If the message is still on display, exit from block 58 is to block 54 to loop around blocks 54 and 58 until the message disappears, whereupon block 59 is executed by removing the potential from phototransistor 11. With lamp 18 being turned on, control proceeds to decision block 56 which tests the potential at the base of transistor 14 to see if the ambient condition is still dim or has changed to a level sufficient to illuminate display 10. If ambient condition has changed to the high luminance, exit from block 56 is to execution block 57 that turns off lamp 18 and thence to decision block 58 to keep the message on display under external light as control loops around blocks 54 and 58.

Exit from decision block 56 is to decision block 60 if the poor lighting condition still prevails while message is being displayed. Block 60 tests for the presence of the message still on display. If present, control exits to block 56 and loops around blocks 60 and 56 until the message disappears, whereupon exit from block 60 is to execution block 61 that turns off phototransistor 11 and lamp 18 simultaneously.

Thus, power supply to phototransistor 11 is shut off during periods when no message is displayed, thus minimizing power consumption.

Claims

1. A pager comprising:

- a) a receiver (2) for receiving a signal;
- b) means for (4, 5, 6) detecting an address in the received signal;
- c) means (10) for displaying a message in the received signal; characterized by
- d) a light sensor (11) for generating a signal indicating that the ambient light has a luminance lower than a predetermined value;
- e) means (15) for detecting a coincidence

between the presence of said message on said display means and the signal generated by the light sensor (11);

f) a light source (18) for illuminating said display means (10) in response to the detection of said coincidence.

2. A pager as claimed in claim 1, further comprising indicator means (33) for giving a flashing indication in response to the detection of said address and a casing (31) having a top surface and means (20) for fastening said casing to a user so that said top is visible from above, wherein said display means (10) is located on the top of said casing (31), said light sensor (11) is located on said top adjacent to one of said display means (10) and said indicator means is located on said top adjacent to the other end of said display means (10).

3. A pager as claimed in claim 1 or 2, further comprising a casing (31) having an opening therein, wherein said light sensor (11) comprises a phototransistor located behind a transparent member which is fluid-tightly engaged in said opening to receive light through said transparent member.

4. A pager as claimed in any of claims 1 to 3, wherein said light sensor comprises:

a) a phototransistor (11) having first and second controlled electrodes;

b) a second transistor (14) having a control electrode connected through the first and second controlled electrodes of said phototransistor (11) to a voltage source (19), the second transistor (14) having a first controlled electrode connected to one terminal of said voltage source (19) and a second controlled electrode connected through a resistor (13) to the other terminal of said voltage source, a junction between said resistor (13) and said second electrode being connected to said coincidence detecting means (15).

5. A pager as claimed in any one of claims 1 to 4, further comprising means (41, 42) for shutting off power supply to said light sensor (11) in the absence of said message on said display means (10, Fig. 3).

6. A pager as claimed in claim 5, wherein said light sensor comprises:

a) a phototransistor (11) having a first controlled electrode connected to a first port and second controlled electrode;

a second transistor (14) having a control electrode connected to the second electrode of said phototransistor (11), the second transistor (14) having a first controlled electrode connected to a common ground and a second controlled electrode connected through a resistor (13) to said first port, a junction between said resistor (13) and said second electrode being connected to a second port,

b) means (41, 42) for coupling a voltage to said first port in response to the signal indicating the presence of said message on said display means and decoupling said voltage from said first port in response to the absence of the last-mentioned signal,

said coincidence detecting means (15) being responsive to a voltage level at said second port as said signal indicating the presence of said ambient light having said lower luminance value.

7. A pager as claimed in any of claims 1 to 6, wherein said display means (10) is a liquid crystal display.

Patentansprüche

1. Personenrufer mit
a) einem Empfänger (2) zum Empfang eines Signals,
b) einer Einrichtung (4, 5, 6) zum Feststellen einer Adresse in dem empfangenen Signal,
c) eine Einrichtung (10) zum Anzeigen einer in dem empfangenen Signal enthaltene Nachricht, gekennzeichnet durch
d) einen Lichtsensor (11) zum Erzeugen eines Signals zur Anzeige, daß das Umgebungslicht eine Luminanz unterhalb eines vorgegebenen Werts aufweist,

e) eine Einrichtung (15) zum Feststellen einer Koinzidenz zwischen dem Vorliegen der Nachricht auf der Anzeige und dem durch den Lichtsensor (11) erzeugten Signal und durch
f) eine Lichtquelle (18) zum Beleuchten der Anzeige (10) bei Vorliegen der Koinzidenz.

2. Personenrufer nach Anspruch 1 mit einer Anzeigevorrichtung (33) für eine Blinkanzeige bei Feststellen der Adresse und ein Gehäuse (31) mit einer Oberseite sowie eine Einrichtung (20) zum Befestigen des Gehäuses am Benutzer, so daß die Oberseite von oben sichtbar ist, wobei die Anzeige (10) an der Oberseite des Gehäuses (31) angeordnet ist, sich der Lichtsensor (11) auf der Oberseite in der Nähe eines Endes der Anzeige (10) befindet, und die Anzeigevorrichtung an der Oberseite in der Nähe des anderen Endes der Anzeige (10) angeordnet ist.

3. Personenrufer nach Anspruch 1 oder 2, gekennzeichnet durch ein Gehäuse (31) mit einer darin befindlichen Öffnung, wobei der Lichtsensor (11) einen Phototransistor aufweist, der hinter einem transparenten Element angeordnet ist, daß mit der Öffnung fluiddicht in Eingriff steht, so daß durch das transparente Element Licht empfangen wird.

4. Personenrufer nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der Lichtsensor folgende Bestandteile aufweist:

a) einen Phototransistor (11) mit einer ersten und einer zweiten gesteuerten Elektrode,

b) einen zweiten Transistor (14) mit einer Steuerelektrode, die über die erste und die zweite gesteuerte Elektrode des Phototransistors (11) mit einer Spannungsquelle (19) verbunden ist, wobei der zweite Transistor (14) eine erste gesteuerte Elektrode, die mit einem Anschluß der Spannungsquelle (19) verbunden ist, und eine zweite gesteuerte Elektrode aufweist, die über einen Widerstand (13) mit dem anderen Anschluß der Spannungsquelle verbunden ist, und wobei ein Verbindungspunkt zwischen dem

Widerstand (13) und der zweiten Elektrode mit dem Koinzidenzdetektor (15) verbunden ist.

5. Personenrufer nach einem der Ansprüche 1 bis 4, gekennzeichnet durch eine Einrichtung (41, 42) zum Abschalten der Stromversorgung des Lichtsensors (11) bei fehlender Nachricht auf der Anzeige (10, Fig. 3).

6. Personenrufer nach Anspruch 5, dadurch gekennzeichnet, daß der Lichtsensor folgende Bestandteile aufweist:

a) einen Phototransistor (11) mit einer ersten gesteuerten Elektrode, die mit einem ersten Anschluß und einer zweiten gesteuerten Elektrode verbunden ist,

einen zweiten Transistor (14) mit einer Steuerelektrode, die mit der zweiten Elektrode des Phototransistors (11) verbunden ist, wobei der zweite Transistor (14) eine erste mit Masse verbundene, gesteuerte Elektrode und eine zweite gesteuerte Elektrode aufweist, die über einen Widerstand (13) mit dem ersten Anschluß verbunden ist, und wobei ein Verbindungspunkt zwischen dem Widerstand (13) und der zweiten Elektrode mit einem zweiten Anschluß verbunden ist,

b) eine Einrichtung (41, 42) zum Anlegen einer Spannung an den ersten Anschluß in Abhängigkeit von dem Signal, das das Vorliegen der Nachricht auf der Anzeige angibt, und zum Trennen der Spannung von dem ersten Anschluß, wenn das zuletztgenannte Signal fehlt,

wobei der Koinzidenzdetektor (15) auf einem Spannungspegel am zweiten Anschluß anspricht, wenn das vorhandensein von Umgebungslicht anzeigende Signal den niedrigeren Luminanzwert aufweist.

7. Personenrufer nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß die Anzeige (10) eine Flüssigkristallanzeige ist.

Revendications

1. Système d'appel comprenant:

a) un récepteur (2) pour recevoir un signal;

b) un moyen (4, 5, 6) pour détecter une adresse dans le signal reçu;

c) un moyen (10) pour afficher un message dans le signal reçu; caractérisé par:

d) un détecteur de lumière (11) pour produire un signal indiquant que la lumière ambiante a une luminance inférieure à une valeur prédéterminée;

e) un moyen (15) pour détecter une coïncidence entre la présence du message sur le moyen d'affichage et le signal produit par le détecteur de lumière (11); et

f) une source lumineuse (18) pour éclairer le moyen d'affichage (10) en réponse à la détection de la coïncidence.

2. Système d'appel selon la revendication 1, comprenant en outre un moyen d'indicateur (33) pour donner une indication clignotante en réponse à la détection de l'adresse et un boîtier (31) ayant une surface supérieure, et un moyen





(20) pour fixer le boîtier à un utilisateur de façon que la partie supérieure soit visible du dessus, où le moyen d'affichage (10) est situé sur la partie supérieure du boîtier (31), le détecteur de lumière (11) est placé sur la partie supérieure contiguë à une extrémité du moyen d'affichage (10) et le moyen d'indicateur est placé sur la partie supérieure contiguë à l'autre extrémité du moyen d'affichage (10).

3. Système d'appel selon la revendication 1 ou la revendication 2, comprenant en outre un boîtier (31) présentant une ouverture, où le détecteur de lumière (11) comprend un phototransistor placé à l'arrière d'un élément transparent qui est engagé en étant étanche aux fluides dans l'ouverture pour recevoir la lumière par l'intermédiaire de l'élément transparent.

4. Système d'appel selon l'une quelconque des revendications 1 à 3, où le détecteur de lumière comprend:

a) un phototransistor (11) ayant des première et seconde électrodes contrôlées;

b) un second transistor (14) ayant une électrode de commande connectée par l'intermédiaire des première et seconde électrodes contrôlées du phototransistor (11) à une source de tension (19), le second transistor (14) comportant une première électrode contrôlée qui est connectée à une borne de la source de tension (19) et une seconde électrode contrôlée qui est connectée par l'intermédiaire d'une résistance (13) à l'autre borne de la source de tension, une jonction entre la résistance (13) et la seconde électrode étant reliée au moyen de détection de coïncidence (15).

5. Système d'appel selon l'une quelconque des revendications 1 à 4, comprenant en outre un moyen (41, 42) pour couper l'alimentation du détecteur de lumière (11) en l'absence du message sur le moyen d'affichage (10) (figure 3).

6. Système d'appel selon la revendication 5, où le détecteur de lumière comprend:

a) un phototransistor (11) ayant une première électrode contrôlée qui est reliée à un premier point d'accès et une seconde électrode contrôlée; un second transistor (14) comportant une électrode de commande connectée à la seconde électrode du phototransistor (11), le second transistor (14) ayant une première électrode contrôlée qui est connectée à une masse commune et une seconde électrode contrôlée qui est connectée par l'intermédiaire d'une résistance (13) au premier point d'accès, une jonction entre la résistance (13) et la seconde électrode étant reliée à un second point d'accès,

b) un moyen (41, 42) pour appliquer une tension au premier point d'accès en réponse au signal indiquant la présence du message sur le moyen d'affichage et enlevant la tension du premier point d'accès en réponse à l'absence du signal cité en dernier;

le moyen de détection de coïncidence (15) répondant à une valeur de tension au second point d'accès alors que le signal indiquant la présence de la lumière ambiante a une valeur de luminance plus faible.

7. Système d'appel selon l'une quelconque des revendications 1 à 6, où le moyen d'affichage (10) est un affichage à cristaux liquides.

