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Inventor(s)	Pappert; Bernard

Battery enhancing vehicle internal temperature monitoring device

Abstract

A system for monitoring ambient temperatures surrounding a child's car seat and alerting a user of unsafe highs or lows includes a battery and a microcontroller mounted within a housing. The microcontroller includes a transmitter that communicates with a temperature sensor and an external server. The transmitter and the temperature sensor each have an active state and a resting state. In the resting state, the components draw little to no power from the battery. The temperature sensor periodically enters the active state to take ambient temperature readings. When those ambient temperature readings fall outside of the predetermined ranges for child safety, the transmitter enters the active state and sends an alert to the server, which relays the alert to the user. The transmitter can also send the alert to an emergency communications line or emit an audible alarm to alert nearby people of the unsafe conditions.

Inventors: **Pappert; Bernard (Austin, TX)**

Applicant: **Pappert; Bernard** (Austin, TX)

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Primary Examiner: Wu; Zhen Y

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS
(1) Not Applicable
STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT
(2) Not Applicable

THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT

(3) Not Applicable

INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC OR AS A TEXT FILE VIA THE OFFICE ELECTRONIC FILING SYSTEM

(4) Not Applicable

STATEMENT REGARDING PRIOR DISCLOSURES BY THE INVENTOR OR JOINT INVENTOR

(5) Not Applicable

BACKGROUND OF THE INVENTION

(1) Field of the Invention

(6) The disclosure relates to temperature monitors and more particularly pertains to a new temperature monitor for measuring an ambient temperature and alerting a user of unsafe highs or lows.

(2) Description of Related Art Including Information Disclosed Under 37 CFR 1.97 and 1.98

(7) The prior art relates to temperature monitors. Some temperature monitors use a pressure pad to determine if a child or other person is inside a vehicle. However, these monitors are expensive and can be difficult to retrofit into used vehicles. Some newer car models also issue an audible reminder alert if, at the beginning of a drive, a rear car door is opened and, at the end of the drive, the rear car door is not opened. These audible reminders are intended to help the driver remember to check the back seat to ensure children or other passengers have exited the vehicle at the end of the drive. However, these audible reminders are unavailable in older cars. Other prior art references disclose temperature sensors that are powered on when a child is buckled into their car seat. These sensors may issue an alert when the surrounding temperatures become unsafe for the child. However, these sensors only work on newer seats which have the sensors integrally installed within the car seats. Thus, there is a need in the art for an affordable temperature monitoring system that can be used in old or new car seats and in any vehicle.

BRIEF SUMMARY OF THE INVENTION

(8) An embodiment of the disclosure meets the needs presented above by generally comprising a temperature monitoring device that can be affixed to a child's car seat. The temperature monitoring device has a housing. A power source and a microcontroller are mounted within the housing. The microcontroller includes a transmitter that wirelessly communicates with an external server and a temperature sensor within the housing. The transmitter and the temperature sensor each have an active state and a resting state. In the resting state, the transmitter and temperature sensor draw little to no power from the power source. The temperature sensor is programmed to periodically enter the active state to take ambient temperature readings. When those ambient temperature readings fall outside of the predetermined ranges for child safety, the transmitter enters the active state and sends an alert to the server, which relays the alert to the user's mobile device. If the user fails to respond to the alert, the transmitter sends the alert to an emergency communications line. If the server is unresponsive, the transmitter emits an audible alarm at a level that will alert passersby without risking damage to the child's hearing. Future minimization of the hardware modules, including the power source, the microcontroller, and the temperature sensor, will make it feasible to connect the temperature monitoring device to a pet's collar to provide protection from excessive heat.

(9) There has thus been outlined, rather broadly, the more important features of the disclosure in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are additional features of the disclosure that will be described hereinafter, and which will form the subject matter of the claims appended hereto.

(10) The objects of the disclosure, along with the various features of novelty which characterize the

disclosure, are pointed out with particularity in the claims annexed to and forming a part of this disclosure.

Description

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWING(S)

(1) The disclosure will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

(2) FIG. **1** is an isometric view of a system and device for monitoring ambient temperatures according to an embodiment of the disclosure.

(3) FIG. **2** is a front view of an embodiment of the disclosure.

(4) FIG. **3** is an exploded view of an embodiment of the disclosure.

(5) FIG. **4** is an in-use view of an embodiment of the disclosure.

(6) FIG. **5** is a block diagram view of an embodiment of the disclosure.

DETAILED DESCRIPTION OF THE INVENTION

(7) With reference now to the drawings, and in particular to FIGS. **1** through **5** thereof, a new temperature monitor embodying the principles and concepts of an embodiment of the disclosure and generally designated by the reference numeral **10** will be described.

(8) As best illustrated in FIGS. **1** through **5**, the system for monitoring ambient temperatures **10** generally comprise a temperature monitoring device **20** that can be affixed to a child's car seat **12** and communicate with an electronic device **14** of a user. The temperature monitoring device **20** has a housing **30**. A power source **32** and a microcontroller **34** are mounted within the housing **20**. The microcontroller **34** includes a transmitter **36** that wirelessly communicates with an external server and a temperature sensor **38** that is the microcontroller. The transmitter **36** and the temperature sensor **38** each have an active state and a resting state. In the resting state, the transmitter **36** and temperature sensor **38** draw little to no power from the power source **32**. The temperature sensor **38** is programmed to periodically enter the active state to take ambient temperature readings. When those ambient temperature readings fall outside of the predetermined ranges for child safety, the transmitter **36** enters the active state and sends an alert to the server, which relays the alert to a mobile device **14** of a user. If the user fails to respond to the alert, the transmitter **36** sends the alert to an emergency communications line **16**. The transmitter may also send the alert to an additional caregiver device **18**, such as a mobile device of another person or user who is responsible for the child. If the server is unresponsive, the transmitter **36** emits an audible alarm at a level that will alert passerby without risking damage to the child's hearing.

(9) Embodiments of the temperature monitoring device **20** include a housing **30** having a base plate **22** surrounded by a peripheral wall **24**. The peripheral wall **24** generally extends upwardly from the base plate **22**. The base plate may be integrally formed with the peripheral wall **24** or may be otherwise attached using any appropriate means. A top plate **26** is opposite the peripheral wall **24** from the base plate **22**. In the example provided in FIG. **3**, the top plate **26** is affixed to the peripheral wall **24** using a plurality of screws **28**, but any appropriate means may be used. The housing **30** has an interior space **31** that is bounded by the base plate **22**, the peripheral wall **24**, and the top plate **26**. An adhesive **29** may be mounted to an exterior surface **23** of the base plate **22**. The adhesive **29** may alternatively be mounted to another exterior surface of the housing **30**. The adhesive **29** is configured to mount the housing **30** to an operating surface, such as a child's car seat **12**. In some embodiments, the adhesive **29** may comprise a temporary or removable adhesive so that the placement of the housing **30** can be adjusted. In other embodiments, an adhesive **29** that more permanently affixes the housing **30** to the operating surface may be used.

(10) A power source **32**, such as a rechargeable battery, is mounted within the interior space **31**. For

example, the power source **32** may be affixed to the base plate **22**. In embodiments including a rechargeable battery as the power source **32**, a charging port **33** may be positioned in the housing **30**. The charging port **33** should be exposed within an exterior surface **23** of the housing **30**. For example, the charging port **33** may be configured to receive a USB charging cable. The charging port **33** is electrically coupled with the rechargeable battery **32**.

(11) A microcontroller **34** is mounted within the interior space **31**, for example to the base plate **22**. The microcontroller **34** is electronically coupled with the power source **32**. The microcontroller **34** includes a transmitter **36** that is in wireless electronic communication with an external server (not shown). The transmitter **36** has an active transmission state and a resting transmission state. While in the resting transmission state, the transmitter **36** draws no power or reduced power from the power source **32**.

(12) The external server (not shown) is in wireless electronic communication with a mobile device **14** of a user. In embodiments, the mobile device **14** may have an application that provides a user interface between the mobile device **14** and the transmitter **36**. With the user interface, the user may view a plurality of their registered temperature monitoring devices **20**, adjust settings and controls for the device **20**, respond to alerts issued by the device **20**, and perform other such tasks. The server is also in wireless electronic communication with an emergency line **16**, such as a 911 line or other emergency contact number. As explained further below, the transmitter **36** can send alerts to the mobile device **14** of the user or the emergency line **16**. For example, if the user does not respond to an alert issued to the mobile device **14**, the transmitter could send the alert to the emergency line **16** so that first responders or other personnel can respond to the dangerous temperature conditions surrounding the device **20**. With this alert, either the user or the emergency personnel can respond and remove a child from the child's car seat **12** when surrounding temperatures pose a risk to the child's health and well-being. Additionally, the server may be in wireless electronic communication with an additional caregiver device **18**, which is a mobile or electronic device of another person or user who may be responsible for the child or otherwise capable of responding to the alert. The transmitter **36** can send the alert to the additional caregiver device **18** if the user does not respond to the alert. For example, the transmitter **36** may send the alert to the additional caregiver device **18** before sending the alert to the emergency line **16** or simultaneously with sending the alert to the emergency line **16**. With this alert, the additional caregiver can also respond and remove the child from the child's care seat **12** when surrounding temperatures risk harming the child. The user interface of the mobile application may permit the user to input information about the additional caregiver or connect the additional caregiver device **18** with the temperature monitoring device **20**.

(13) A temperature sensor **38** is also included in the microcontroller **34**. The temperature sensor **38** is in electronic communication with the transmitter **36**. The temperature sensor **38** has an active state and a resting state. The temperature sensor **38** draws no power or reduced power from the power source **32** when the temperature sensor **38** is in the resting state. The temperature sensor **38** periodically alternates to the active state, when the temperature sensor **38** measures the temperature surrounding the device **20**. For example, the periodic alterations into the active state may occur at an interval ranging from 2 minutes to 8 minutes. In some embodiments, the user can adjust the interval using the application on their mobile device **14**. The temperature sensor **38** is also configured to be in the resting state during a sleep time. Again, in some embodiments the user may adjust the sleep time using their mobile device **14**. The temperature sensor **38** may also have a default setting for the sleep time, for example from 11:00 P.M. to 7:00 A.M. The sleep time may be determined based on lower environmental temperatures at night, when the sun is down and therefore not elevating the temperatures inside a vehicle, the sleep schedule and routine of the user, or other appropriate factors.

(14) The transmitter **36** is configured to enter the active transmission state when the temperature sensor **38** measures an ambient temperature that is less than a minimum temperature or greater than

a maximum temperature. The minimum and maximum temperatures should be determined by considering the safety of a child sitting inside a vehicle at those temperatures. For example, the minimum temperature may be no greater than 55° F. and the maximum temperature may be at least greater than 82° F. Because the device **20** measures ambient temperatures within the vehicle, the minimum and maximum temperatures will also be based on temperatures within the vehicle or other environment directly surrounding the child's car seat.

(15) The transmitter **36** is configured to send a temperature alert to the server when the ambient temperature is less than the minimum temperature or greater than the maximum temperature. The server is configured to relay the temperature alert to the mobile device **14**. For example, the alert may display on the mobile device **14** as a notification from the application installed on the mobile device **14**. The transmitter **36** may be further configured to receive a response from the server that originates from the mobile device **14**. For example, the user may input the response using the application to confirm the child has been removed from the vehicle.

(16) If the user does not respond to the temperature alert, the transmitter **36** can send an emergency alert to the emergency line **16** or to an additional caregiver device **18**. For example, the transmitter **36** may send the emergency alert when the response is not received within a threshold time limit. In embodiments, the threshold time limit ranges from 1 minute to 5 minutes after the transmitter **36** sends the temperature alert to the mobile device **14** via the server. The threshold time limit should be determined by considering how long a child can stay in extreme temperatures without risking illness or injury. Accordingly, a relatively short threshold time limit should be used, because temperatures within vehicles can rise to dangerously high levels in under 10 minutes. The emergency alert may include information used to identify the vehicle in which the child's car seat **12** is placed, such as a last-known location, make, or model of the vehicle. Other appropriate identifying information may also be included. In some embodiments, the user may input the identifying information into the application on the mobile device **14** so that emergency personnel or additional caregivers can more easily locate the child in an emergency.

(17) If the server is offline or unresponsive to the temperature alert or the emergency alert, the transmitter may issue an audible alarm to notify nearby people that a child may need assistance. The alarm should be loud enough for passersby to hear the alarm from outside the vehicle, but not so loud that it would risk damaging the child's hearing. The child may be stuck in the vehicle listening to the alarm for some time, so the alarm may issue a noise ranging from 60 dB to 70 dB.

(18) Because the transmitter **36** and temperature sensor **38** only draw power from the power source **32** when each is in their respective active states, the power requirements for the device **20** are relatively low. The power source **32** can therefore retain a power charge for a long time. In embodiments using a rechargeable battery, the battery would only need to be recharged weekly or monthly. With improved battery performance, the recharge interval could be extended even further. This improved battery performance means the device **20** can remain affixed to the child's car seat **12** at all times. The user does not need to constantly remember to recharge or reattach the device **20**. A low module battery warning message may also be sent to the mobile device **14** when the power source **32** needs to be recharged. This will mean the device **20** is far more likely to be in a position to provide assistance when needed.

(19) In use, the device **20** may be relatively small, making it easy to place onto any existing car seat **14**. For example, the housing **30** may have measurements of 4 inches by 3 inches by 1.5 inches. Because the device **20** can fit onto any car seat, it can be used on new seats or old ones. The device **20** is small enough that it could be built into new car seats or attached to existing ones. The device is convenient and affordable enough to be used in nearly any situation involving a child's car seat.

(20) With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of an embodiment enabled by the disclosure, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in

the drawings and described in the specification are intended to be encompassed by an embodiment of the disclosure.

(21) Therefore, the foregoing is considered as illustrative only of the principles of the disclosure. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the disclosure to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the disclosure. In this patent document, the word “comprising” is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article “a” does not exclude the possibility that more than one of the elements is present, unless the context clearly requires that there be only one of the elements.

Claims

1. A temperature monitoring device, comprising: a housing having an interior space being bounded by a base plate surrounded by a peripheral wall and a top plate attached to the peripheral wall opposite the base plate; a power source being mounted to the base plate within the interior space; a microcontroller being mounted within the interior space, the microcontroller being electronically coupled with the power source, including: a transmitter being in wireless electronic communication with a server, the transmitter having an active transmission state and a resting transmission state, wherein the transmitter draws no power or reduced power from the power source when the transmitter is in the resting transmission state; the server being configured to relay signals between the transmitter and at least one of an electronic device of a user and an emergency communications line; a temperature sensor being in electronic communication with the transmitter, the temperature sensor having an active state and a resting state, wherein no or reduced power is drawn from the power source when the temperature sensor is in the resting state, the temperature sensor periodically alternating to the active state, an interval of the periodic alterations of the temperature sensor is programmable by the user via the electronic device, the temperature sensor being configured to measure an ambient temperature when the temperature sensor is in the active state; the transmitter being configured to activate when the temperature sensor measures an ambient temperature that is less than a minimum temperature or greater than a maximum temperature; the transmitter being configured to send a temperature alert to the server when the ambient temperature is less than the minimum temperature or greater than the maximum temperature, the server being configured to relay the temperature alert to the electronic device; the transmitter being configured to receive a response from the electronic device via the server; and the transmitter being configured to send an emergency alert to the emergency communications line when the response is not received within a threshold time limit.

2. The temperature monitoring device of claim 1, wherein the peripheral wall extends upwardly from the base plate.

3. The temperature monitoring device of claim 1, the housing further comprising: an adhesive being mounted to an exterior surface of the base plate, the adhesive being configured to removably mount the housing to an operating surface.

4. The temperature monitoring device of claim 3, wherein the operating surface is a child's car seat.

5. The temperature monitoring device of claim 1, wherein the microcontroller is mounted to the base plate.

6. The temperature monitoring device of claim 1, wherein an interval of the periodic alterations of the temperature sensor has a range of between 2 minutes and 8 minutes.

7. The temperature monitoring device of claim 1, wherein the temperature sensor is configured to be in the resting state during a sleep time.

8. The temperature monitoring device of claim 7, wherein the sleep time is programmable by the

user via the electronic device, the sleep time further comprising a default setting from 10:00 P.M. to 8:00 A.M.

9. The temperature monitoring device of claim 1, wherein the minimum temperature is no greater than 55° F. and wherein the maximum temperature is at least greater than 82° F.

10. The temperature monitoring device of claim 1, wherein the threshold time limit is at least 3 minutes after the transmitter sends the temperature alert.

11. The temperature monitoring device of claim 1, the emergency alert further comprising a location data of the microcontroller.

12. The temperature monitoring device of claim 1, wherein the server is configured to relay signals between the transmitter and an additional caregiver device, and wherein the transmitter is configured to send the emergency alert to the additional caregiver device when the response is not received within the threshold time limit.

13. The temperature monitoring device of claim 1, wherein the power source is a rechargeable battery.

14. The temperature monitoring device of claim 13, further comprising: a charging port being positioned in the housing and being exposed within an exterior of the housing, the charging port being electrically coupled with the rechargeable battery, the charging port being configured to receive a USB charging cable.

15. The temperature monitoring device of claim 14, the rechargeable battery being configured to receive a charge from a magnetic charging assembly.

16. The temperature monitoring device of claim 1, wherein the transmitter is configured to issue an audible alarm when the server is not responding to the temperature alert, the audible alarm ranging from 60 decibels to 70 decibels.

17. A temperature monitoring device, comprising: a housing having a base plate surrounded by a peripheral wall, the peripheral wall extending upwardly from the base plate, the base plate being integrally formed with the peripheral wall; a top plate being opposite the peripheral wall from the base plate, the housing having an interior space being bounded by the base plate, the peripheral wall, and the top plate, the housing including: a plurality of screws affixing the top plate to the peripheral wall; an adhesive being mounted to an exterior surface of the base plate, the adhesive being configured to removably mount the housing to an operating surface, the operating surface being on a car seat; a rechargeable battery being mounted to the base plate within the interior space; and a charging port being positioned in the housing and being exposed within an exterior of the housing, the charging port being electrically coupled with the rechargeable battery, the charging port being configured to receive a USB charging cable; a microcontroller being mounted to the base plate within the interior space, the microcontroller being electronically coupled with the rechargeable battery, the microcontroller including: a transmitter being in wireless electronic communication with a server, the transmitter having an active transmission state and a resting transmission state, wherein the transmitter draws no power or reduced power from the rechargeable battery when the transmitter is in the resting transmission state; the server being in wireless electronic communication with a mobile device of a user, the mobile device having an application being configured to provide a user interface between the mobile device and the transmitter, the server being in wireless electronic communication with an emergency line; a temperature sensor being in electronic communication with the transmitter, the temperature sensor having an active state and a resting state, wherein the temperature sensor draws no power or reduced power from the rechargeable battery when the temperature sensor is in the resting state, the temperature sensor periodically alternating to the active state, the temperature sensor being configured to measure an ambient temperature when the temperature sensor is in the active state, the periodic alterations having an interval ranging from 3 minutes to 7 minutes, the temperature sensor being configured to be in the resting state during a sleep time, the sleep time being from 11:00 P.M. to 7:00 A.M.; the transmitter being configured to enter the active transmission state when the temperature sensor

measures an ambient temperature that is less than a minimum temperature or greater than a maximum temperature, the minimum temperature being no greater than 55° F., the maximum temperature being at least greater than 82° F.; the transmitter being configured to send a temperature alert to the server when the ambient temperature is less than the minimum temperature or greater than the maximum temperature, the server being configured to relay the temperature alert to the mobile device; the transmitter being configured to receive a response from the server, the response originating from the mobile device, the user inputting the response with the user interface; the transmitter being configured to send an emergency alert to the emergency line when the response is not received within a threshold time limit, the threshold time limit ranging from 1 minute to 5 minutes after the transmitter sends the temperature alert; the emergency alert including information about a location of the microcontroller; the transmitter being configured to issue an audible alarm when the server is unresponsive to the temperature alert, the audible alarm ranging from 60 dB to 70 dB.

18. The temperature monitoring device of claim 17, wherein the server is in wireless electronic communication with an additional caregiver device, and wherein the transmitter is configured to send the emergency alert to the additional caregiver device when the response is not received within the threshold time limit.

19. A temperature monitoring system, comprising: an electronic device of a user, the electronic device having an application configured to provide a user interface for the temperature monitoring system; a child's car seat; a temperature monitoring device being affixed to the child's car seat, the temperature monitoring device comprising: a housing having an interior space being bounded by a base plate surrounded by a peripheral wall and a top plate attached to the peripheral wall opposite the base plate; a power source being mounted to the base plate within the interior space; a microcontroller being mounted within the interior space, the microcontroller being electronically coupled with the power source, including: a transmitter being in wireless electronic communication with a server, the transmitter having an active transmission state and a resting transmission state, wherein the transmitter draws no power or reduced power from the power source when the transmitter is in the resting transmission state; the server being configured to relay signals between the transmitter and at least one of an electronic device of a user and an emergency communications line; a temperature sensor being in electronic communication with the transmitter, the temperature sensor having an active state and a resting state, wherein no or reduced power is drawn from the power source when the temperature sensor is in the resting state, the temperature sensor periodically alternating to the active state, the periodic alterations having an interval ranging from 3 minutes to 7 minutes wherein the interval of the periodic alterations is programmable by the user via the electronic device; the transmitter being configured to activate when the temperature sensor measures an ambient temperature that is less than a minimum temperature or greater than a maximum temperature; the transmitter being configured to send a temperature alert to the server when the ambient temperature is less than the minimum temperature or greater than the maximum temperature, the server being configured to relay the temperature alert to the electronic device; the transmitter being configured to receive a response from the electronic device via the server; and the transmitter being configured to send an emergency alert to the emergency communications line when the response is not received within a threshold time limit.