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(71) Applicant(s):
Xiaoyang Zhang
109 Standard Avenue, Coventry, West Midlands, CV4 9BT, United Kingdom

(72) Inventor(s):
Xiaoyang Zhang

(74) Agent and/or Address for Service:
Marks & Clerk LLP
Alpha Tower, Suffolk Street Queensway, BIRMINGHAM, B1 1TT, United Kingdom

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INT CL **A42B, B60Q, B62J**
Other: **EPODOC, WPI**

(54) Title of the Invention: **Cyclist accessory system**
Abstract Title: **Accessory system with sensors for cyclists**

(57) A system suitable for use by cyclists comprising a personal electronic device (PED) 13 such as a mobile phone, one or more sensors, a wearable accessory 18 having electrically activated features 14, a software application (app) installed on the PED, wireless means for signals to be sent between the PED and the accessory, where the app processes sensor data and generates and sends control signals to the accessory for the actuated features. The sensors might measure acceleration, or receive GPS signals. Preferably the accessory is a helmet and the actuated features are brake, indicator or hazard lights. Preferably the lights are lasers which project onto the ground around the user. A helmet and an app are claimed as additional aspects of the invention. Using the sensors already found in a mobile phone, brake, indicator and hazard lights can be triggered in a helmet without anything needing to be fitted to the bike itself.

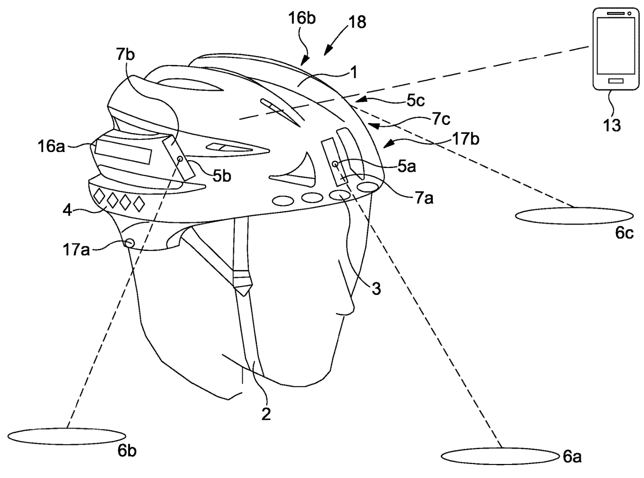

Fig. 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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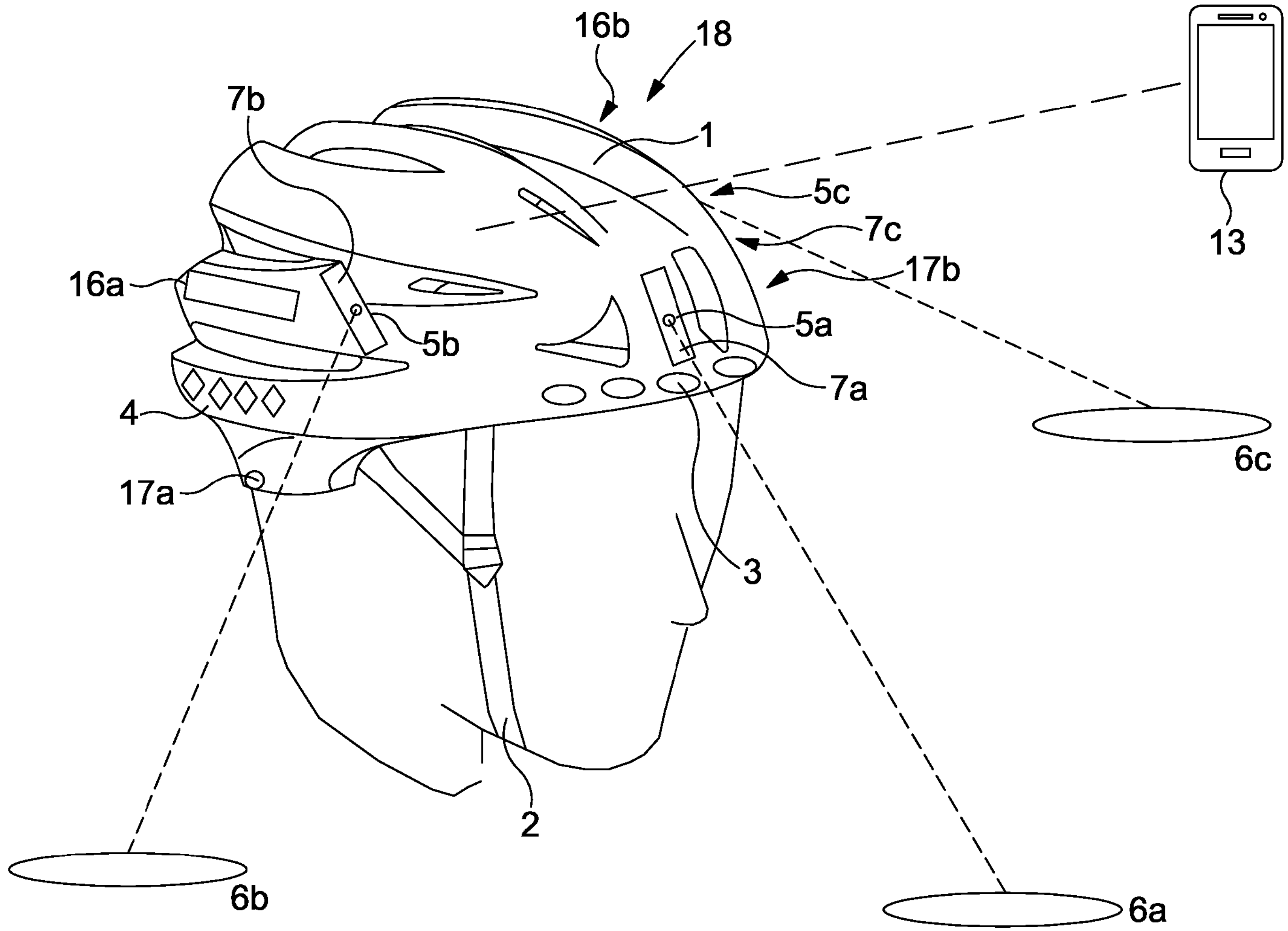

Fig. 1

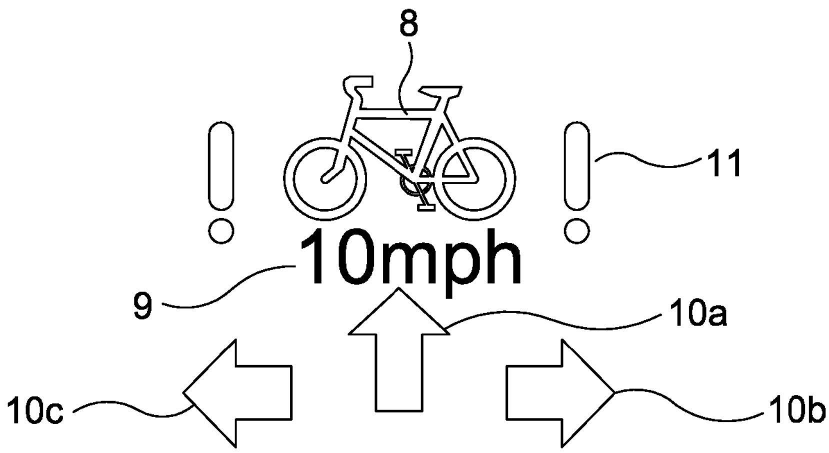

Fig. 2

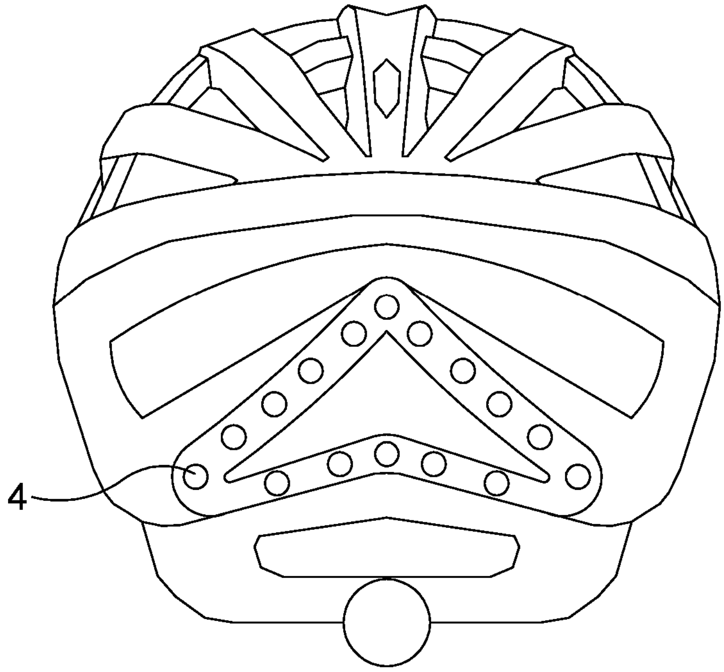

Fig. 3a

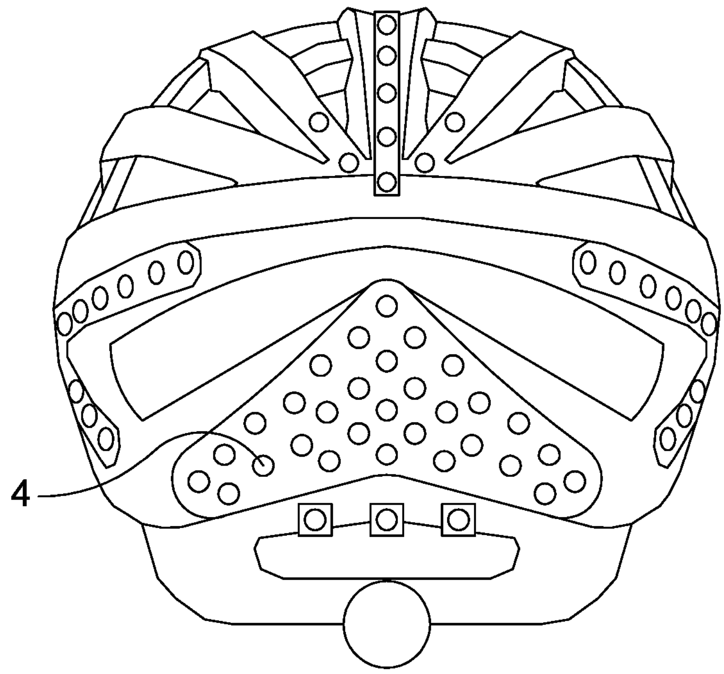

Fig. 3b

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Fig. 4

Cyclist Accessory System

FIELD OF THE INVENTION

The present invention relates to an accessory system suitable for use by riders of bicycles.

BACKGROUND TO THE INVENTION

Cycle helmets are typically worn by riders of bicycles as a safety device in order to protect the head of a rider. In the event of a collision with a hard object, the head of the rider is protected to a degree since the force of the impact is partially absorbed by the cycle helmet.

Currently cycle helmets are mainly used solely for the purpose of safety. However devices exist that allow a rider to attach further accessories to a helmet, thereby increasing its utility. For example lights may be added to improve the visibility of a rider.

Many devices exist that may be attached to bikes such as Global Positioning System (GPS) navigation units, mobile phone mounts, speedometers, indicators, lights, and brake lights. Recent developments include laser lights that may be attached to bikes that display a symbol on the road ahead, behind, or to the side of the cyclist to help ensure that they are visible to other road cyclists even when the cyclist himself is not visible. However it is inconvenient for cyclists to be burdened with a variety of devices that have to be attached to a bicycle and that may require modification and/or further paraphernalia to be attached to the bike frame such as wheel sensors for speedometers that must be calibrated.

Currently cyclists may not be able to visually observe the status of devices and it may be burdensome to maintain control over a large number of devices. Furthermore such devices are at risk of theft and must usually be disconnected every time a cyclist arrives at a destination.

With the above in mind, it is an aim of the present invention to provide a cycling system to alleviate the problems discussed.

SUMMARY OF THE INVENTION

According to one aspect of the present invention there is disclosed a system for use by a cyclist, said system comprising a portable electronic processing device (hereafter referred to as a PEPD), one or more sensors, a cyclist-wearable accessory having one or more electrically actuated features, a software application installed on said PEPD, and wireless means for signals to be wirelessly transferred between the PEPD and the cyclist-wearable accessory.

Portable electronic processing devices (PEPDs) are devices that contain processors and have the ability to wirelessly connect to other devices. Such PEPDs may be mobile phones, personal data assistants (PDA's) or devices specialising in navigation such as portable Global Navigation Satellite System (GNSS) receivers. The most common type of PEPD is a mobile phone with features such as a large colour touch-screen display, the ability to install third party applications on an operating system, internet connectivity, integrated processor and memory, wireless connectivity, integrated GNSS receiver, and a variety of integrated sensors such as accelerometers or gyroscopes.

An example of a PEPD that would be suitable for use in the system of the present invention is a mobile phone or "Smartphone" with the features as described above. However other types of PEPD may be used such as a portable GNSS receiver or a portable personal computer. The PEPD may or may not have connection to a cellular data network. The PEPD may have in-built wireless means of connecting to the cyclist-wearable accessory, or may require an additional wireless accessory to provide this functionality. Any standard wireless protocol may be used such as Bluetooth ®, internet connectivity, or Wi-Fi ®.

The one or more sensors may include but is not limited to gyroscopes, heart rate monitors, accelerometers, and temperature sensors. The sensor(s) may be wirelessly connected, or have a wired connection to the PEPD. The one or more sensors may be located within, or be built-in, to the PEPD.

The cyclist-wearable accessory may be any type of accessory that may be in some way worn by the cyclist. Examples of cyclist-wearable accessories are, but not limited to, helmets, vests or belts. Electrically actuated features on the cyclist-wearable accessory may consist of, but are not limited to, any sort of visual indicator.

An advantage of the cyclist-wearable accessory is that since it is worn by the cyclist, the cyclist may easily take advantage of all electrically actuated features of the cyclist-wearable accessory without needing to adapt a bicycle. This is particularly advantageous if a cyclist wishes to ride multiple bikes during a journey, or wishes to borrow a bike, whilst retaining use of the electrically actuated features provided.

The software application comprises programming for configuring the PEPD to process sensor data received from the one or more sensors, and to generate and wirelessly transmit control signals to the cyclist-wearable accessory for controlling the electrically actuated features. The software application may be stored on a physical medium such as a hard drive, or be accessed via an internet connection. The software application may comprise further programming for generating further signals based on human input to the PEPD. The programming may enable the software application to display a graphical user interface on the display of the PEPD and allow a user to provide inputs to the software application that result in the transmission of signals to the cyclist-wearable accessory.

The use of a PEPD to wirelessly transmit signals to a cyclist-wearable accessory is advantageous in that a cyclist may only need to carry a PEPD such as his Smartphone, and the cyclist-wearable accessory in order to access a wide range of sophisticated and useful cycling features. Due to the wide array of possible sensors that are built-into common PEPDs, and the potential processing power of a PEPD, electrically actuated features on the cyclist-wearable accessory may be intelligently controlled using the components of this system. PEPD's with highly accurate sensors and a large amount of processing power, such as a Smartphone that is capable of running the Android ® or iOS ® operating systems are very common and the present invention may take advantage of the capabilities of such devices in order to provide cyclists with a system that provides features that would otherwise require complicated and/or expensive equipment necessitating a large amount of adaptation to a bicycle.

Furthermore the cyclist-wearable accessory is relatively easy to manufacture compared to alternative accessories that may require in-built sensors or other advanced computational elements. The power requirement for the cyclist-wearable accessory using the system of the present invention is also lower than alternative systems that incorporate computational elements since the most power-intensive functions are undertaken by the PEPD which is likely to be highly optimised for such activity. The use of a cyclist-wearable accessory, as opposed to an accessory to be mounted on a bike, means that a cyclist will not be inconvenienced when departing or arriving with the necessities of adapting his bicycle. Further advantages of the present invention will become apparent below.

One or more of the sensors of the system may include an acceleration sensor capable of detecting acceleration and deceleration such as an accelerometer. The software application may comprise programming for enabling the PEPD to generate and transmit a braking signal to the cyclist-wearable accessory when the deceleration of the cyclist is above a predetermined level as detected by said acceleration sensor. The cyclist-wearable accessory may further comprise one or more in-built brake lights configured to switch on or change state when said signal is received. The sensor may or may not be located within the PEPD.

This functionality is advantageous in that it allows the cyclist to have a functional brake light without requiring modification or adaptation to a bicycle. Furthermore the acceleration sensor may be located on the body of a cyclist, such as in a pocket, or mounted on the bicycle in order to obtain a highly accurate measurement of acceleration since it is not disrupted by movements of the cyclist-wearable accessory which may, for example, be a helmet that is susceptible to a large amount of head movement.

The brake lights may be configured to face rearwards of the cyclist’s direction of travel so that they are visible to other road users who would be benefit from being alerted of the deceleration of the cyclist. The brake lights may further be configured to only switch on when a brake signal is transmitted, or to flash at a first predetermined frequency, and switch to being permanently on when a brake signal is transmitted. They may also flash at a second predetermined frequency when a brake signal is transmitted. The software application may be configured to allow the user to vary the predetermined level of deceleration at which the braking signal is transmitted, and to vary the behaviour of the brake light when a brake signal is, and is not transmitted.

There may be one or more brake lights made up of Light Emitting Diodes (LEDs) and the software application may be configured to recognise one or more braking conditions, said braking condition being a particular range of levels of deceleration. For example, if the level of deceleration matches a first braking condition, the one or more brake lights may enter a first braking state. A braking state is a particular configuration of which brake lights are activated, or a particular frequency of brake light flashing. If the level of deceleration matches a second or third braking condition, the one or more brake lights may enter a second or third braking state. There may be any number of braking conditions, and braking states. The advantages of such a system include the brake light being highly user-configurable whilst not requiring complex modifications to a bicycle. For example more brake lights may engage at higher levels of deceleration.

The cyclist wearable accessory may further comprise one or more concentrated light sources capable of projecting an image on to the surface traversed by the cyclist wherein said image comprises graphics, text, numbers, symbols or any combination thereof. The concentrated light source may be a laser, said laser providing a high intensity beam that may be modified through a diffractive optical element to create a desired image. The image(s) may dynamically change and numerical values may be displayed on the image(s) that are changeable, using methods such as a 7 segment display. This allows information such as the current velocity of the cyclist to be displayed on the image where the velocity is determined by a sensor within the system. The image(s) may also be configured to display a symbol that warns other road users of the presence of a cyclist. For example the image may consist of, but is not limited to, a schematic image of a bike, or the word ‘BIKE!’.

Hereafter, the terms ‘ahead’, ‘rear’, ‘left’ and ‘right’ refer to positions relative to the direction of travel of a cyclist.

The one or more concentrated light sources may be configured so that there are three light sources that are located on the cyclist-wearable accessory. One light source may display an image ahead of the cyclist in, and the other two light sources may be display images on the left and right sides of the cyclist. The images displayed by each light source may be the same or different.

The cyclist-wearable accessory may comprise means to manually adjust the concentrated light source(s) so that the relative location of the image to the bicycle of the cyclist is adjusted. For example a knurled adjuster may be located on the cyclist-wearable accessory, configured to rotate the concentrated light source, when the adjuster is rotated.

The system may further comprise a navigation module wherein said navigation module comprises means of determining the geographical location of the PEPD using a global navigating satellite system (GNSS), mapping data, and programming for enabling the PEPD to calculate navigational directions to a destination. The software application may further comprise programming enabling the PEPD to transmit navigation signals to the cyclist-wearable accessory based on data obtained from said navigation module. The navigation module may be located within the PEDP. Direction indicators of the direction of travel may be displayed to the cyclist on the image.

The software application may utilise locally stored mapping data on the memory of the PEPD to enable the PEPD to calculate a route, or the route may be calculated on a remote server. The user may have the ability to select a route profile, for example a ‘quiet’ route, or the ‘quickest’ route.

The software application may further comprise programming to enable the portable electronic processing device to determine the velocity of the cyclist and the cyclist wearable accessory may be configured to display the velocity of the cyclist.

The software application may comprise programming to determine the acceleration of the cyclist based on the output of the navigation module. The software application may further comprise programming to enable the PEPD to determine whether the deceleration value based on the output of the acceleration sensor or navigation module is more accurate. External factors may affect the accuracy of both these means of detecting acceleration. For example the acceleration sensor in the PEPD may be less accurate at determining the acceleration of the cyclist if the PEPD is carried in a pocket located on the cyclist’s moving leg. The use of the data outputted by the navigation module may be less accurate when there is a lack of GNSS signal, as would be the case when riding through a tunnel. The software application may comprise programming to determine a combined deceleration based on a combination of navigation module data and output of the acceleration sensor. For example, the software application could determine which acceleration determiner is most accurate based on, for example, rapid jolting of the PEPD as detected by the acceleration sensor, or lack of GNSS signals as detected by the navigation module. The software application may be programmed to use the value of acceleration that is being determined using whichever means of detecting acceleration is the most accurate at a given point in time. Said most accurate value of acceleration will be used as an input to the software application to determine when the brake signal will be transmitted by the PEPD to the cyclist wearable accessory. As external factors change, the software application may automatically switch between using the output of the navigation module or acceleration sensor as a means of determining the acceleration. In this way, the most accurate acceleration reading that may be obtained using the hardware of the system is always being used to inform activation of the brake light.

The software application may further comprise programming to enable the PEPD to transmit a hazard signal to the cyclist-wearable accessory when the cyclist is encountering or likely to encounter hazardous conditions such as a steep gradient, an accident prone route, hazardous traffic conditions, recalibration of GNSS system, or recalculation of navigational directions, using, geographic location, locally stored data, data from the internet, or any combination thereof; and the cyclist-wearable accessory further comprises means of displaying a hazard symbol on the image when a hazard signal is transmitted by the PEDP.

The hazard symbol may be an exclamation mark or any other appropriate symbol that may be interpreted to warn the cyclist/other road users of a hazard. The user may be able to input to the software application which hazards he would like a warning issued for.

The resulting display of information on to the ground surface is advantageous in that it is easily viewable by the cyclist since it is within his field of view when looking directly ahead. The requirement for any sort of display device to be mounted on the bicycle is removed.

The system may further comprise a pair of indicator lights and a pair of indicator buttons. The pair of indicator lights may be located on the user-wearable accessory and configured to be viewable to road users who are directly or non-directly behind the cyclist when the cyclist is sitting on a bicycle. The pair of indicator lights may be further configured to be situated and/or shaped to display a left or right directional indicator to road users. The pair of indicator lights may also be configured to flash at a predetermined frequency when activated. Each one of the pair of indicator buttons may be configured to enable activation of one of the pair of indicator lights and may be located on the cyclist-wearable accessory. Furthermore each indicator light may have a surface area of between 18 cm^2 and 144 cm^2, or a surface area of between 1/8x and 1x the area of the palm of the average adult. The size may significantly exceed the fingertip area of an average adult, or may be of a size that comprises a length or width above 5 cm which exceeds the fingertip length or width of an average adult. Therefore each indicator light is configured to be easily accessible. Each one of the pair of indicator lights may comprise one or more lights, wherein preferably said light(s) are LED(s).

The indicator lights may flash for a predetermined length of time on activation. For example the initial indicator duration time may be, but is not limited to, 10 seconds. Multiple depressions of the relevant indicator button may increase the indicator duration time by the initial indicator duration time for each button depression. For example depressing the button 3 times in this case may result in an indicator duration time of 30 seconds.

The advantage of this type of configuration of indicator lights and buttons is that the requirement for any type of indicator switch to be mounted on the bicycle is removed.

The cyclist-wearable accessory of the system may further comprise at least one speaker that is configured to broadcast a notification that is audible to the cyclist. A notification may be broadcast when an indicator light is activated. Notifications may also be broadcast containing navigational directions to the cycles and when there are impending hazards.

The audible notifications are advantageous in that the cyclist may obtain information generated by the PEDP and software application without requiring the use of any visual means. If a cyclist is travelling in an area with a large amount of road users, he may prefer to receive information via audible notifications if, for example, there is a risk of the projected image being distorted by the position of vehicles.

The cyclist-wearable accessory may comprise means of transmitting signals to the PEPD and the software application may further comprise programming for enabling the PEPD to display information based on signals transmitted by the cyclist-wearable accessory.

For example the cyclist-wearable accessory may transmit signals containing information about what lights are activated to the PEPD. It is advantageous for the PEPD to display such information since the cyclist has the ability to determine what lights are activated on the cyclist-wearable accessory when said lights may not be visible to him whilst wearing it.

According to a further aspect of the present invention there is provided a safety helmet for use by a cyclist, said safety helmet comprising a helmet body, one or more electrically actuated features that are connected to the helmet body and a transmitter and receiver for wirelessly transmitting and receiving signals to and from a PEPD. The one or more electrically actuated features are switched on or off based on signals received by the safety helmet from the PEPD.

The configuration of said safety helmet is advantageous in that it is located on the head of a cyclist, and therefore any visual features located on the helmet are highly visible. Furthermore helmets are already commonly used by cyclists for safety purposes and therefore the additional burden on a cyclist who wishes to use features of the present invention is minimal. The safety helmet may be constructed so that it complies with any relevant safety standards.

The safety helmet may comprise means to receive and interpret a wireless braking signal from the PEPD when the deceleration of the cyclist is above a predetermined level, and, one or more in-built brake lights configured to switch on or change state when said braking signal is received as determined by a means of sensing a level of deceleration. It is advantageous that the means of detecting the level of deceleration is not located on the helmet due to the inaccuracies that would be introduced due to natural movement of the cyclist’s head.

The safety helmet may comprise one or more concentrated light sources capable of projecting an image onto the surface traversed by the cyclist wherein said image comprises graphics, text, numbers or any combination thereof. The concentrated light source may be a laser.

In order to prevent distraction to other road users the safety helmet may comprise means of activating and deactivating the light sources based on factors such as the velocity of the cyclist (as determined by a sensor on the PEPD).

The safety helmet may comprise one or more rotational knurled adjusters linked to the concentrated light source(s) and configured to adjust the location of the projected image relative to the cyclist. This feature would allow the image to be adjusted based on the height of the cyclist so that it is always located at the optimal position within the cyclist’s view.

The safety helmet may be configured to receive and interpret wireless navigational signals from the portable electronic device and to display directional indicators of the direction of travel based on said wireless navigational signals on the image and/or wireless velocity signals based on the geographical location of the PEPD.

The safety helmet may also be configured to receive and interpret a wireless hazard signal from the PEPD wherein said wireless hazard signal is configured to be transmitted when hazardous conditions such as a steep gradient, an accident prone route, hazardous road traffic, risk of icy conditions, recalibration of GNSS system, or recalculation of navigational directions are being, or likely to be, encountered. Where wireless hazard signals are received by the helmet, the concentrated light source may be configured to display a hazard symbol on the image.

The safety helmet may further comprise a pair of indicator lights and a pair of indicator buttons. The pair of indicator lights may be located on the safety helmet and configured to be viewable to road users who are directly behind or non-directly behind the cyclist when the cyclist is sitting on a bicycle. The pair of indicator lights may be further configured to flash at a predetermined frequency when activated and each one of the pair of indicator buttons may be configured to activate one of the pair of indicator lights and are located on the safety helmet.

Each indicator button may have a surface area of between 18 cm^2 and 144 cm^2, or a surface area of between 1/8x and 1x the area of the palm of the average adult. The size may significantly exceed the fingertip area of an average adult, or may be of a size that comprises a length or width above 5 cm which exceeds the fingertip length or width of an average adult. Therefore each indicator light is configured to be easily accessible.

Each one of the pair of indicator lights may comprise one or more lights, said lights may be LEDs.

The safety helmet may comprise at least one speaker that is configured to broadcast an audible notification to the cyclist. The audible notification may contain navigational directions. An audible hazard signal may also be broadcast when hazardous conditions are predicted or when an indicator light is activated.

According to a further aspect of the present invention there is provided a software application for installation on a portable electronic processing device for use by a cyclist with a cyclist-wearable accessory comprising electrically actuated features and for use with one or more sensors. The portable electronic processing device wirelessly connects to the cyclist-wearable accessory and said software application comprises programming configured to generate signals to be transferred wirelessly to the cyclist-wearable accessory that actuate electrical features on the cyclist-wearable accessory based on either the output of sensor(s) or cyclist input to the software application, or a combination of sensor output and cyclist input.

The software application may comprise programming configured to generate signals based on the output of an acceleration sensor capable of detecting acceleration and deceleration. The software application may further comprise programming for enabling the portable electronic processing device to generate and transmit a braking signal to the cyclist-wearable accessory when the deceleration of the cyclist is above a predetermined level as detected by the acceleration sensor.

The software application may comprise programming configured to receive location data from a navigation module wherein said navigation module comprises means of determining the geographical location of the portable electronic device using a global navigating satellite system (GNSS), mapping data, and programming for enabling the portable electronic processing device to calculate navigational directions to a destination. The software application may further comprise programming for enabling the portable electronic processing device to transmit navigation signals and velocity data to the cyclist-wearable accessory based on data obtained from said navigation module.

The software application may comprise programming to enable the portable electronic processing device to transmit a hazard signal to the cyclist-wearable accessory when the cyclist is encountering or likely to encounter hazardous conditions such as a steep gradient, an accident prone route, hazardous road traffic, risk of icy conditions, recalibration of GNSS system, or recalculation of navigational directions, using, geographic location, locally stored, data from the internet, or any combination thereof.

The software application may comprise programming to enable the portable electronic device to receive signals from the cyclist-wearable accessory and display the status of any electrically actuated features on the cyclist-wearable accessory.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a cycle system in accordance with an embodiment of the present invention.

Fig. 2 shows the image that is projected by the concentrated light source in accordance with an embodiment of the present invention.

Fig. 3a shows the rear of the cyclist-wearable accessory with rear visibility light illuminated in accordance with an embodiment of the present invention.

Fig. 3b shows the rear of the cyclist-wearable accessory with rear visibility lights and brake lights illuminated in accordance with an embodiment of the present invention.

Fig. 4 shows the arrangement of indicator lights in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF A CERTAIN EMBODIMENT

With reference to figs 1 – 4, there is illustrated a system for use by a cyclist.

It is to be understood that the invention may comprise of any of the below features in any possible combination. Specific descriptions are not intended to be limiting. Exemplary systems may contain all of these features, a single feature, or any combination thereof.

For the purpose of the following description, the terms “front”, “rear”, “left”, and “right” are relative to the direction of forward travel of a cyclist who is wearing a cyclist-wearable accessory.

With reference to Fig. 1 there is an example embodiment of the present invention where the system comprises a cyclist-wearable accessory 18, a PEPD 13, and a software application (not shown).

As shown in Fig. 1, the cyclist-wearable accessory may be a novel safety helmet 18, hereafter referred to as the “helmet”. The helmet 18 comprises a helmet body 1 and a means for securing the helmet to the head of a cyclist. In the embodiment shown this is a strap 2. The helmet may further comprise a plurality of front lights 3, a plurality of rear lights 4, concentrated light sources 5a, 5b, 5c that project images 6a, 6b, 6c onto the ground , knurled adjusters 7a, 7b, 7c, indicator buttons 16a and 16b, and speakers 17a, 17b. The helmet 18 may be waterproof and may be constructed to conform to bicycle helmet safety standards such as, but not limited to, BSEN1078 or Snell Foundation B90.

With reference to Fig. 3b, the helmet may further comprise brake lights 14.

With reference to Fig. 4, the helmet may further comprise indicator lights 15a, 15b that are situated on the rear of the helmet 18.

The helmet may further comprise a processor (not shown), integrated memory (not shown), a rechargeable battery (not shown), and Bluetooth ® wireless connectivity module (not shown) and electronically actuated features as will become apparent below. The battery may be recharged using a USB or mains input. In other embodiments the battery may be disposable and different wireless connectivity protocols may be used, such as Wi-Fi. In other embodiments the helmet may not include integrated memory or a processor.

The embodiment shown in Fig. 1 also includes a PEPD 13 which is typically a Smartphone that comprises (all not shown) at least a touchscreen, sensors including an accelerometer, GNSS receiver, Bluetooth ® wireless connectivity, and cellular data connectivity. In this example the smartphone 13 is wirelessly connected to the helmet 18 using the Bluetooth ® wireless protocol. The smartphone 13 may connect to the internet using a cellular data connection or via another wireless connection such as Wi-Fi. In other embodiments the smartphone 13 may be unable to connect to the internet.

With further reference to the embodiment shown in Fig. 1, the software application (not shown) is installed on the smartphone 13. The software application may be downloaded from the internet, however in other embodiments the application may be transferred to the smartphone 13, for example using a USB connection to a desktop computer (not shown) or using any type of physical data transfer medium such as a memory card or a USB pen drive (both not shown).

Before use the helmet 18 is switched on using an on/off switch (not shown). The helmet may then automatically wirelessly connect to the smartphone 13 using the wireless protocol. When the helmet 18 is first used with a particular smartphone 13, the helmet may need to be paired with the smartphone 13. The cyclist can pair the smartphone 13 to the helmet 18 using functionality in-built into the operating system of the smartphone 13. The cyclist may then launch the software application (not shown) in order to configure features on the helmet 18 and engage full functionality of the cycle system.

With reference to the embodiment shown in Figs 1 and 3a, the front lights 3 and rear lights 4 are mounted on the helmet 18. The lights may be switched on via a switch (not shown), or via input to the smartphone 13 application. The lights 3,4 may be configured to flash at different frequencies, in a pattern, or remain “always on”. This configuration is possible via input to the software application or by a light configuration button on the helmet (not shown). The cyclist may also design their own flashing configuration using the application. In the embodiment shown in the figures, the lights consist of a plurality light emitting diodes (LEDs). In embodiments there may be any number of front lights 3, and rear lights 4 that are configurable using the software application. The front lights 3, and rear lights 4, may be controlled in any way by the software application based on any input to the software application including user input or any sensor input.

Rear brake lights 14 are mounted on the helmet as shown in Fig. 3b (shown when illuminated). The rear brake lights 14 also consist of LEDs. The rear brake lights 14 are configured to illuminate when the deceleration of the cyclist is above a certain brake engagement level. This brake engagement level will be set so that it is the typical level of deceleration that the cyclist would experience when the brakes are engaged. The level of deceleration is detected using the in-built accelerometer (not shown) of the smartphone 13. The software application (not shown) on the smartphone 13 uses data from the accelerometer of the smartphone 13 to determine when the current level of deceleration is above the brake engagement level. If the current level of deceleration is above the brake engagement level, then the smartphone will transmit a braking signal to the helmet via the wireless protocol to engage the brake lights 14. The brake engagement level may be configured using the smartphone application by the cyclist.

As shown in Fig. 1, three concentrated light sources are mounted on the helmet 5a, 5b, 5c. In the embodiment shown, the concentrated light sources are lasers that project an image (6a, 6b, 6c) onto the ground around the cyclist. The lasers use diffractive optical elements (not shown) to provide a particular beam shape so that the image may consist of recognisable shapes or images. The image 6a is located ahead of the cyclist and within his field of vision. Images 6b and 6c are located on both sides of the cyclist.

The images 6a, 6b, 6c shown in Fig. 1 may be configured using the smartphone application. Fig. 2 shows features of the image 6a in this embodiment. A visibility symbol 8 is displayed to improve visibility of the cyclist to other road users. In the embodiment shown the visibility symbol 8 is a schematic image of a bike, however in other embodiments it may be any other symbol that road users may interpret as a bike, for example the word “BIKE!”. Image 6a is displayed ahead of the cyclist so that road users will be notified that the cyclist is approaching even if the bike and body of the cyclist are not immediately visible, for example around a blind corner. A further advantage is that drivers of large vehicles such as heavy goods vehicles will be notified of the presence of a cyclist who may be in their blind spot. The smartphone application may be used to configure the visibility symbol 8, for example by setting the desired shape to be displayed.

As shown in Figs 1 and 2, visual navigational directions 10a, 10b, 10c may be displayed to the cyclist using the image 6a. The visual navigational directions will direct a cyclist to his destination by illuminating the respective arrow 10a, 10b, 10c depending on what direction the cyclist should take at street junctions. The cyclist inputs his destination into the smartphone application which determines an optimal route. The cyclist may select to take a route that is the quickest, quietest (with the least amount of traffic and busy roads), or a combination thereof. In the embodiment shown the route is calculated on a server (not shown) via an internet connection of the smartphone and using mapping/traffic data stored on the online server. However in other embodiments the route may be calculated on the smartphone or other type of mobile device using mapping/traffic data that is preinstalled on the device. The software application on the smartphone 13 monitors the geographical location of the cyclist using an in-built Global Navigation Satellite System (GNSS) receiver and generates directions based on the calculated route. The directions are transmitted to the helmet 18 using the wireless protocol and displayed to the cyclist on the image 6a.

The software application may combine the outputs of the acceleration sensor (not shown) and the GNSS receiver (not shown) to determine a more accurate value of deceleration in order to better determine when the brake light on the helmet should be engaged.

As shown in Figs 1 and 2, a visual stress symbol 11 may be displayed to the cyclist using the image 6a. The visual stress symbol 11 illuminates to notify the cyclist that there is an impending potential hazard, or that he is currently cycling through hazardous conditions. The visual stress symbol 11 may illuminate during the following conditions; when the gradient of the ground is steep, when the route is accident-prone, when the navigation system is recalculating a route or has lost satellite signal, when the traffic is hazardous or when there is a risk of ice on the road. In other embodiments there may be further hazards that may cause the visual stress symbol 11 to be displayed. The smartphone application uses a combination of online data and the location of the cyclist from the in-built GNSS receiver to determine when the visual stress symbol 11 should be displayed. In other embodiments the smartphone may be a different type of mobile device and use offline data to determine when the visual stress symbol should be displayed. The cyclist may configure which hazards cause the visual stress symbol 11 to be displayed via input to the smartphone application. In this embodiment, the visual stress symbol 11 is an exclamation mark. However in other embodiments any symbol may be used that is interpreted as a warning symbol.

As shown in Fig. 2, a velocity reading 9 may be displayed to the cyclist using the image 6a. The current velocity will be determined by the smartphone application (not shown) via data from the in-built GNSS receiver of the Smartphone 13. The velocity may be displayed in miles per hour or kilometres per hour as configured by the user using the smartphone application. In this embodiment the velocity reading 9 is displayed using the seven-segment display method of displaying numerical digits. However in other embodiments other methods may be used that result in the clear display of numerical characters using a laser projection.

As shown in Figs 1 and 2, the images 6b, 6c are displayed on either side of the cyclist. They may display visibility symbols 8 so as to improve the visibility of the cyclist to other road users. The concentrated light sources 5a, 5b, 5c may be de-illuminated when the cyclist is travelling below a predetermined velocity to prevent other road users being affected by rapid movement of the projected images 6a, 6b, 6c during periods when the cyclist is most likely to rapidly move his head.

As shown in Fig. 1, the vertical angle of the concentrated light sources 5a, 5b, 5c may be adjusted using the knurled adjusters 7a, 7b, or 7c. This allows the cyclist to configure the location of the images 6a, 6b, 6c on the surface relative to his bicycle (not shown).

As shown in Fig. 1 and Fig. 4, the helmet further comprises left and right indicator lights 15. The lights are LEDs and positioned on the rear of the helmet so that they are visible to other road users who are behind the cyclist. The indicator lights 15a and 15b are activated by depression of buttons 16a, 16b respectively as shown in Fig. 1. The buttons 16a, 16b are sized so as to be easily accessible to cyclists who may be wearing thick gloves and are located on the left and right sides of the helmet. The left button 16b engages the left indicator 15a and the right button 16a engages the right indicator 15a. The indicators are configured to flash at a predetermined indicator frequency which may be configured using the smartphone application. When buttons 16a, 16b are depressed, the indicators engage for a predetermined period of preferably 10 seconds. If the buttons 16a, 16b are depressed multiple times, the period of engagement will be multiplied by the number of times the buttons are pressed. The cyclist may view the status of the indicators on the screen of the smartphone and engage or disengage the indicators via input to the smartphone application.

As shown in Figs 1 and 4, the indicator buttons 16a may be configured to switch off indicator light 15b, and indicator button 16b may be configured to switch off indicator light 15a. In another embodiment the indicators may be configured to switch on and off automatically based on the navigational directions, geographical location, and velocity determined by the software application as described above.

As shown in Fig. 1 speakers 17a and 17b may be located on the helmet and near the ears (not shown) of the cyclist. The speakers provide for a further means of communication to the cyclist of information. The speakers 17a, 17b may not cover the ear of the cyclist, thereby allowing him to continue to be aware of his surroundings. When an indicator light 15a, 15b is engaged, a speaker 17a, 17b may broadcast an indicator ticking noise on the respective side of the helmet to whichever indicator is engaged. Furthermore an audible stress signal (not shown) may be broadcasted from the speakers 17a, 17b depending on signals from the smartphone application. The audible stress signal would be broadcast under the same circumstances as for when the visible stress signal is displayed as described above. The audible stress symbol may furthermore describe the exact type of hazard to complement the visual cue of the visual stress symbol 11. The audible stress symbol is configurable using the smartphone application. Audible navigational directions may be broadcast to the cyclist using the speakers 17a, 17b. The audible navigational directions are determined using the same method as for the visual navigational directions as described above. They may consist of electronically generated voice directions that are generated by the software application on the smartphone 13.

CLAIMS:

1. A system for use by a cyclist, said system comprising:
   a portable electronic processing device;
   one or more sensors;
   a cyclist-wearable accessory having one or more electrically actuated features;
   a software application installed on said portable electronic processing device; and
   wireless means for signals to be wirelessly transferred between the portable electronic processing device and the cyclist-wearable accessory;

   wherein,
   said software application comprises programming for configuring the portable electronic processing device to process sensor data received from the one or more sensors, and to generate and wirelessly transmit control signals to the cyclist-wearable accessory for controlling the one or more electrically actuated features.

2. The system of claim 1, wherein said software application comprises further programming for generating further signals based on human input to the portable electronic processing device.

3. The system of any preceding claim, wherein,
   said one or more sensors includes an acceleration sensor capable of detecting acceleration and deceleration such as an accelerometer;
   the software application comprises programming for enabling the portable electronic processing device to generate and transmit a braking signal to the cyclist-wearable accessory when the deceleration of the cyclist is above a predetermined level as detected by said acceleration sensor; and
   the cyclist-wearable accessory comprises one or more in-built brake lights configured to switch on or change state when said signal is received.

4. The system of any preceding claim, wherein any of the one or more sensors are located within the portable electronic processing device.

5. The system of any preceding claim, wherein the portable electronic processing device is a mobile phone.

6. The system of any preceding claim, wherein the cyclist-wearable accessory further comprises one or more concentrated light sources capable of projecting an image on to the surface traversed by the cyclist wherein said image comprises graphics, text, numbers or any combination thereof.

7. The system of claim 6, wherein the one or more concentrated light sources are lasers.

8. The system of claim 6 or 7, wherein the cyclist-wearable accessory further comprises means to manually adjust the concentrated light source(s) so that the relative location of the image to the cyclist is adjusted.

9. The system of any preceding claim wherein:

   the system further comprises a navigation module wherein said navigation module comprises means of determining the geographical location of the portable electronic processing device using a global navigating satellite system (GNSS), mapping data, and programming for enabling the portable electronic processing device to calculate navigational directions to a destination;

   the software application further comprises programming enabling the portable electronic processing device to transmit navigation signals to the cyclist-wearable accessory based on data obtained from said navigation module.

10. The system of claim 9 wherein said navigation module is located within the portable electronic processing device.

11. The system of claim 9 or 10 further comprising means of displaying navigational directions to the cyclist.

12. The system of any of claims 9 to 11 wherein the software application further comprises programming to enable the portable electronic processing device to determine the velocity of the cyclist and the cyclist wearable accessory is configured to display the velocity of the cyclist.

13. The system of any of claims 9 to 12 wherein the software application further comprises programming to;

enable the portable electronic processing device to determine the deceleration of the cyclist based on output of the navigation module; and

determine a combined deceleration value based on a combination of outputs of the acceleration sensor and navigation module.

14. The system of any of claims 9 to 13, wherein,

the software application further comprises programming to enable the portable electronic processing device to transmit a hazard signal to the cyclist-wearable accessory when the cyclist is encountering or likely to encounter hazardous conditions; and

the cyclist-wearable accessory further comprises means of displaying a hazard symbol on the image when a hazard signal is transmitted by the portable electronic processing device.

15. The system of any preceding claim further comprising,

a pair of indicator lights;

a pair of indicator buttons;

wherein,

the pair of indicator lights are located on the cyclist-wearable accessory and configured to be viewable to road users who are directly or non-directly behind the cyclist when the cyclist is sitting on a bicycle;

the pair of indicator lights are further configured to be situated and/or shaped to display a left or right directional indicator to road users;

the pair of indicator lights are configured to flash at a predetermined frequency when activated;

each one of the pair of indicator buttons is configured to enable activation of one of the pair of indicator lights and is located on the cyclist-wearable accessory.

16. The system of claim 15 wherein each one of the pair of indicator lights comprises one or more lights, wherein preferably said light(s) are LED(s).

17. The system of any preceding claim further comprising at least one speaker wherein said speaker(s) are configured to broadcast a notification that is audible to the cyclist.

18. The system of claim 17 wherein the speaker(s) are configured to broadcast an audible notification when an indicator light is activated.

19. The system of claim 17 or 18 wherein the speaker(s) are configured to broadcast an audible notification containing navigational directions to the cyclist.

20. The system of claims 17 to 19 wherein the speaker(s) are configured to broadcast an audible hazard signal to the cyclist.

21. The system of any preceding claim wherein,
the cyclist-wearable accessory further comprises means of transmitting signals to the portable electronic processing device; and
the software application further comprises programming for enabling the portable electronic processing device to display information based on signals transmitted by the cyclist-wearable accessory.

22. A safety helmet for use by a cyclist, said safety helmet comprising:
a helmet body;
one or more electrically actuated features that are connected to the helmet body; and
a transmitter and receiver for wirelessly transmitting and receiving signals to and from a portable electronic processing device;
wherein,

the one or more electrically actuated features are switched on or off based on signals received by the safety helmet from the portable electronic processing device.

23. The safety helmet of claim 22, wherein:

    said safety helmet comprises means to receive and interpret a wireless braking signal from the portable electronic processing device that is transmitted when the deceleration of the cyclist is above a predetermined level as determined by a means of sensing a level of deceleration; and

    the safety helmet further comprises one or more in-built brake lights configured to switch on or change state when said braking signal is received.

24. The safety helmet of claim 22 or 23, wherein the safety helmet further comprises one or more concentrated light sources capable of projecting an image onto the surface traversed by the cyclist wherein said image comprises graphics, text, numbers or any combination thereof.

25. The safety helmet of claim 24 wherein the concentrated light source is a laser.

26. The safety helmet of claim 24 or 25 further comprising one or more rotational knurled adjusters linked to the concentrated light source(s) and configured to adjust the location of the projected image relative to the cyclist.

27. The safety helmet of any of claims 22 to 26 wherein the safety helmet is configured to receive and interpret wireless navigational signals from the portable electronic processing device and/or wireless velocity signals based on the geographical location of the PEPD.

28. The safety helmet of claim 27 wherein said concentrated light source(s) are configured to display directional indicators of the direction of travel based on the wireless navigational signals on the image and/or the velocity of the cyclist.

29. The safety helmet of any of claims 22 to 28 wherein the safety helmet is configured to receive and interpret a wireless hazard signal from the portable electronic processing device wherein said wireless hazard signal is configured to be transmitted when hazardous conditions such as a steep gradient, an accident prone route, hazardous road traffic, risk of icy conditions, recalibration of GNSS system, or recalculation of navigational directions are being, or likely to be, encountered.

30. The safety helmet of claim 29 wherein the concentrated light source(s) are configured to display a hazard symbol on the image.

31. The safety helmet of any preceding claim further comprising,
    a pair of indicator lights;
    a pair of indicator buttons;
  wherein,
    the pair of indicator lights are located on the safety helmet and configured to be viewable to road users who are directly or non-directly behind the cyclist when the cyclist is sitting on a bicycle;
    the pair of indicator lights are further configured to be situated and/or shaped to display a left or right direction to road users;
    the pair of indicator lights are configured to flash at a predetermined frequency when activated;
    each one of the pair of indicator buttons are configured to activate one of the pair of indicator lights and are located on the safety helmet.

32. The safety helmet of claim 31 wherein each one of the pair of indicator buttons has a surface area of between 18 cm^2 and 144 cm^2.

33. The safety helmet of claim 31 or 32 wherein each one of the pair of indicator buttons is of a size that comprises a length greater than 5 cm.

34. The safety helmet of claim 31 wherein each one of the pair of indicator lights comprises one or more lights, said light(s) are preferably LED(s)

35. The safety helmet of any of claims 22 to 34 further comprising at least one speaker wherein said speaker(s) are configured to broadcast an audible notification to the cyclist.

36. The safety helmet of claim 35 wherein the speaker(s) broadcast an audible notification when an indicator light is activated.

37. The safety helmet of claims 35 or 36 wherein the speaker(s) broadcast navigational directions to the cyclist.

38. The safety helmet of any of claims 35 to 37 wherein the speaker(s) broadcast an audible hazard signal to the cyclist.

39. A software application for installation on a portable electronic processing device for use by a cyclist with a cyclist-wearable accessory comprising electrically actuated features and for use with one or more sensors, wherein the portable electronic processing device wirelessly connects to the cyclist-wearable accessory and wherein said software application comprises programming configured to,

    generate signals to be transferred wirelessly to the cyclist-wearable accessory that actuate electrical features on the cyclist-wearable accessory based on either the output of sensor(s) or cyclist input to the software application, or a combination of sensor output and cyclist input.

40. The software application of claim 39, wherein:

    said software application further comprises programming configured to generate signals based on the output of an acceleration sensor capable of detecting acceleration and deceleration;

    said software application further comprises programming for enabling the portable electronic processing device to generate and transmit a braking signal to the cyclist-wearable accessory when the deceleration of the cyclist is above a predetermined level as detected by said acceleration sensor.

41. The software application of claim 39 or 40 wherein:

said software application further comprises programming configured to receive location data from a navigation module wherein said navigation module comprises means of determining the geographical location of the portable electronic device using a global navigating satellite system (GNSS), mapping data, and programming for enabling the portable electronic processing device to calculate navigational directions to a destination;

said software application further comprising programming for enabling the portable electronic processing device to transmit navigation signals and velocity data to the cyclist-wearable accessory based on data obtained from said navigation module.

42. The software application of any of claims 39 to 41 further comprising programming to;

enable the portable electronic device to determine the deceleration of the cyclist based on output of the navigation module; and

determine a combined deceleration value based on a combination of outputs of the acceleration sensor and navigation module.

43. The software application of any of claims 39 to 42, further comprising programming to enable the portable electronic processing device to transmit a hazard signal to the cyclist-wearable accessory when the cyclist is encountering or likely to encounter hazardous conditions such as a steep gradient, an accident prone route, hazardous road traffic, risk of icy conditions, recalibration of GNSS system, or recalculation of navigational directions, using, geographic location, locally stored, data from the internet, or any combination thereof.

44. The software application of any of claims 39 to 43, further comprising programming to enable the portable electronic device to receive signals from the cyclist-wearable accessory and display the status of any electrically actuated features on the cyclist-wearable accessory.

Intellectual Property Office

Application No:	GB1604206.1	**Examiner:**	Mr Chris Morris
Claims searched:	1-44	**Date of search:**	7 September 2016

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-16, 22-28, 30, 31-34, 39-42	US 2014/371953 A1 (MILLER) Abstract; Figures 4-6; Description 0032-0033
X	1-2, 4-5, 21-22, 29, 35, 38-39, 43-44	WO 2016/012516 A1 (MODUS) Figures, Abstract
X	1-2, 5, 17, 20, 22, 29, 35, 38-39, 43	GB 2528553 A (FORD) Figures, Abstract, Description 0015-0019
X	1-2, 22	JP 2007031875 A (YAMAHA) Abstract, WPI abstract, Figures 1-3
A	-	EP 2868556 A1 (BENATI) Figres 1-2, 8
A	-	CN202368719 U (DONGGUAN) Figures 2-4
A	-	CN103693134 A (LI) Figures 2, 6-7
A	-	GB 2485804 A (BISCHOFF) Figures 1, 3; Abstract
A	-	US 2010/198453 A1 (APPLE) Figure 1, Description 0094-0095

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

Worldwide search of patent documents classified in the following areas of the IPC

A42B; B60Q; B62J

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI

International Classification:

Subclass	Subgroup	Valid From
A42B	0003/04	01/01/2006
B60Q	0001/26	01/01/2006
B62J	0006/00	01/01/2006