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(54) **A SAFETY HELMET**

EIN SCHUTZHELM

UN CASQUE DE SECURITE

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(73) Proprietor: **Puconja, Folko**
2204 Miklavz na Dravskem polju (SI)

(72) Inventor: **Puconja, Folko**
2204 Miklavz na Dravskem polju (SI)

(74) Representative: **Patentni Biro AF d.o.o.**
Kotnikova 32, p.p. 2706
1001 Ljubljana (SI)

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Description

Field of the invention

[0001] The present invention belongs to the field of human needs, namely helmets, more precisely to the field of safety helmets to be used in traffic. The invention also touches the field of vehicles, particularly controlling the driving speed, as well as the field of signalling and controlling based on specific values measured by sensors. The invention relates to a safety helmet and a process for termination of driving or limitation of driving speed during driving of electric or motorized two-, three- or four-wheeled vehicles based on use of the said safety helmet.

Background of the invention and the technical problem

[0002] Transportation means enable mobility of people worldwide and are also accessible to a wide population, from children to elderly. Driving transportation means having two, three or four wheels, for example motors, electric scooters, motorized bicycles, tricycles, and quads (ATV) require use of a certified safety helmet, which prevents injuries to the head or even death. However, the problem is that the helmets are not properly used, for example the helmet is held in hands, hanged on the steering, stored in a basket or a trunk, or worn on an elbow instead on the head, thus endangering the driver.

[0003] The technical problem, which is solved by the present invention, is thus to design of a safety helmet that will enable reliable control of helmet use and that will, at the same time, ensure a connection with a vehicle, operation of which will be dependent on the sensed proper use of the helmet. The aim and the purpose of the invention is consequently decreasing the number of injuries and improving the safety during driving of said vehicles.

State of the art

[0004] Utility model CN209473673 (U) discloses a firefighting helmet, which has a system for monitoring vital signs of a firefighter wearing the helmet, and means for connecting and sending data, which allows monitoring of the firefighter. The said helmet comprises a temperature sensor and a heartbeat sensor for checking vital signs of the firefighter, a gyroscope module, which follows movement of the firefighter. Data are sent via a microprocessor module and a wireless network transmission module to a central unit. This solution is not suitable for use in traffic and it does not allow any interaction with a drive of an electric and/or motorized vehicle.

[0005] Document CN110179195 describes a helmet for an electric bicycle, which can via a communication module connect to a system for controlling the driving speed of the electric bicycle. The helmet also has a system for checking proper use (Wear) of the helmet on a person's head. In case a human body is detected, the signal is via the communication module sent to the control system and the electric bicycle can be driven with any speed allowed by the said bicycle. This solution does not describe the exact control system and the process for regulation of the driving speed.

[0006] Patent application EP0346300 describes a protective helmet, comprising power, sensors for normal use of the helmet, transmitter and an antenna, with which information about suitable use of the helmet is sent to the receiver installed in a vehicle. Ignition of the vehicle engine is possible if suitable use of the helmet is detected. In case sensors do not detect sutable wear, the vehicle cannot be moved, which is a disadvantage in case the vehicle has to be moved for few metres in a garage or to a vehicle service space or a space for a technical inspection.

[0007] Patent application KR20180137864A relates to a motorcycle helmet for generating a warning sound, which improves stability of a driver, comprising: a motorcycle helmet having a shape of filling an interior material therein; a proximity sensor transmitting a signal to a sensor by checking an access to an object; a heartbeat sensor transmitting a signal to the sensor by measuring a heartbeat; a buzzer generating sound when the sensor does not satisfy a condition; a Bluetooth transmitter; a Bluetooth receiver; a helmet main board receiving the signals from the proximity sensor and the heartbeat sensor to transmit the same via Bluetooth; a motorcycle main board positioned in a motorcycle saddle cover; and a battery connection jack connecting power to the main board. This solution does not allow any interaction with the vehicle or its operation. US2017136875A1 discloses a system and method for encouraging a user of a recreational vehicle to wear safety equipment. The helmet contains a microprocessor and sensors to determine if the helmet is worn. The helmet communicates with the vehicle and the vehicle either disables operation or allows limited operation if the helmet is not worn. The helmet is arranged to enable limitation of the driving speed in case it is not worn properly and discloses the preamble of claim 1.

[0008] The present invention differs from the above-mentioned documents in the components and the way of connection to the vehicle, driving of which is terminated in case of non-suitable helmet wear.

Description of the solution to the technical problem

[0009] The safety helmet according to the invention comprises a base moulding (mould) which fits to a user's head, an under-chin safety belt, suitable vibration absorbers arranged between the base mould and the user's head and optional visor and other common components of safety helmets for use in traffic. The essence of the helmet according to the invention is in that it further comprises:

- at least one heartbeat sensor for determination of presence of a user's heartbeat,
- at least one gyroscope for sensing tilt of the helmet,
- preferably a suitable sensor on a clip of the under-chin safety belt for determination of use of the under-chin safety belt,
- a battery for powering said sensors and the gyroscope, said battery being arranged for charging in any known manner and/or the battery uses replaceable batteries,
- a central unit, comprising a microcontroller or a microprocessor module, on which a helmet program is run, which is arranged to ensure sensing and obtaining data from the sensors and the gyroscope as well as transmitting data between the helmet and a vehicle,
- an optional mobile application, which monitors data sensed by said sensors and the gyroscope and is arranged to trigger termination of vehicle drive operation based on said data, and
- a wireless receiving-transmitting module for connection with the vehicle and/or the mobile application

[0010] The helmet according to the invention enables termination of vehicle operation, when the pre-defined threshold speed of at least 5 km/h, preferably 10 km/h, is exceeded. Until the pre-defined threshold speed is achieved, the drive system of the vehicle operates normally regardless of the use of the helmet, particularly to allow manoeuvring of the vehicle in case of technical inspection, servicing or parking.

[0011] The in-built heartbeat sensor is intended to ensure the helmet is properly installed and that it is placed on a human body (head) and not on a seat or in the trunk of the vehicle. The sensor may operate on the principle of optical transmitting and receiving diodes or on the principle of sensing electric pulses. The heartbeat sensor may be any suitable sensor known to the person skilled in the art of sensors, preferably the heartbeat sensor is an optical sensor operating on the principle of transmitting and receiving an amount of reflected light from the skin. Two or more sensors may be used, wherein the higher number of measurements ensures better reliability of the helmet. The sensor(s) is installed in the inner part of the helmet, preferably on the left and/or right temple. The tolerated range of the heartbeat is from 30 to 200 bpm, while any deviation from this range is detected with the safety helmet and reported to the central unit and the vehicle, which operation is then suitably adjusted in case the driving speed exceeds the pre-defined threshold value - for example by termination of operation of engine electronics in the vehicle.

[0012] The gyroscope is preferably a combination of a rotation and acceleration sensor and is arranged to measure tilt of the helmet and reports if the helmet is suitably installed. The gyroscope and the battery, which is charged with a battery charger or with replaceable batteries, are installed in the helmet body, preferably in the front on the forehead or in the back on the head vertex. The safety helmet determines that the use is not proper, if the gyroscope senses a tilt into each direction of more than 90 degrees from the natural, i.e., upright position, when the helmet is properly installed on the head. Preferably a larger tilt is allowed, which may not last for more than a few seconds, for example 5 seconds, which can occur during an extreme leaning in road bends.

[0013] An additional and preferred part of the system for sensing proper use of the safety helmet is the sensor on the clip of the under-chin safety belt. This sensor may be either an electro-mechanical (switch, magnet) or an opto-electric sensor. Any other sensor may be used, as long as it is arranged to be installed in the clip or beside the clip and allows sensing if both parts of the clip are clipped or not. Hence, if the helmet is not attached with the under-chin safety belt, the circuit is interrupted and the drive of the vehicle ceases to operate.

[0014] The central unit, which is a part of the helmet, comprises a microcontroller or a microprocessor module, on which the program of the helmet is run and ensures in data transfer and processing as well as data transfer between the helmet and the vehicle. A wireless receiving-transmitting module is intended for connection with the vehicle and/or the mobile application and is installed in the central unit or represents a separate unit. The antenna may be connected to the printed circuit or simply installed in the frame of the helmet. All currently known and future types of wireless connections and protocols may be used, for example standard connections as Bluetooth, Wi-Fi, ZigBee and similar. In case the mobile application is used, it has to be programmed in such a manner that it is arranged to check sensor-sensed parameters, perform suitable communication with the central unit of the helmet and the module of the vehicle, which controls the electronics, which are used for adjusting operation of the drive system of the vehicle.

[0015] The helmet is with the vehicle module or the vehicle connected with a wireless network, preferably Bluetooth network, as the connection is achieved using a password, thus preventing interruptions due to different connections. In the opposite case, each vehicle and each helmet should have a unique frequency in order to prevent cross-signalling. Preferably the mentioned module is installed in the steering part of the vehicle or on the dashboard. The module is powered in the vehicle with the vehicle's power, for example with an accumulator or a battery and similar, hence external power source is not needed. Alternatively, instead of the connection with the module, the helmet may be directly connected to the application, which is arranged to control the drive system of the vehicle, such as an electric scooter.

[0016] The safety helmet is through the wireless network connected with the mobile application or the vehicle module, which is connected to the drive aggregate of the vehicle, which is arranged to terminate driving upon sensed unsuitable use (wear) of the helmet, wherein termination or limitation of driving speed is achieved in the

same way as if the user pressed the off-switch (button). Each electric vehicle comprises the microprocessor (or a microcontroller), which reads the position of the speed handle and with regards to its position, sends a suitable power to the electromotor via the controller. All that needs to be added to the system to be compatible with the helmet according to the invention is a wireless module through which communication with the helmet will be enabled and thus the impact on the operating state of the vehicle with respect to the sensed use of the helmet. The receiver or the module on the vehicle is connected to the control electronics of the vehicle and in the event of a deviation from the predetermined parameters detected by the sensors, it is simply interrupted (in the embodiment where the engine is stopped). Most of the vehicles, cars included, use CAN communication, however other protocols such as RS232, RS485, Ethernet and similar may be used.

[0017] The process of termination or limitation of the driving speed of a vehicle based on use of the above-described safety helmet according to the invention comprises the following steps:

a) the helmet is wirelessly connected to the vehicle upon turning the vehicle on,
b) the sensors and the gyroscope sense suitable wear (use) of the helmet, wherein:

i. unsuitable use of the helmet is allowed when the driving speed is lower than the pre-set threshold value, which is preferably 5 km/h,
ii. suitable use of the helmet allows ordinary driving (operation) of the vehicle,
iii. unsuitable wear of the helmet at speeds higher than the pre-set threshold value, which is preferably 5 km/h, triggers turning off of the vehicle, so that the vehicle module connected to the electronics that control operation of the vehicle, interrupts the circuit of the drive system.

[0018] Preferably, after termination of driving, the vehicle is started normally, however, in case the helmet is again not properly installed, the driving may be terminated again. The vehicle could, have an additional button for reset, which could set initial settings and vehicle start-up, however, this solution would further complicate operation of the present invention. In all cases the wireless safety module in the vehicle decides which mode of driving will be used (normal, limited, terminated).

[0019] The safety helmet according to the invention may be used in driving different vehicles, such as electric bicycles, scooters, motorized bicycles, motors, quads, tri-cycles and similar vehicles, which are driven by a drive system such as internal combustion engine, electric drive and all other possible drives. The helmet will prevent driving at a speed higher than the pre-set threshold speed, preferably 10 km/h, in case that:

- the helmet will be on the user's arm - no heartbeat, the gyroscope senses an unsuitable tilt (rotation),
- the helmet is on the head, but the under-chin belt is not attached,
- the helmet is in the trunk - no heartbeat, or
- in any other case, in which one of the sensors senses a discrepancy from the pre-set threshold values.

[0020] Thus, the safety of the drivers and all other persons in the traffic will be significantly improved.

[0021] The safety helmet and a process for termination of driving or limitation of driving speed based on use of the said safety helmet will be described in further detail using figures, which show:

Figure 1 Diagram of operation of the invention and the process for termination of vehicle operation based on sensed use of the helmet according to the invention
Figure 2 A block diagram of a possible embodiment of helmet electronics
Figure 3 A block diagram of a possible embodiment of electronics in a vehicle

[0022] Figure 1 shows a diagram of operation of the invention and the process for termination of vehicle operation based on sensed use of the helmet according to the invention, which comprises a heartbeat sensor, a gyroscope and a sensor on a clip of an under-chin safety belt, wherein the said components are suitable installed in a basic mould of the helmet, while their status is monitored with a central unit or a microprocessor, respectively. In case a heartbeat is not detected and/or the gyroscope senses an unsuitable tilt and/or the clip of the under-chin safety belt is not closed, the helmet causes termination of driving via a wireless communication with a vehicle module, in case the driving speed exceeds the pre-defined threshold value, which is 5 km/h. Even in case the helmet allows normal operation of the vehicle, termination of driving is still possible in case the gyroscope senses unsuitable values for too long or if the clip of the under-chin belt is opened.

[0023] Figure 2 shows a block diagram of a possible embodiment of the helmet electronics, while figure 3 shows a block diagram of a possible embodiment of vehicle electronics, wherein both wireless modules are arranged to wirelessly communicate.

Claims

1. A safety helmet comprising a base mould arranged to fit to a human head, an under-chin safety belt, suitable vibration absorbers provided between the mould and the human head and an optional visor, **characterized in that** the helmet further comprises:

- at least one heartbeat sensor for determination

of presence of a user's heartbeat,
- at least one gyroscope for sensing tilt of the helmet,
- preferably a suitable sensor on a clip of the under-chin safety belt for determination of use of the under-chin safety belt,
- a battery for powering said sensors and the gyroscope, said battery being arranged for charging in any known manner and/or the battery uses replaceable batteries,
- a central unit, comprising a microcontroller or a microprocessor module, on which a helmet program is run, which is arranged to ensure sensing and obtaining data from the sensors and the gyroscope as well as transmitting data between the helmet and a vehicle, and
- a wireless receiving-transmitting module for connection with the vehicle and/or a mobile application,

wherein the helmet enables termination of vehicle operation once a pre-defined threshold speed is exceeded, said speed being at least 5 km/h, preferably 10 km/h or more.

2. The safety helmet according to claim 1, **characterized in that** the helmet further comprises a mobile application, which tracks the data sensed by both sensors and the gyroscope, wherein the application is arranged to trigger termination of operation of the drive system of the vehicle based on said data.

3. The safety helmet according to claim 1 or 2, **characterized in that** the heartbeat sensor is installed in the inner part of the helmet and operates on the principle of optical transmitting and receiving diodes or on the principle of sensing electric pulses, preferably the heartbeat sensor is an optical sensor operating on the principle of transmitting and receiving an amount of reflected light from the skin, wherein the tolerated range of the heartbeat is from 30 to 200 bpm.

4. The safety helmet according to the preceding claim, **characterized in that** the helmet comprises two or more heartbeat sensors.

5. The safety helmet according to any of the preceding claims, **characterized in that** the gyroscope is a combination of a rotation and acceleration sensor and the threshold tilt into each direction is more than 90 degrees from the natural, i.e., upright position, when the helmet is properly installed on the head.

6. The safety helmet according to any of the preceding claims, **characterized in that** the sensor on the clip of the under-chin safety belt is either an electro-mechanical, i.e., switch, magnet, or an opto-electric sensor.

7. The safety helmet according to any of the preceding claims, **characterized in that** the central unit and the wireless receiving-transmitting module use any wireless connection and protocols, for example standard connections such as Bluetooth, Wi-Fi, and ZigBee.

8. The safety helmet according to any of the preceding claims, **characterized in that** the helmet is arranged for a wireless connection with a vehicle module, preferably Bluetooth, as the connection is achieved with a password, thus preventing interference between different connections.

9. The safety helmet according to any claim from 2 to 8, **characterized in that** the mobile application is programmed in such a way that it performs checking sensor-sensed parameters, suitable connection with the central unit of the helmet and the vehicle module controlling vehicle electronics, wherein operation status of the vehicle drive is adjusted based on sensed parameters.

10. A process of interruption or limitation of driving speed of a vehicle based on use of the safety helmet according to any of the preceding claims, wherein the process comprises the following steps:

a) the helmet is wirelessly connected to the vehicle upon turning the vehicle on,
b) the sensors and the gyroscope sense suitable wear (use) of the helmet, wherein:

i. unsuitable use of the helmet is allowed when the driving speed is lower than the pre-set threshold value, which is preferably 5 km/h,
ii. suitable use of the helmet allows ordinary driving (operation) of the vehicle,
iii. unsuitable wear of the helmet at speeds higher than the pre-set threshold value, which is preferably 5 km/h, triggers turning off of the vehicle, so that the vehicle module connected to the electronics that control operation of the vehicle, interrupts the circuit of the drive system.

11. The process according to the preceding claim, **characterized in that** the vehicle is an electric bicycle, a scooter, a motorized bicycle, a motor, a tri-cycle, a quad (ATV) or a sim ilar vehicle driven by a drive system such as an internal combustion engine, electric drive and other possible drives.

Patentansprüche

1. Schutzhelm, umfassend eine Basisform, die angeordnet ist, um auf einen menschlichen Kopf zu passen, einen Sicherheitsriemen unter dem Kinn, geeignete Schwingungsdämpfer zwischen der Form und dem menschlichen Kopf, und ein optionales Visier, **dadurch gekennzeichnet, dass** der Helm außerdem Folgendes umfasst:

   - mindestens einen Herzschlagsensor zur Bestimmung des Vorhandenseins des Herzschlags eines Benutzers,
   - mindestens ein Gyroskop zum Erfassen der Neigung des Helms,
   - vorzugsweise einen geeigneten Sensor auf einem Clip des Kinnsicherheitsriemens zur Bestimmung der Nutzung des Kinnsicherheitsriemens,
   - eine Batterie zum Betreiben der Sensoren und des Gyroskops, wobei die Batterie angeordnet ist, um auf jede bekannte Art aufgeladen zu werden, und/oder die Batterie auswechselbare Batterien verwendet,
   - eine Zentraleinheit, umfassend einen Mikrocontroller oder ein Mikroprozessormodul, auf dem ein Helmprogramm ausgeführt wird, das ausgelegt ist, um die Erfassung und den Erhalt von Daten von den Sensoren und dem Gyroskop sowie die Datenübertragung zwischen dem Helm und einem Fahrzeug sicherzustellen, und
   - ein drahtloses Empfangs-Sendemodul zur Verbindung mit dem Fahrzeug und/oder einer mobilen Anwendung,

   wobei der Helm die Beendigung des Fahrzeugbetriebs ermöglicht, sobald eine vordefinierte Schwellengeschwindigkeit überschritten wird, wobei die Geschwindigkeit mindestens 5 km/h, vorzugsweise 10 km/h oder mehr beträgt.

2. Schutzhelm nach Anspruch 1, **dadurch gekennzeichnet, dass** der Helm ferner eine mobile Anwendung umfasst, welche die von beiden Sensoren und dem Gyroskop erfassten Daten verfolgt, wobei die Anwendung ausgelegt ist, um basierend auf den Daten eine Beendigung des Betriebs des Antriebssystems des Fahrzeugs auszulösen.

3. Schutzhelm nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Herzschlagsensor im Innenteil des Helms eingebaut ist und nach dem Prinzip optischer Sende- und Empfangsdioden oder nach dem Prinzip der Erfassung elektrischer Impulse arbeitet, vorzugsweise ist der Herzschlagsensor ein optischer Sensor, der nach dem Prinzip des Sendens und Empfangens einer von der Haut reflektierten Lichtmenge arbeitet, wobei der tolerierte Bereich des Herzschlags zwischen 30 und 200 Schlägen pro Minute liegt.

4. Schutzhelm nach dem vorstehenden Anspruch, **dadurch gekennzeichnet, dass** der Helm zwei oder mehr Herzschlagsensoren umfasst.

5. Schutzhelm nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** das Gyroskop eine Kombination aus einem Rotations- und Beschleunigungssensor ist und die Schwellenneigung in jede Richtung mehr als 90 Grad von der natürlichen, d. h. aufrechten, Position des Helms beträgt, wenn der Helm ordnungsgemäß am Kopf getragen wird.

6. Schutzhelm nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der Sensor auf dem Clip des Kinnsicherheitsriemens entweder ein elektromechanischer, also Schalter, Magnet, oder ein optoelektrischer Sensor ist.

7. Schutzhelm nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Zentraleinheit und das drahtlose Empfangs-Sendemodul beliebige drahtlose Verbindungen und Protokolle verwenden, beispielsweise Standardverbindungen wie Bluetooth, Wi-Fi und ZigBee.

8. Schutzhelm nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der Helm für eine drahtlose Verbindung mit einem Fahrzeugmodul, vorzugsweise Bluetooth, ausgelegt ist, da die Verbindung mit einem Passwort erfolgt und dadurch Interferenzen zwischen verschiedenen Verbindungen verhindert werden.

9. Schutzhelm nach einem der Ansprüche 2 bis 8, **dadurch gekennzeichnet, dass** die mobile Anwendung so programmiert ist, dass sie die Überprüfung sensorisch erfasster Parameter, eine geeignete Verbindung mit der Zentraleinheit des Helms und dem Fahrzeugmodul zur Steuerung der Fahrzeugelektronik durchführt, wobei der Betriebsstatus des Fahrzeugantriebs basierend auf erfassten Parametern angepasst wird.

10. Verfahren zur Unterbrechung oder Begrenzung der Fahrgeschwindigkeit eines Fahrzeugs basierend auf der Verwendung des Schutzhelms nach einem der vorstehenden Ansprüche, wobei das Verfahren die folgenden Schritte umfasst:

    a) der Helm wird beim Einschalten des Fahrzeugs drahtlos mit dem Fahrzeug verbunden,
    b) die Sensoren und das Gyroskop erfassen ein sachgemäßes Tragen (Verwenden) des Helms, wobei:

i. eine unsachgemäße Verwendung des Helms zulässig ist, wenn die Fahrgeschwindigkeit unter dem voreingestellten Schwellenwert liegt, der vorzugsweise 5 km/h beträgt.
ii. eine sachgemäße Verwendung des Helms das normale Fahren (den normalen Betrieb) des Fahrzeugs ermöglicht,
iii. ein unsachgemäßes Tragen des Helms bei Geschwindigkeiten über dem voreingestellten Schwellenwert, der vorzugsweise 5 km/h beträgt, zum Abschalten des Fahrzeugs führt, sodass das Fahrzeugmodul, das mit der Elektronik verbunden ist, die den Betrieb des Fahrzeugs steuert, den Stromkreis des Antriebssystems unterbricht.

11. Verfahren nach dem vorstehenden Anspruch, **dadurch gekennzeichnet, dass** das Fahrzeug ein Elektrofahrrad, ein Scooter, ein motorisiertes Fahrrad, ein Motorfahrzeug, ein Dreirad, ein Quad (ATV) oder ein ähnliches Fahrzeug ist, das von einem Antriebssystem wie einem Verbrennungsmotor, Elektroantrieb und anderen möglichen Antrieben angetrieben wird.

Revendications

1. Un casque de sécurité comprenant un moule de base conçu pour s'adapter à une tête humaine, une sangle de sécurité passant sous le menton, des amortisseurs de vibration appropriés situés entre le moule et la tête et une visière facultative, le casque étant **caractérisé par le fait qu'**il comprend également :

- au moins un capteur de fréquence cardiaque pour déterminer la présence de battements de coeur chez l'utilisateur,
- au moins un gyroscope pour détecter l'inclinaison du casque,
- de préférence un capteur approprié sur une attache de la sangle de sécurité passant sous le menton pour déterminer l'utilisation de ladite sangle,
- une batterie pour alimenter lesdits capteurs et le gyroscope, ladite batterie étant conçue pour être rechargée de toute manière connue et/ou la batterie utilisant des piles remplaçables,
- une unité centrale, comprenant un microcontrôleur ou un module à microprocesseur, sur lequel un programme pour casque est exécuté, qui est conçu de façon à assurer la détection et l'obtention de données provenant des capteurs et du gyroscope, ainsi que la transmission de données entre le casque et un véhicule, et
- un module récepteur-émetteur sans fil pour la connexion avec le véhicule et/ou une application mobile,

où le casque permet l'interruption du fonctionnement du véhicule quand un seuil de vitesse pré-défini est dépassé, ladite vitesse étant d'au moins 5 km/h, de préférence 10 km/h ou plus.

2. Le casque de sécurité selon la revendication 1, **caractérisé par le fait que** le casque comprend également une application mobile, qui suit les données détectées par à la fois les capteurs et le gyroscope, où l'application est conçue pour déclencher l'interruption du fonctionnement du système d'entraînement du véhicule sur la base desdites données.

3. Le casque de sécurité selon la revendication 1 ou 2, **caractérisé par le fait que** le capteur de fréquence cardiaque est installé dans la partie interne du casque et fonctionne sur le principe de diodes optiques émettrices et réceptrices ou sur le principe de détection de pulsations électriques, le capteur de fréquence cardiaque étant de préférence un capteur optique fonctionnant sur le principe d'émission et de réception d'une quantité de lumière réfléchie par la peau, où la plage de fréquence cardiaque acceptée va de 30 à 200 bpm.

4. Le casque de sécurité selon la revendication précédente, **caractérisé par le fait que** le casque comprend deux capteurs de fréquence cardiaque ou davantage.

5. Le casque de sécurité selon l'une quelconque des revendications précédentes, **caractérisé par le fait que** le gyroscope est une combinaison de capteur de rotation et d'accélération et que le seuil d'inclinaison dans chaque direction est de plus de 90 degrés depuis la position naturelle, c.-à-d., verticale, quand le casque est installé correctement sur la tête.

6. Le casque de sécurité selon l'une quelconque des revendications précédentes, **caractérisé par le fait que** le capteur sur l'attache de la sangle de sécurité passant sous le menton est soit électromécanique, c.-à-d. à commutateur, aimant, soit un capteur optoélectrique.

7. Le casque de sécurité selon l'une quelconque des revendications précédentes, **caractérisé par le fait que** l'unité centrale et le module récepteur-émetteur sans fil utilisent tout type de protocoles et de connexion sans fil, par exemple des connexions standard telles que le Bluetooth, la Wi-Fi et ZigBee.

8. Le casque de sécurité selon l'une quelconque des revendications précédentes, **caractérisé par le fait que** le casque est conçu pour une connexion sans

fil avec un module de véhicule, de préférence Bluetooth, puisque la connexion est obtenue avec un mot de passe, prévenant ainsi toute interférence entre des connexions différentes.

9. Le casque de sécurité selon l'une des revendications 2 à 8, **caractérisé par le fait que** l'application mobile est programmée de façon à effectuer le contrôle des paramètres captés par les capteurs, à établir une connexion appropriée entre l'unité centrale du casque et le module de véhicule contrôlant le système électronique du véhicule, où le statut de fonctionnement de l'entraînement du véhicule est ajusté sur la base des paramètres captés.

10. Un processus d'interruption ou de limitation de la vitesse de conduite d'un véhicule sur la base de l'utilisation du casque de sécurité selon l'une quelconque des revendications précédentes, où le processus comprend les étapes suivantes :

a) le casque est connecté sans fil au véhicule lors du démarrage du véhicule,
b) les capteurs et le gyroscope détectent le port (l'utilisation) approprié du casque, où :

i. une utilisation inappropriée du casque est permise quand la vitesse de conduite est inférieure à la valeur de seuil prédéfinie, qui est de préférence de 5 km/h,
ii. l'utilisation appropriée du casque permet la conduite (l'utilisation) ordinaire du véhicule,
iii. le port inapproprié du casque à des vitesses supérieures à la valeur de seuil prédéfinie, qui est de préférence de 5 km/h, déclenche l'extinction du véhicule, de façon à ce que le module de véhicule connecté au système électronique qui contrôle le fonctionnement du véhicule, interrompe le circuit du système d'entraînement.

11. Le processus selon la revendication précédente, **caractérisé par le fait que** le véhicule est un vélo électrique, un scooter, une bicyclette à moteur, un moteur, un tricycle, un quad (ATV) ou véhicule similaire entraîné par un système d'entraînement tel que moteur à combustion interne, entraînement électrique et autres entraînements possibles.

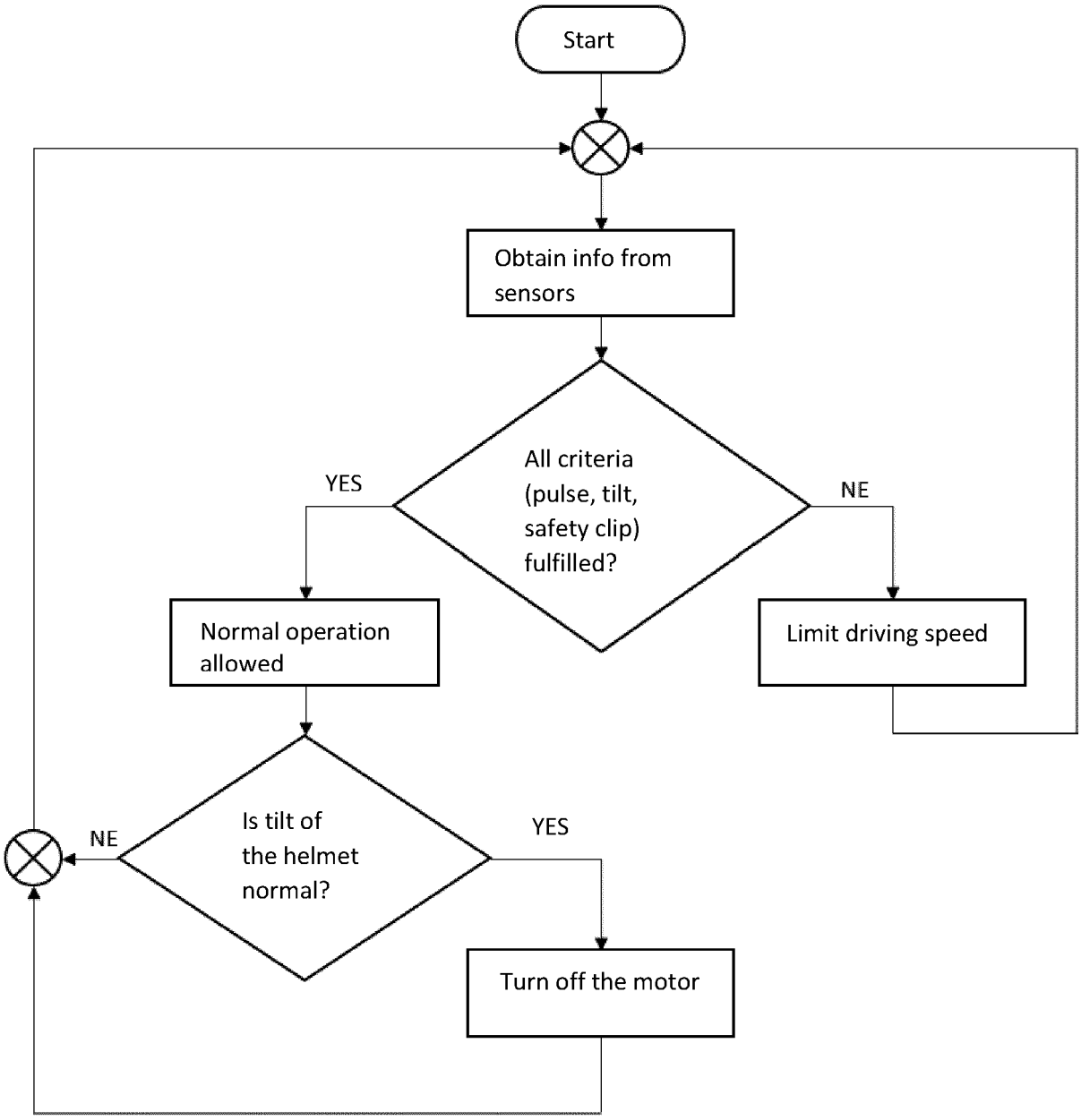
Start
Obtain info from sensors
All criteria (pulse, tilt, safety clip) fulfilled?
YES
NE
Normal operation allowed
Limit driving speed
Is tilt of the helmet normal?
NE
YES
Turn off the motor

Figure 1

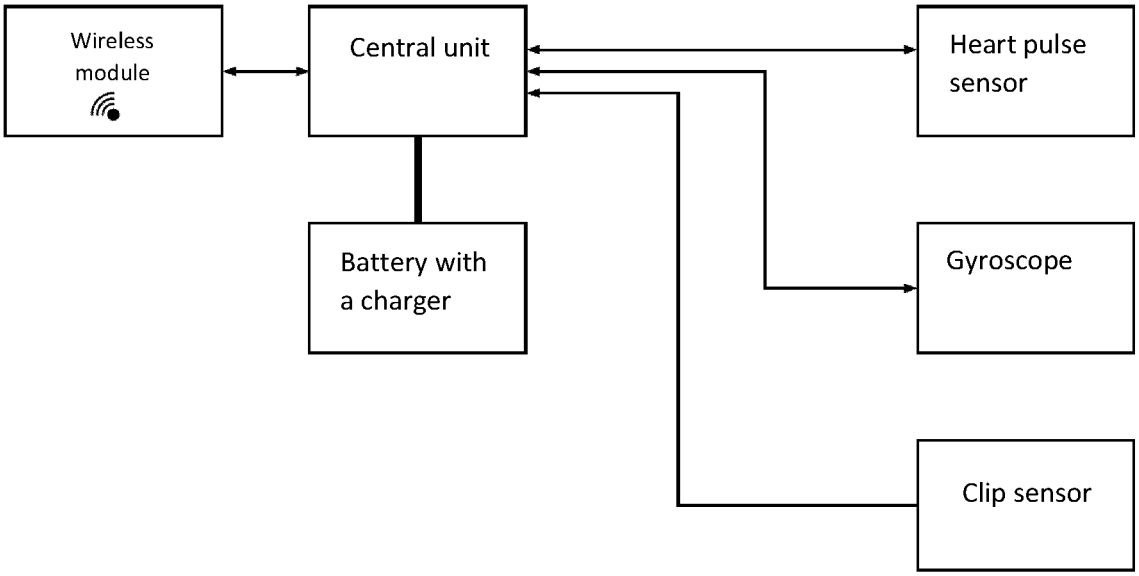

Figure 2

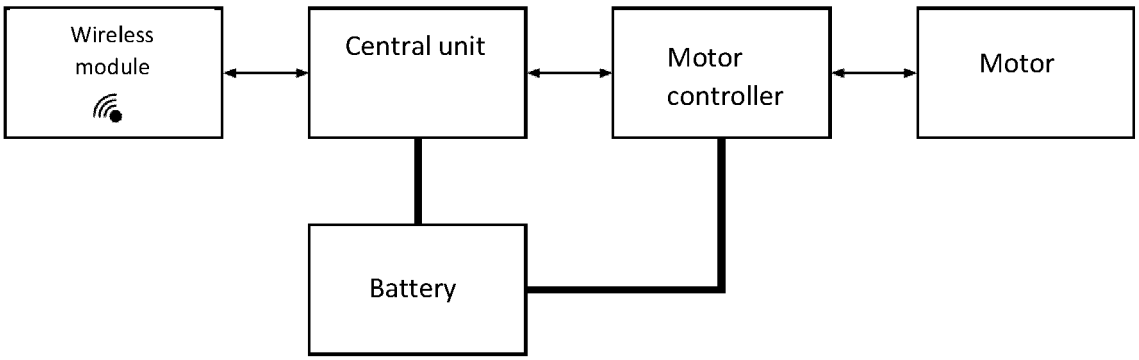

Figure 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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