



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.06.2022 Bulletin 2022/25

(51) International Patent Classification (IPC):
A42B 3/04 ^(2006.01) **B60W 30/16** ^(2020.01)
B60W 50/14 ^(2020.01)

(21) Application number: **21211554.7**

(52) Cooperative Patent Classification (CPC):
A42B 3/046; B60W 30/16; B60W 50/14

(22) Date of filing: **01.12.2021**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

- **Dumitru, Traian**
Yokohama-shi, Kanagawa, 2248501 (JP)
- **Prashanth, S N**
Yokohama-shi, Kanagawa, 2248501 (JP)
- **Gavimath, Santosh**
560 095 Bangalore, Karnataka (IN)
- **Burton, Edward**
Clayton, Victoria,, 3168 (AU)

(30) Priority: **21.12.2020 JP 2020211038**

(74) Representative: **Isarpatent**
Patent- und Rechtsanwälte Barth
Charles Hassa Peckmann & Partner mbB
Friedrichstrasse 31
80801 München (DE)

(71) Applicant: **Robert Bosch GmbH**
70442 Stuttgart (DE)

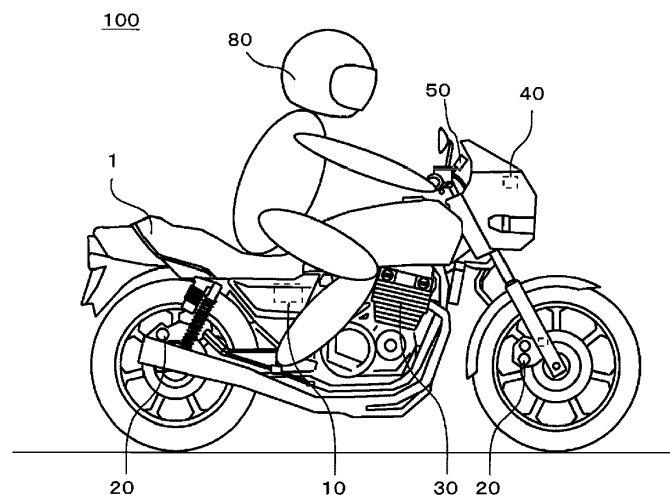
(72) Inventors:
• **Saio, Tomoaki**
Yokohama-shi, Kanagawa, 2248501 (JP)

(54) **HELMET, RIDER SUPPORT SYSTEM, AND CONTROL METHOD**

(57) A helmet (80) according to the invention includes a communication unit which directly or indirectly receives behavior control information which is information on automatic deceleration or automatic acceleration caused in a straddle-type vehicle (1) by a behavior control device

(10) according to surrounding environment information acquired during traveling from a communication device (50) and a control unit which executes a warning operation for a rider based on the behavior control information received by the communication unit.

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a helmet worn on a head of a rider, a rider support system including the helmet, a control method of the helmet, and a control method of the rider support system.

2. Description of the Background Art

[0002] As a rider support system of the related art, it is known that a behavior control device incorporated in a straddle-type vehicle causes the straddle-type vehicle to automatically decelerate or accelerate according to surrounding environment information acquired during traveling, regardless of an operation by a rider (for example, International Publication No. 2018/185577).

SUMMARY OF THE INVENTION

[0003] Since the automatic deceleration or automatic acceleration occurs suddenly, the rider may be confused by the automatic deceleration or automatic acceleration and the straddle-type vehicle on which the rider is on board may become unstable. In particular, straddle-type vehicles tend to lose their traveling stability compared to other vehicles (for example, automobiles, trucks, or the likes.), so it is necessary to take appropriate measures against automatic deceleration or automatic acceleration by a rider. Therefore, in the rider support system of the related art, a warning operation for notifying a rider of automatic deceleration or automatic acceleration is executed under a situation where the automatic deceleration or the automatic acceleration occurs. Then, the warning operation is executed by causing a device incorporated in a vicinity of a handle of the straddle-type vehicle on which the rider is on board to issue a warning. However, in a situation where the rider is paying attention in a direction different from a traveling direction, it may be difficult for the rider to recognize the warning issued from the device, and thus it may be difficult to deal with the automatic deceleration or automatic acceleration.

[0004] The invention is made in the context of the problems described above and is to obtain a helmet which can secure a rider, a rider support system which includes such a helmet, a control method of such a helmet, and a control method of such a rider support system.

[0005] A helmet according to the invention is a helmet which is worn on a head of a rider which includes a communication unit which directly or indirectly receives information transmitted from a communication device incorporated in a straddle-type vehicle and a control unit which executes a warning operation for the rider based on the information received by the communication unit, where the communication unit receives behavior control infor-

mation which is information on automatic deceleration or automatic acceleration caused in the straddle-type vehicle by a behavior control device incorporated in the straddle-type vehicle according to surrounding environment information acquired during traveling as the information and the control unit executes the warning operation based on the behavior control information received by the communication unit.

[0006] A rider support system according to invention is a rider support system which includes a behavior control device and a communication device which are incorporated in a straddle-type vehicle and a helmet which is worn on a head of a rider, where the helmet includes a communication unit which directly or indirectly receives information transmitted from the communication device and a control unit which executes a warning operation for the rider based on the information received by the communication unit, the communication unit receives behavior control information which is information on automatic deceleration or automatic acceleration caused in the straddle-type vehicle by the behavior control device according to surrounding environment information acquired during traveling as the information, and the control unit executes the warning operation based on the behavior control information received by the communication unit.

[0007] A control method of a helmet according to the invention is a control method of a helmet which is worn on a head of a rider which includes a communication step of receiving information transmitted from a communication device incorporated in a straddle-type vehicle by a communication unit of the helmet directly or indirectly and a control step of executing a warning operation for the rider based on the information received in step a) with a control unit of the helmet, where, in the communication step, the communication unit receives behavior control information which is information on automatic deceleration or automatic acceleration caused in the straddle-type vehicle by a behavior control device incorporated in the straddle-type vehicle according to surrounding environment information acquired during traveling as the information and, in the control step, the control unit executes the warning operation based on the behavior control information received in the communication step.

[0008] A control method of a rider support system according to the invention is a control method of a rider support system including a behavior control device and a communication device which are incorporated in a straddle-type vehicle and a helmet which is worn on a head of a rider which includes a communication step of receiving information transmitted from the communication device by a communication unit of the helmet directly or indirectly and a control step of executing a warning operation for the rider based on the information received in the communication step with a control unit of the helmet, where, in the communication step, the communication unit receives behavior control information which is information on automatic deceleration or automatic ac-

celeration caused in the straddle-type vehicle by the behavior control device according to surrounding environment information acquired during traveling as the information and, in the control step, the control unit executes the warning operation based on the behavior control information received in the communication step.

[0009] In the helmet, rider support system, control method of the helmet, and control method of the rider support system according to the invention, in a situation where automatic deceleration or automatic acceleration occurs, the warning operation is performed using the helmet worn on the head of the rider to notify the rider of the automatic deceleration or automatic acceleration. Therefore, even when the rider is paying attention to a direction different from a traveling direction, the warning is easily recognized and the coping with the automatic deceleration or the automatic acceleration is facilitated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 is a diagram illustrating a schematic configuration of a rider support system according to an embodiment of the invention.

Fig. 2 is a diagram illustrating a system configuration of the rider support system according to the embodiment of the invention.

Fig. 3 is a diagram illustrating an example of an operation flow of the rider support system according to the embodiment of the invention.

Fig. 4 is a diagram illustrating a schematic configuration of a modification example of the rider support system according to the embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0011] Hereinafter, a helmet, a rider support system, a control method of the helmet, and a control method of the rider support system according to the invention will be described with reference to the drawings.

[0012] The configuration, operation, and the like described below are examples and the helmet, the rider support system, the control method of the helmet, and the control method of the rider support system according to the invention are not limited to such a configuration, operation, and the like.

[0013] In the following, a case where the rider support system according to the invention is used for an automatic two-wheeled vehicle is described, but the rider support system according to the invention may be used for straddle-type vehicles other than automatic two-wheeled vehicles. A straddle-type vehicle means all vehicles that a rider straddles. Straddle-type vehicles include motorcycles (automatic two-wheeled vehicle, automatic three-wheeled vehicle), buggies, bicycles, and the like. Motorcycles include automatic two-wheeled vehicles or auto-

matic three-wheeled vehicles whose propulsion source is an engine, automatic two-wheeled vehicles or automatic three-wheeled vehicles whose propulsion source is an electric motor, and the like, and include, for example, automatic bikes, scooters, electric scooters, and the like. Bicycle also means all vehicles that can be propelled on a road by a pedaling force of a rider applied to a pedal. Bicycles include ordinary bicycles, electrically power assisted bicycles, electric bicycles, and the likes.

[0014] Further, in the following, the detailed structure is appropriately simplified or omitted in the drawings. In addition, duplicate or similar descriptions are simplified or omitted as appropriate.

15 Embodiment

[0015] A rider support system according to an embodiment will be described below.

20 Configuration of Rider Support System

[0016] A configuration of the rider support system according to the embodiment will be described.

[0017] Fig. 1 is a diagram illustrating a schematic configuration of the rider support system according to the embodiment of the invention. Fig. 2 is a diagram illustrating a system configuration of the rider support system according to the embodiment of the invention.

[0018] As illustrated in Figs. 1 and 2, a rider support system 100 includes at least a behavior control device 10, a braking device 20, a driving device 30, a communication device 50, which are incorporated in a straddle-type vehicle 1, and a helmet 80 mounted on the rider's head.

[0019] Detection results of various sensors mounted on the straddle-type vehicle 1 are input to the behavior control device 10. Further, the behavior control device 10 causes the straddle-type vehicle 1 to automatically decelerate or accelerate according to surrounding environment information acquired during traveling, without an operation by a rider on board the straddle-type vehicle 1. For example, when it is determined that it is necessary to cause a predetermined deceleration based on the surrounding environment information, the behavior control device 10 outputs a control command to the braking device 20 or the driving device 30 to cause the straddle-type vehicle 1 to automatically decelerate. In addition, when it is determined that it is necessary to generate a predetermined acceleration based on the surrounding environment information, the behavior control device 10 outputs a control command to the driving device 30 or the braking device 20 to cause the straddle-type vehicle 1 to automatically accelerate.

[0020] Each part of the behavior control device 10 may be provided collectively in one housing, or may be divided into a plurality of housings. Further, a part or all of the behavior control device 10 may be composed of, for example, a microcomputer, a microprocessor unit, or the

like, may be composed of an updatable one such as firmware, or may be a program module or the like executed by a command from a CPU or the like.

[0021] The surrounding environment information is acquired based on, for example, output of a surrounding environment detection device 40 incorporated in the straddle-type vehicle 1. The surrounding environment detection device 40 is, for example, a radar, a Lidar sensor, an ultrasonic sensor, a camera, or the like. The surrounding environment detection device 40 may be one or plural. A detection range of the surrounding environment detection device 40 may be directed to the front of the straddle-type vehicle 1, may be directed to the rear of the straddle-type vehicle 1, may be directed to the side of the straddle-type vehicle 1, or may be a combination thereof. The surrounding environment information may be acquired based on output of the communication device 50 in place of or in addition to the output of the surrounding environment detection device 40. The communication device 50 directly or indirectly performs wireless communication with infrastructure equipment or other vehicles located around the straddle-type vehicle 1.

[0022] As an example, the behavior control device 10 executes a collision avoidance operation of the straddle-type vehicle 1. The behavior control device 10 acquires surrounding environment information based on the output of the surrounding environment detection device 40 or the communication device 50 and determines possibilities of collision of the straddle-type vehicle 1 with an object (vehicles, people, animals, obstacles, falling objects, and the likes) located around (front, rear, side, and the like) the straddle-type vehicle 1. When it is determined that there is a high possibility of collision, the behavior control device 10 causes the straddle-type vehicle 1 to automatically decelerate or accelerate to avoid a collision.

[0023] As an example, the behavior control device 10 executes an adaptive cruise operation of the straddle-type vehicle 1. During the adaptive cruise operation, the straddle-type vehicle 1 is controlled to travel at a target speed set by the rider when there is no preceding vehicle, whereas, when there is a preceding vehicle, the straddle-type vehicle 1 is controlled to travel at a speed that is equal to or lower than the target speed and that aims to maintain an inter-vehicle distance from the preceding vehicle. The behavior control device 10 acquires surrounding environment information based on the output of the surrounding environment detection device 40 or the communication device 50 and determines the inter-vehicle distance between the straddle-type vehicle 1 and the preceding vehicle. The behavior control device 10 causes the straddle-type vehicle 1 to automatically decelerate when it is determined that the inter-vehicle distance is short and causes the straddle-type vehicle 1 to automatically accelerate when it is determined that the inter-vehicle distance is long.

[0024] As an example, the behavior control device 10 executes an overtaking traveling assisting operation of

the straddle-type vehicle 1. The behavior control device 10 acquires surrounding environment information based on the output of the surrounding environment detection device 40 or the communication device 50 and determines the safety of overtaking traveling by the straddle-type vehicle 1 and whether the rider intends to overtake. The behavior control device 10 assists the overtaking traveling by causing the straddle-type vehicle 1 to automatically accelerate when it is determined that the safety is high and the rider has the intention of overtaking.

[0025] As an example, the behavior control device 10 executes inter-vehicle-to-vehicle passing traveling assist operation of the straddle-type vehicle 1. The behavior control device 10 acquires surrounding environment information based on the output of the surrounding environment detection device 40 or the communication device 50 and determines whether the straddle-type vehicle 1 is in a state of inter-vehicle-to-vehicle passing traveling. The behavior control device 10 assists the inter-vehicle-to-vehicle passing traveling by causing the straddle-type vehicle 1 to automatically decelerate when it is determined that the straddle-type vehicle 1 is in the state of inter-vehicle-to-vehicle passing traveling.

[0026] The helmet 80 includes at least a communication unit 81 which receives information transmitted from the communication device 50 and a control unit 82 which executes a warning operation for the rider wearing the helmet 80 based on the information received by the communication unit 81. The communication unit 81 automatically starts communication with the communication device 50 when a main power of the helmet 80 is turned on. The communication unit 81 may directly receive the information transmitted from the communication device 50, or may indirectly receive the information via a portable wireless terminal 90 (smartphone, tablet, or the like). Further, the control unit 82 may execute the warning operation by causing an audio output unit 83 provided in the helmet 80 to output a warning, may execute the warning operation by causing a display unit 84 provided on the helmet 80 to output a warning, or may execute the warning operation with both the audio output unit 83 and the display unit 84. The audio output unit 83 may emit a sound indicating a warning, may emit a warning message, or may emit both. The display unit 84 may turn on a lamp indicating a warning, display a warning message, or perform both.

[0027] The control unit 82 may be provided collectively in one housing, or may be divided into a plurality of housings. Further, a part or all of the control unit 82 may be composed of, for example, a microcomputer, a microprocessor unit, or the like, or may be composed of an updatable one such as firmware. Also, a part or all of the control unit 82 may be a program module or the like executed by a command from a CPU or the like.

[0028] The communication unit 81 receives behavior control information which is information on the automatic deceleration or the automatic acceleration caused in the straddle-type vehicle 1 by the behavior control device 10

according to the surrounding environment information acquired during traveling. Then, the control unit 82 executes a warning operation based on the behavior control information received by the communication unit 81. The control unit 82 may execute a warning operation of warning only the presence or absence of automatic deceleration or automatic acceleration, or may execute a warning operation of warning the magnitude of automatic deceleration or automatic acceleration in addition to the presence or absence thereof.

Operation of Rider Support System

[0029] An operation of the rider support system according to the embodiment will be described.

[0030] Fig. 3 is a diagram illustrating an example of an operation flow of the rider support system according to the embodiment of the invention.

[0031] While the straddle-type vehicle 1 is traveling, the operation flow illustrated in Fig. 3 is repeatedly executed.

Determination Step

[0032] In Step S101, the behavior control device 10 incorporated in the straddle-type vehicle 1 acquires the surrounding environment information and determines whether it is necessary to cause the straddle-type vehicle 1 to automatically decelerate or accelerate. When it is necessary to cause the straddle-type vehicle 1 to automatically decelerate or accelerate, the process proceeds to Step S102, and if not, Step S101 is repeated.

Communication Step

[0033] In Step S102, the communication unit 81 of the helmet 80 receives the behavior control information, which is the information on the automatic deceleration or the automatic acceleration caused by the behavior control device 10 in the straddle-type vehicle 1, directly or indirectly from the communication device 50 incorporated in the straddle-type vehicle 1.

Control Step

[0034] In Step S103, the control unit 82 of the helmet 80 executes a warning operation for the rider based on the behavior control information received in Step S102.

Behavior Control Step

[0035] In Step S104, the behavior control device 10 causes the straddle-type vehicle 1 to automatically decelerate or accelerate.

[0036] The order of each step may be changed as appropriate, or another step may be added as appropriate. For example, Step S103 may be executed after the start of Step S104, or may be executed before and after the

start of Step S104.

Effect of Rider Support System

[0037] An effect of the rider support system according to the embodiment will be described.

[0038] In the rider support system 100, the helmet 80, which is wore on the rider's head, includes the communication unit 81 which directly or indirectly receives information transmitted from the communication device 50 incorporated in the straddle-type vehicle 1 and the control unit 82 which executes a warning operation for the rider based on the information received by the communication unit 81. The communication unit 81 receives the behavior control information, which is information on automatic deceleration or automatic acceleration caused in the straddle-type vehicle 1 by the behavior control device 10 incorporated in straddle-type vehicle 1 according to the surrounding environment information acquired during traveling, as the information and the control unit 82 executes the warning operation based on the behavior control information received by the communication unit 81. Therefore, even when the rider is paying attention to a direction different from a traveling direction, the warning is easily recognized, and thus the coping with the automatic deceleration or the automatic acceleration is facilitated.

[0039] The embodiment of the invention is not limited to the above description. That is, the invention includes a modification form of the embodiment described above. In addition, the invention includes a form in which only a part of the embodiment described above is carried out, or a form in which the embodiments are combined.

[0040] Fig. 4 is a diagram illustrating a schematic configuration of a modification example of the rider support system according to the embodiment of the invention.

[0041] For example, in the above, the case where the communication unit 81 of the helmet 80 receives the behavior control information in the straddle-type vehicle 1 on which the rider wearing the helmet 80 is on board is described. However, in place of or in addition to that, as illustrated in Fig. 4, the communication unit 81 of the helmet 80 may receive the behavior control information in the straddle-type vehicle 1 on which a rider wearing the helmet 80 is not on board. That is, the control unit 82 of the helmet 80 may notify the rider of the automatic deceleration or the automatic acceleration which occurs in the straddle-type vehicle 1 on which the rider wearing the helmet 80 is not on board. The straddle-type vehicle 1 may be a preceding vehicle of a straddle-type vehicle 101 on which the rider wearing the helmet 80 is on board. In such a configuration, it is easy to deal with the automatic deceleration or the automatic acceleration which occurs in the preceding vehicle. The straddle-type vehicle 101 may or may not be capable of causing automatic deceleration or automatic acceleration. Further, it is preferable that the straddle-type vehicle 1 and the straddle-type vehicle 101 are vehicles set as vehicles which travel

in a group in the same group. When group driving is performed, there is an increasing need to cause the straddle-type vehicle 101 to decelerate or accelerate in conjunction with the automatic deceleration or automatic acceleration of the straddle-type vehicle 1. That is, the configuration in which the control unit 82 notifies the rider of the automatic deceleration or automatic acceleration which occurs in the straddle-type vehicle 1 on which the rider wearing the helmet 80 is not on board is particularly useful in group driving.

Claims

1. A helmet (80) which is worn on a head of a rider, comprising:
 - a communication unit (81) which directly or indirectly receives information transmitted from a communication device (50) incorporated in a straddle-type vehicle (1); and
 - a control unit (82) which executes a warning operation for the rider based on the information received by the communication unit (81), wherein
 - the communication unit (81) receives behavior control information which is information on automatic deceleration or automatic acceleration caused in the straddle-type vehicle (1) by a behavior control device (10) incorporated in the straddle-type vehicle (1) according to surrounding environment information acquired during traveling as the information, and
 - the control unit (82) executes the warning operation based on the behavior control information received by the communication unit (81).
2. The helmet (80) according to claim 1, wherein the communication unit (81) receives the behavior control information directly from the communication device (50).
3. The helmet (80) according to claim 1, wherein the communication unit (81) receives the behavior control information from the communication device (50) via a portable wireless terminal (90).
4. The helmet (80) according to any one of claims 1 to 3, wherein the communication unit (81) receives the behavior control information transmitted from the communication device (50) incorporated in the straddle-type vehicle (1) on which the rider is on board.
5. The helmet (80) according to any one of claims 1 to 3, wherein the communication unit (81) receives the behavior control information transmitted from the communication device (50) incorporated in the straddle-type vehicle (1) on which the rider is not on board.
6. The helmet (80) according to claim 5, wherein the straddle-type vehicle (1) is a vehicle set as a vehicle which travels in a group in the same group with another straddle-type vehicle (101) on which the rider is on board.
7. The helmet (80) according to any one of claims 1 to 6, wherein the behavior control information includes information on automatic deceleration or automatic acceleration in a collision avoidance operation.
8. The helmet (80) according to any one of claims 1 to 7, wherein the behavior control information includes information on automatic deceleration or automatic acceleration in an adaptive cruise operation.
9. The helmet (80) according to any one of claims 1 to 8, further comprising:
 - an audio output unit (83), wherein the warning operation includes an operation of causing the audio output unit (83) to output a warning.
10. The helmet (80) according to any one of claims 1 to 9, further comprising:
 - a display unit (84), wherein the warning operation includes an operation of causing the display unit (84) to output a warning.
11. The helmet (80) according to any one of claims 1 to 10, wherein the communication unit (81) automatically starts direct or indirect communication with the communication device (50).
12. A rider support system (100) which includes a behavior control device (10) and a communication device (50) which are incorporated in a straddle-type vehicle (1) and a helmet (80) which is worn on a head of a rider, wherein the helmet (80) includes,
 - a communication unit (81) which directly or indirectly receives information transmitted from the communication device (50), and
 - a control unit (82) which executes a warning operation for the rider based on the information received by the communication unit (81),
 - the communication unit (81) receives behavior control information which is information on automatic deceleration or automatic acceleration

caused in the straddle-type vehicle (1) by the behavior control device (10) according to surrounding environment information acquired during traveling as the information, and the control unit (82) executes the warning operation based on the behavior control information received by the communication unit (81). 5

13. A control method of a helmet (80) which is worn on a head of a rider, the control method comprising: 10

a communication step (S102) of receiving information transmitted from a communication device (50) incorporated in a straddle-type vehicle (1) by a communication unit (81) of the helmet (80) directly or indirectly; and 15
a control step (S103) of executing a warning operation for the rider based on the information received in the communication step (S102) with a control unit (82) of the helmet (80), wherein 20
in the communication step (S102), the communication unit (81) receives behavior control information which is information on automatic deceleration or automatic acceleration caused in the straddle-type vehicle (1) by a behavior control device (10) incorporated in the straddle-type vehicle (1) according to surrounding environment information acquired during traveling as the information, and 25
in the control step (S103), the control unit (82) executes the warning operation based on the behavior control information received in the communication step (S102). 30

14. A control method of a rider support system (100) including a behavior control device (10) and a communication device (50) which are incorporated in a straddle-type vehicle (1) and a helmet (80) which is worn on a head of a rider, the control method comprising the steps of: 35 40

a communication step (S102) of receiving information transmitted from the communication device (50) by a communication unit (81) of the helmet (80) directly or indirectly; and 45
a control step (S103) of executing a warning operation for the rider based on the information received in the communication step (S102) with a control unit (82) of the helmet (80), wherein 50
in the communication step (S102), the communication unit (81) receives behavior control information which is information on automatic deceleration or automatic acceleration caused in the straddle-type vehicle (1) by the behavior control device (10) according to surrounding environment information acquired during traveling as the information, and 55
in the control step (S103), the control unit (82)

executes the warning operation based on the behavior control information received in the communication step (S102).

FIG. 1

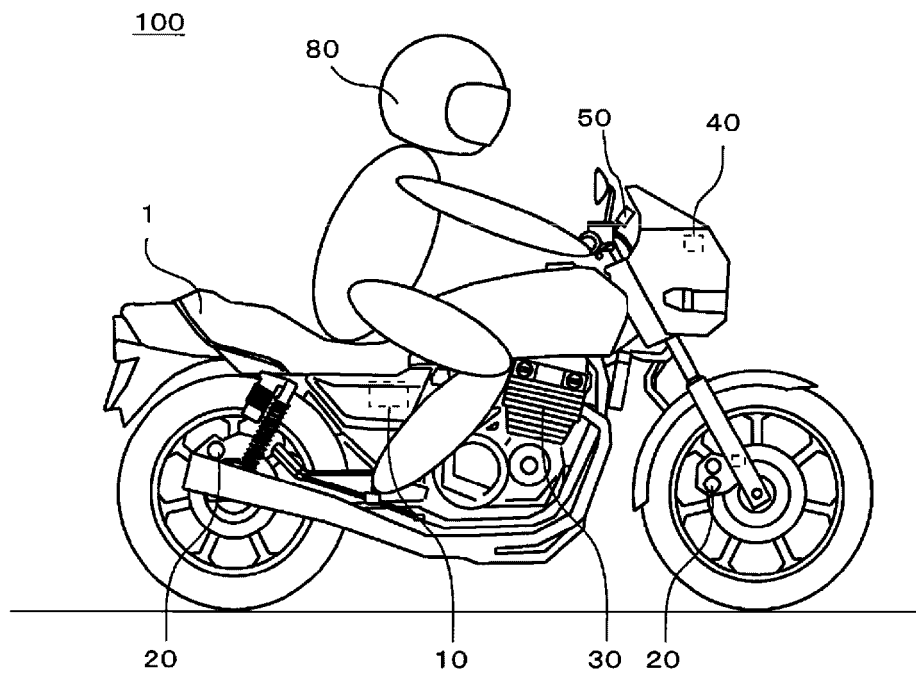


FIG. 2

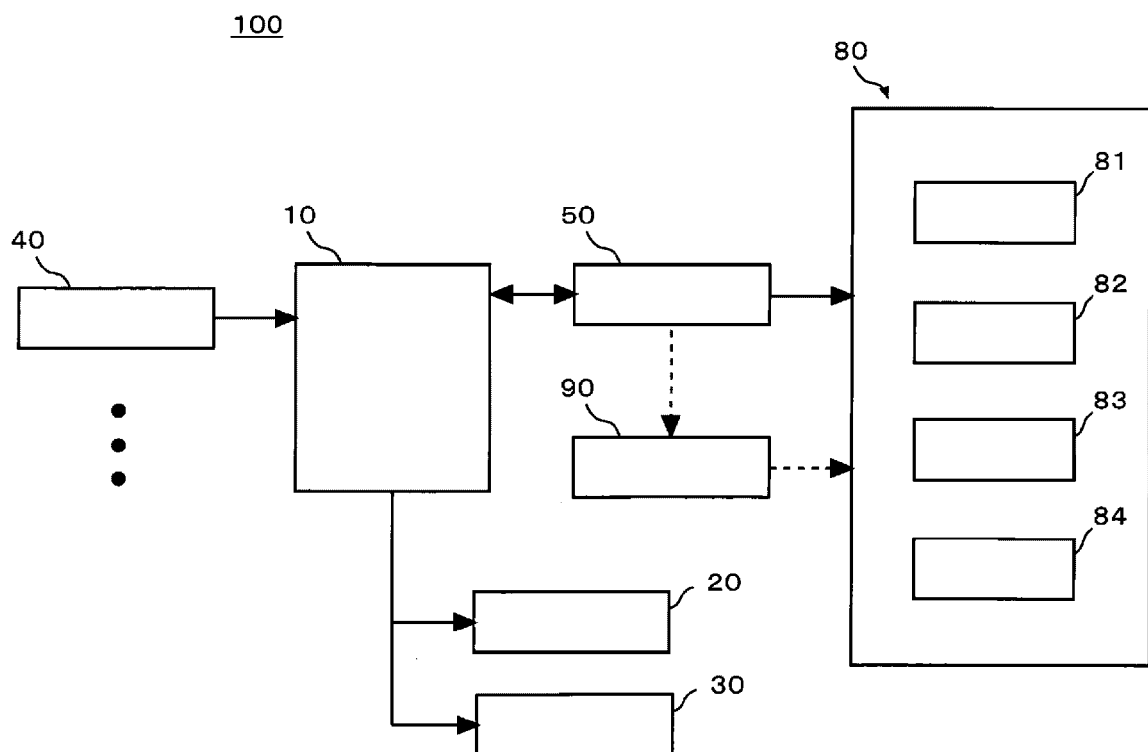


FIG. 3

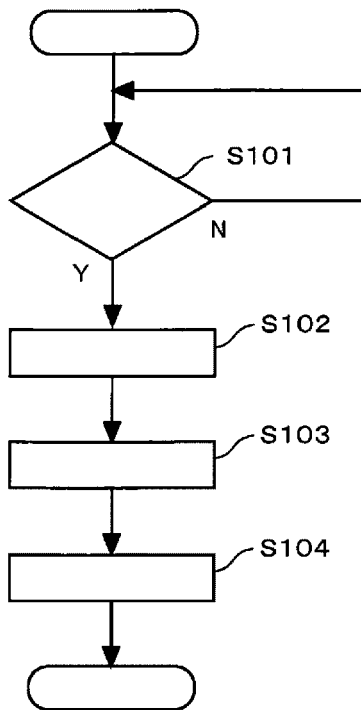
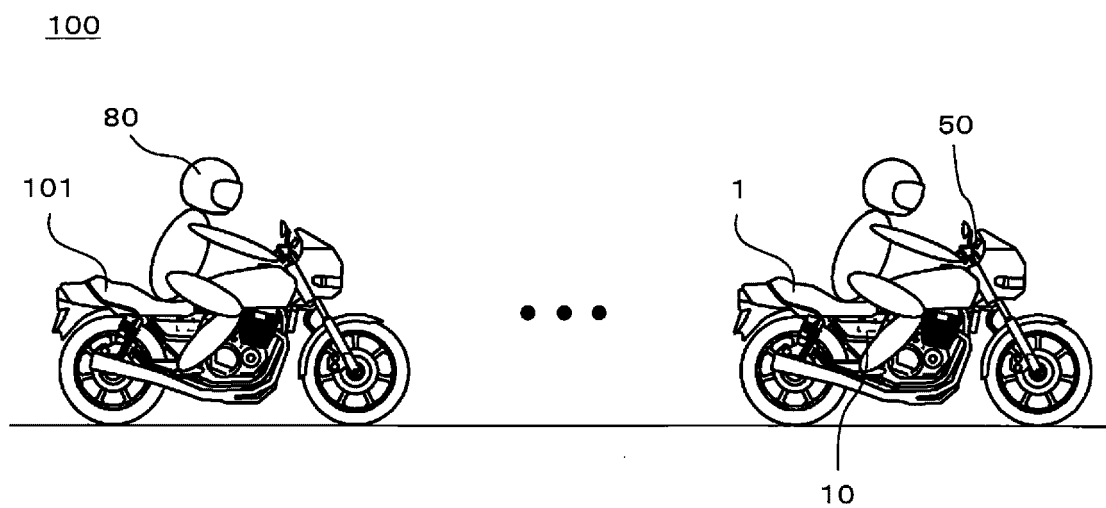


FIG. 4





EUROPEAN SEARCH REPORT

Application Number

EP 21 21 1554

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2020/008302 A1 (BOSCH GMBH ROBERT) 9 January 2020 (2020-01-09) * abstract *	1, 3, 4, 7-14	INV. A42B3/04 B60W30/16 B60W50/14
X,P	& EP 3 819 179 A1 (BOSCH GMBH ROBERT [DE]) 12 May 2021 (2021-05-12) * paragraphs [0007], [0040] - [0057]; figure 4 *	1-4, 7-14	
A	US 2018/201188 A1 (SAKUMA YASUSHI [JP] ET AL) 19 July 2018 (2018-07-19) * claims 1,15 *	1-14	
A,D	EP 3 608 181 A1 (BOSCH GMBH ROBERT [DE]) 12 February 2020 (2020-02-12) * paragraphs [0045], [0046]; claim 1 *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			A42B B60W B60T
The present search report has been drawn up for all claims			

1

EPO FORM 1503 03.82 (P04C01)

Place of search	Date of completion of the search	Examiner
The Hague	13 April 2022	D'Souza, Jennifer
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 21 1554

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-04-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2020008302 A1	09-01-2020	CN 112313132 A	02-02-2021
		EP 3819179 A1	12-05-2021
		JP 2020006740 A	16-01-2020
		JP WO2020008302 A1	24-06-2021
		US 2021276552 A1	09-09-2021
		WO 2020008302 A1	09-01-2020

US 2018201188 A1	19-07-2018	DE 112016004471 T5	14-06-2018
		JP 6443381 B2	26-12-2018
		JP 2017068821 A	06-04-2017
		US 2018201188 A1	19-07-2018

EP 3608181 A1	12-02-2020	CN 110446635 A	12-11-2019
		EP 3608181 A1	12-02-2020
		JP 6817417 B2	20-01-2021
		JP 2018176861 A	15-11-2018
		JP WO2018185577 A1	12-12-2019
		WO 2018185577 A1	11-10-2018

FORM P0459

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2018185577 A [0002]