Innovation, Sciences et Développement économique Canada
Office de la Propriété Intellectuelle du Canada

Innovation, Science and Economic Development Canada
Canadian Intellectual Property Office

CA 3088914 C 2023/10/03

(11)(21) 3 088 914

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2018/12/17
(87) Date publication PCT/PCT Publication Date: 2019/07/04
(45) Date de délivrance/Issue Date: 2023/10/03
(85) Entrée phase nationale/National Entry: 2020/07/15
(86) N° demande PCT/PCT Application No.: CN 2018/121459
(87) N° publication PCT/PCT Publication No.: 2019/128755
(30) Priorités/Priorities: 2017/12/28 (CN201711463873.6); 2017/12/28 (CN201721880343.7)

(51) Cl.Int./Int.Cl. *G01C 21/34* (2006.01), *B60L 53/50* (2019.01)

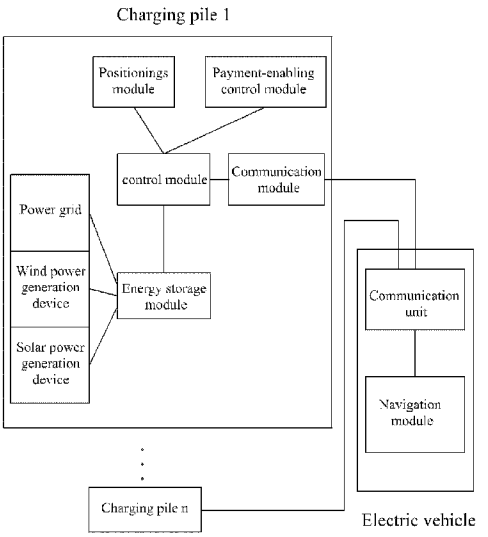
(72) Inventeurs/Inventors:
WEI, TAO, CN;
HUANG, JINGWEN, CN;
LUO, JIAREN, CN;
LIU, JIN, CN

(73) Propriétaires/Owners:
WEI, TAO, CN;
HUANG, JINGWEN, CN;
LUO, JIAREN, CN;
LIU, JIN, CN

(74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : PROCEDE ET SYSTEME DE NAVIGATION DE VEHICULE ELECTRIQUE REPOSANT SUR UN GUIDAGE DE PUISSANCE DE PILE DE CHARGE A STOCKAGE D'ENERGIE

(54) Title: NAVIGATION METHOD AND SYSTEM FOR ELECTRIC VEHICLES BASED ON ELECTRICITY QUANTITY GUIDANCE OF ENERGY-STORAGE CHARGING PILES



(57) Abrégé/Abstract:
An electric vehicle navigation method based on power guidance of an energy-storage charging pile. An electric vehicle selects, according to location information of charging piles and real-time stored power information of energy storage modules of the charging piles, a charging pile nearby that can meet own charging power demand and moves thereto for charging. The system using the method comprises a charging pile provided with a control module, a positioning module, an energy storage module, and a communication module; the electric vehicle is provided with a communication unit; the control module separately acquires the location information of the charging pile and real-time stored power information, and sends the information to the communication unit of the electric vehicle by means of the communication module. The navigation method and system can reasonably guide the electric vehicle to charge according to the distribution of charging piles and the stored power, and can dynamically plan a charging scheme for the electric vehicle, thereby preventing the electric vehicle from stop on the way due to no power and long-term inefficient waiting for charging, so that the stored power of the charging pile can be reasonably distributed and used, and energy idleness and waste are avoided.

(12) 按照专利合作条约所公布的国际申请

(19) 世界知识产权组织
国 际 局

(43) 国际公布日
2019 年 7 月 4 日 (04.07.2019)

WIPO | PCT

(10) 国际公布号
WO 2019/128755 A1

(51) 国际专利分类号:
G01C 21/34 (2006.01) *B60L 53/50* (2019.01)

(21) 国际申请号: PCT/CN2018/121459

(22) 国际申请日: 2018 年 12 月 17 日 (17.12.2018)

(25) 申请语言: 中文

(26) 公布语言: 中文

(30) 优先权:
201711463873.6 2017年12月28日 (28.12.2017) CN
201721880343.7 2017年12月28日 (28.12.2017) CN

(72) 发明人; 及

(71) 申请人: 韦涛 (**WEI, Tao**) [CN/CN]; 中国广西壮族自治区南宁市西乡塘区中华路66号兴华苑B座21-1号房, Guangxi 530000 (CN)。 黄景文 (**HUANG, Jingwen**) [CN/CN]; 中国广西壮族自治区南宁市西乡塘区大学东路100号, Guangxi 530000 (CN)。 罗家仁 (**LUO, Jiaren**) [CN/CN]; 中国广西壮族自治区柳州市柳南区柳邕路377号6栋1单元301室, Guangxi 545025 (CN)。 刘瑾 (**LIU, Jin**) [CN/CN]; 中国广西壮族自治区南宁市青秀区佛子岭路23号14栋2单元1802号房, Guangxi 530000 (CN)。

(74) 代理人: 广西南宁公平知识产权代理有限公司 (**GUANGXI NANNING GONGPING INTELLECTUAL PROPERTY AGENT CO., LTD**); 中国广西壮族自治区南宁市青秀区建政路二轻大厦515室黄春莲, Guangxi 530023 (CN)。

(81) 指定国 (除另有指明, 要求每一种可提供的国家保护): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB,

(54) **Title:** ELECTRIC VEHICLE NAVIGATION METHOD AND SYSTEM BASED ON POWER GUIDANCE OF ENERGY-STORAGE CHARGING PILE

(54) **发明名称:** 基于蓄能充电桩电量引导的电动运载工具导航方法及系统

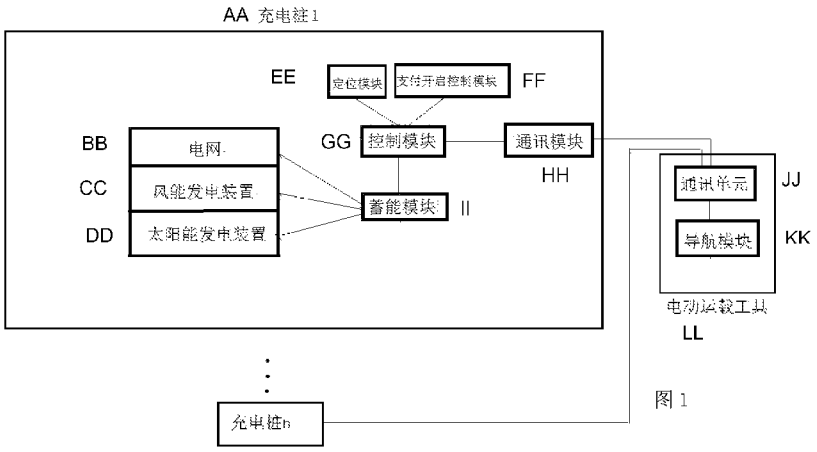


图 1

AA	Charging pile	GG	Control module
BB	Power grid	HH	Communication module
CC	Wind-driven power generation device	II	Energy storage module
DD	Solar power generation device	JJ	Communication unit
EE	Positioning module	KK	Navigation module
FF	Payment-enabling control device	LL	Electric vehicle

(57) **Abstract:** An electric vehicle navigation method based on power guidance of an energy-storage charging pile. An electric vehicle selects, according to location information of charging piles and real-time stored power information of energy storage modules of the charging piles, a charging pile nearby that can meet own charging power demand and moves thereto for charging. The system using the method comprises a charging pile provided with a control module, a positioning module, an energy storage module, and a communication module; the electric vehicle is provided with a communication unit; the control module separately acquires the location information of the charging pile and real-time stored power information, and sends the information to the communication unit of the electric vehicle by means of the communication module. The navigation method and system can reasonably guide the electric vehicle to charge according to the distribution of charging piles and the stored power, and can dynamically plan a charging scheme for the electric

WO 2019/128755 A1

[见续页]

WO 2019/128755 A1

GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW。

(84) 指定国(除另有指明，要求每一种可提供的地区保护)：ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), 欧亚 (AM, AZ, BY, KG, KZ, RU, TJ, TM), 欧洲 (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG)。

本国际公布:

— 包括国际检索报告(条约第21条(3))。

vehicle, thereby preventing the electric vehicle from stop on the way due to no power and long-term inefficient waiting for charging, so that the stored power of the charging pile can be reasonably distributed and used, and energy idleness and waste are avoided.

(57) 摘要：一种基于蓄能充电桩电量引导的电动运载工具导航方法，电动运载工具根据充电桩的位置信息及充电桩蓄能模块的实时蓄能电量信息，选择能满足自身充电电量需求的附近充电桩前往充电。采用该方法的系统包括充电桩，其具有控制模块、定位模块、蓄能模块和通讯模块；电动运载工具具有通讯单元；控制模块分别采集充电桩定位信息和实时蓄能电量信息，通过通讯模块发送到电动运载工具的通讯单元。该导航方法及系统能根据充电桩分布和蓄能电量合理引导电动运载工具进行充电，并能为电动运载工具动态规划出行充电方案，避免了电动运载工具途中无电停驶和长时间低效等待充电的问题，使充电桩蓄能电量得到合理分配利用，避免能源闲置和浪费。

NAVIGATION METHOD AND SYSTEM FOR ELECTRIC VEHICLES BASED ON ELECTRICITY QUANTITY GUIDANCE OF ENERGY-STORAGE CHARGING PILES

TECHNICAL FIELD

The present invention relates to the field of electric vehicle charging navigation, in particular to a navigation method and system for electric vehicles based on electricity quantity guidance of energy-storage charging piles.

BACKGROUND OF THE PRESENT INVENTION

With the deepening of the concept of green environmental protection in the world, electric vehicles, including electromobiles, unmanned aerial vehicles and the like, are developing rapidly. However, the main problems that limit the promotion of electric vehicles, particularly the electromobiles, include short endurance mileage and incomplete charging and recharging facilities, which often cause that the electromobiles are often short of electricity on the way and unable to be recharged in time, bringing troubles to users. In urban suburbs, vast rural areas and wilderness areas, the problem that the electromobiles are unable to go out of the city and go to the countryside is particularly prominent due to the lack of charging facilities. The existing electromobile charging navigation only gives a charging point on the electronic map and plans a route to reach the charging point quickly without considering the electricity quantity of some energy-storage charging piles in a charging station, which is easy to cause inefficient waiting for a long time at the empty-electricity energy-storage charging piles. However, an energy-storage charging device based on clean energy street lamps, which is developed vigorously in rural areas and is operated off the power grid, cannot be effectively utilized in the charging and recharging field due to the difficulty in knowing the stored electricity.

The unmanned aerial vehicles and electric ships driven by batteries are also unable to select charging time and places reasonably due to the lack of charging facilities and the inability to know the stored electricity of the energy-storage charging piles, thereby

Date Reçue/Date Received 2020-07-15

affecting the work efficiency due to short endurance mileage and frequent back-and-forth charging.

SUMMARY OF THE PRESENT INVENTION

TECHNICAL PROBLEMS

The present invention provides a navigation method and system for electric vehicles based on electricity quantity guidance of energy-storage charging piles. The navigation method and system can select charging piles nearby that can meet own charging quantity demands to charge according to the own remaining electricity quantity and energy consumption of the electric vehicles and in combination with the distribution and energy storage of the energy-storage charging piles, and can dynamically plan travel charging solutions for the electric vehicles, thereby avoiding problems that the electric vehicles stop running without electricity on the way to the charging piles and inefficiently wait for charging for a long time, so that the stored electricity of the charging piles can be reasonably distributed and utilized, and energy idleness and waste are avoided.

SOLUTIONS TO PROBLEMS

TECHNICAL SOLUTIONS

The present invention is realized by the following technical solutions:

A navigation method for electric vehicles based on electricity quantity guidance of energy-storage charging piles, wherein the charging piles are provided with energy storage modules; and the electric vehicles select charging piles nearby that can meet own charging quantity demands to charge according to location information of the charging piles and real-time stored electricity information of the energy storage modules of the charging piles.

The navigation method further includes a step that a navigation module guides each electric vehicle to one charging pile for charging. Specifically, the charging pile sends location information and real-time stored electricity information of the charging pile to the navigation module; and the navigation module guides the electric vehicle to

Date Reçue/Date Received 2020-07-15

the charging pile nearby that can meet the own charging quantity demands to charge according to the received location information of the charging pile and real-time stored electricity information of the energy storage module of the charging pile.

The navigation method further includes a step that an electricity quantity navigation server and the navigation module cooperate with each other to guide the electric vehicle to the charging pile for charging. Specifically, the charging pile sends the location information of the charging pile and the real-time stored electricity information of the energy storage module of the charging pile to the electricity quantity navigation server; the electric vehicle sends real-time location information and charging quantity demands of the electric vehicle to the electricity quantity navigation server through the navigation module; the electricity quantity navigation server matches the charging pile nearby that can meet the charging quantity demands of the electric vehicle and sends the location information of the matched charging pile and the real-time stored electricity information of the energy storage module of the matched charging pile to the navigation module; and the navigation module guides the electric vehicle to charge.

The navigation method further includes a step that the electricity quantity navigation server formulates a charging planning solution for the electric vehicle. Specifically, the charging pile sends self-state detection information to the electricity quantity navigation server, wherein the self-state detection information includes the location information of the charging pile and the real-time stored electricity information of the energy storage module of the charging pile; the electric vehicle sends destination information and real-time remaining electricity quantity and energy consumption information of the electric vehicle to the electricity quantity navigation server through the navigation module; the electricity quantity navigation server formulates the charging planning solution according to the received information and sends the charging planning solution to the navigation module; and the navigation module guides the electric vehicle to the designated charging pile for charging according to the charging planning solution.

The navigation method further includes a step that the electricity quantity navigation server dynamically plans a travel charging solution for the electric vehicle.

Date Reçue/Date Received 2020-07-15

Specifically, the charging pile sends the self-state detection information to the electricity quantity navigation server, wherein the self-state detection information includes the location information of the charging pile and the real-time stored quantity information of the energy storage module of the charging pile; the electric vehicle sends the destination information and the electricity quantity and energy consumption information of the electric vehicle to the electricity quantity navigation server through the navigation module; the electricity quantity navigation server acquires meteorological information of a region where the charging pile is located, respectively predicts storage time of the energy storage module of the charging pile, charging time of the electric vehicle, energy consumption of a route and average driving time through analysis, dynamically plans the travel charging solution, predicts the whole time consumption of the electric vehicle, and provides the solutions to the navigation module; and the navigation module guides the electric vehicle to travel according to the travel charging solution.

A navigation system for electric vehicles based on electricity quantity guidance of energy-storage charging piles adopts the navigation method for electric vehicles based on electricity quantity guidance of energy-storage charging piles, wherein each charging pile is provided with a control module, a positioning module, an energy storage module and a communication module; each electric vehicle is provided with a communication unit; and the control module respectively collects positioning information of the positioning module and stored electricity information of the energy storage module in real time, and sends the information to the communication unit of the electric vehicle through the communication module.

The navigation system further includes a navigation module, which is connected with the communication unit of the electric vehicle.

The navigation system further includes an electricity quantity navigation server, wherein the navigation module is connected with the electricity quantity navigation server through the communication unit; and the control module of the charging pile is connected with the electricity quantity navigation server through the communication module.

Date Reçue/Date Received 2020-07-15

Each charging pile is also provided with a meteorological monitoring unit, which is connected with the control module of the charging pile; a control switch is electrically connected between a power supply of the energy storage module and the energy storage module; and the control switch is controlled by the control module of the charging pile. Each charging pile is also provided with a self-state monitoring unit, which monitors temperature, electricity quantity and electric parameters of an input end and an output end of the energy storage module of the charging pile in real time and sends to the electricity quantity navigation server through the control module.

The charging piles may be power grid-powered charging piles with energy storage modules, new energy charging piles with energy storage modules and energy-storage charging piles attached to distributed new energy street lamps, wherein the new energy refers to wind power generation, solar power generation, tidal power generation, hydroelectric generation or combustible gas power generation; the power supply of each energy storage module is one or more of a power grid, a wind power generation device, a solar power generation device, a tidal power generation device, a hydroelectric generation device and a combustible gas power generation device; and the charging piles are provided with one or two of alternating current (AC) charging interfaces and direct current (DC) charging interfaces.

BENEFICIAL EFFECTS OF THE PRESENT INVENTION

BENEFICIAL EFFECTS

The present invention has the advantages as follows.

1. The method and system provided by the present invention have strong adaptability, can be widely used for charging the electric vehicles including the electromobiles, the unmanned aerial vehicles, the electric ships and the like, and integrates various energy-storage charging piles, particularly the distributed new energy charging piles unstable in electricity quantity, thereby greatly expanding the distribution range of charging facilities of the electric vehicles.

2. The method and system provided by the present invention can intelligently navigate and control the charging after reasonably planning the charging solution

Date Reçue/Date Received 2020-07-15

according to the remaining electricity quantity and energy consumption of the electric vehicles and in combination with the distribution and energy storage conditions of the energy-storage charging piles, thereby improving the charging efficiency, effectively extending the endurance mileage of the electric vehicles, also reasonably distributing and utilizing the stored electricity of the charging piles, and avoiding energy idleness and waste.

3. The method and the system provided by the present invention can intelligently select the power supply of the energy storage module of each charging pile according to the meteorological information, ensure the electricity quantity of the energy storage module and prolong the service life.

4. The method and system provided by the present invention can dynamically plan the travel charging solution for the electric vehicles, thereby avoiding the problems that the electric vehicles stop running without electricity and inefficiently wait for charging for a long time, and ensuring that the electric vehicles successfully complete the journey with low cost and high timeliness.

BRIEF DESCRIPTION OF THE DRAWINGS

DESCRIPTION OF THE DRAWINGS

Fig. 1 is a frame schematic diagram of a system according to an embodiment 1 of the present invention;

Fig. 2 is a frame schematic diagram of a system according to embodiments 2 and 3 of the present invention; and

Fig. 3 is a frame schematic diagram of a system according to an embodiment 4 of the present invention.

PREFERRED EMBODIMENTS OF THE PRESENT INVENTION

DETAILED DESCRIPTION OF THE PRESENT INVENTION

The technical solutions of the present invention will be described in detail below with reference to embodiments and the accompany drawings, but do not constitute a limitation on the protection scope of claims of the present invention.

Date Reçue/Date Received 2020-07-15

Embodiment 1:

As shown in Fig. 1, a navigation system for electric vehicles based on electricity quantity guidance of energy-storage charging piles is provided; and the electric vehicles include electromobiles, unmanned aerial vehicles or electric ships. A plurality of charging piles are provided, and include power grid-powered charging piles with energy storage modules, new energy charging piles with energy storage modules and energy-storage charging piles attached to distributed new energy street lamps. A power supply of each energy storage module is one or more of a power grid, a wind power generation device, a solar power generation device, a tidal power generation device, a hydroelectric generation device and a combustible gas power generation device. The energy storage modules are used for storing electric energy, e.g., storage batteries or supercapacitors are used. The charging piles are provided with one or two of AC charging interfaces and DC charging interfaces, and can also be selectively provided with charging interfaces special for the unmanned aerial vehicles.

Each charging pile is provided with a control module, a positioning module, an energy storage module and a communication module. Each electric vehicle is provided with a communication unit. The control module respectively collects positioning information of the positioning module and stored electricity information of the energy storage module in real time, and sends the information to the communication unit of the electric vehicle through the communication module in a wired or wireless connection manner.

Each electric vehicle judges idle states of the corresponding charging piles according to location information of the charging pile and real-time stored electricity information of the energy storage module of the charging pile received by the communication unit, own remaining electricity and real-time stored electricity information of the energy storage module, and selects the charging pile nearby that can meet own charging quantity demands to charge.

To realize intelligent navigation, a navigation module can also be arranged in each electric vehicle. The communication unit transmits the received location information of the charging pile and the real-time stored electricity information of the energy storage

Date Reçue/Date Received 2020-07-15

module of the charging pile to the navigation module. Meanwhile, the navigation module receives the remaining electricity quantity information and positioning information of the electric vehicle. The navigation module judges the charging pile nearby that is idle and can meet own charging quantity demands according to the received information, and guides the electric vehicle to the charging pile nearby for charging through an electronic map or geographical coordinates loaded on the navigation module.

Embodiment 2:

As shown in Fig. 2, a navigation system for electric vehicles based on electricity quantity guidance of energy-storage charging piles is provided; and the electric vehicles include electromobiles, unmanned aerial vehicles or electric ships. A plurality of charging piles are provided, and include power grid-powered charging piles with energy storage modules, new energy charging piles with energy storage modules and energy-storage charging piles attached to distributed new energy street lamps. A power supply of each energy storage module is one or more of a power grid, a wind power generation device, a solar power generation device, a tidal power generation device, a hydroelectric generation device and a combustible gas power generation device. The energy storage modules are used for storing electric energy, e.g., storage batteries or supercapacitors are used. The charging piles are provided with one or two of AC charging interfaces and DC charging interfaces, and can also be selectively provided with charging interfaces special for the unmanned aerial vehicles.

The navigation system provided by the present invention further includes an electricity quantity navigation server. Each charging pile is provided with a control module, a positioning module, an energy storage module and a communication module. The control module respectively collects positioning information of the positioning module and stored electricity information of the energy storage module in real time, and sends the information to the electricity quantity navigation server through the communication module in a wired or wireless connection manner.

Each electric vehicle is provided with a navigation module, a communication unit and a positioning device, wherein the navigation module is connected with the

Date Reçue/Date Received 2020-07-15

communication unit. The navigation module collects the remaining electricity quantity information of a storage battery and positioning information of the electric vehicle, and sends the information to the electricity quantity navigation server through the communication unit. The electricity quantity navigation server judges an idle state of the corresponding charging piles according to the received real-time stored electricity information of the energy storage module of the charging pile, matches the charging pile nearby that can meet the charging quantity demands for the electric vehicle, and sends location information of the matched charging pile and the real-time stored electricity information of the energy storage module of the matched charging pile to the navigation module. Then, the navigation module guides the electric vehicle to the matched charging pile for charging through an electronic map.

Embodiment 3:

As shown in Fig. 2, a navigation system for electric vehicles based on electricity quantity guidance of energy-storage charging piles is constructed as the Embodiment 2.

To improve the efficiency of electricity quantity navigation, the navigation module simultaneously sends destination information or work schedule planning of each electric vehicle, as well as elements of electricity quantity information and energy consumption information of a storage battery of the electric vehicle such as model and load of the electric vehicle to the electricity quantity navigation server. The electricity quantity navigation server calculates the energy consumption of the electric vehicle, deduces and predicts the endurance mileage of the electric vehicle, formulates a charging planning solution according to the real-time stored electricity information of the charging pile nearby, and sends the charging planning solution to the navigation module. The navigation module guides the electric vehicle to the energy-storage charging pile designated by the charging planning solution for charging through the electronic map or geographical coordinates, thereby ensuring that the electric vehicle can reach the next charging pile capable of providing charging quantity before the storage battery runs out.

Embodiment 4:

As shown in Fig. 3, a navigation system for electric vehicles based on electricity

Date Reçue/Date Received 2020-07-15

quantity guidance of energy-storage charging piles is provided; and the electric vehicles include electromobiles, unmanned aerial vehicles or electric ships. A plurality of charging piles are provided, and include power grid-powered charging piles with energy storage modules, new energy charging piles with energy storage modules and energy-storage charging piles attached to distributed new energy street lamps. A power supply of each energy storage module is one or more of a power grid, a wind power generation device, a solar power generation device, a tidal power generation device, a hydroelectric generation device and a combustible gas power generation device. The energy storage modules are used for storing electric energy, e.g., storage batteries or supercapacitors are used. The charging piles are provided with one or two of AC charging interfaces and DC charging interfaces, and can also be selectively provided with charging interfaces special for the unmanned aerial vehicles.

The navigation system provided by the present invention further includes an electricity quantity navigation server. Each charging pile is provided with a control module, a positioning module, an energy storage module and a communication module. The control module is respectively connected with the positioning module, the energy storage module and the communication module; and the communication module is connected with the electricity quantity navigation server in a wired or wireless connection manner. Each electric vehicle is provided with a navigation module, a communication unit and a positioning device, wherein the navigation module is connected with the communication unit.

In consideration of the influence of weather on the travel and charging of electric vehicles, each charging pile is also provided with a meteorological monitoring unit for monitoring local weather such as rain, snow, wind and sunshine. The meteorological monitoring unit is connected with the control module of each charging pile. A control switch is electrically connected between a power supply of the energy storage module and the energy storage module, wherein a control end of the control switch is connected with the control module of the charging pile. The meteorological monitoring unit sends the monitored meteorological information to the control module of the charging pile; and the control module sends the meteorological information to the electricity quantity

Date Reçue/Date Received 2020-07-15

navigation server. Meanwhile, the control module selects the corresponding power supply to charge the energy storage module by controlling the control switch in combination with the received real-time stored electricity information of the energy storage module, e.g., the solar power generation device is selected to charge the energy storage module by the control switch in the case of sunny day with strong sunshine and weak wind.

Each charging pile is also provided with a self-state monitoring unit, which monitors temperature, electricity quantity, electric parameters such as voltage and current of an input end and an output end, and other self-state detection information of the energy storage module of the charging pile in real time and sends to the control module. The control module sends the received self-state detection information of the energy storage module to the electricity quantity navigation server.

The navigation system provided by the present invention is utilized to provide a dynamic travel charging solution for each electric vehicle.

Each electric vehicle sends a travel destination, model and positioning information of the electric vehicle, electricity quantity state information of a storage battery of the electric vehicle, as well as load, energy consumption and other information of the electric vehicle to the electricity quantity navigation server. The electric quantity navigation server integrates various received information, combines traffic condition information, applies big data analysis on the basis of a large number of historical working data of electric vehicle, predicts the storage time and the storage progress of the charging pile under meteorological conditions for a period of time in the future, dynamically plans a reasonable travel charging solution for the electric vehicle, and predicts the whole time consumption of the electric vehicle. The navigation module guides the electric vehicle to travel through an electronic map according to the travel charging solution provided by the electricity quantity navigation server. The travel charging solution can meet the battery life requirements of the electric vehicle in the whole travel process. Meanwhile, the stored electricity of the charging piles is effectively and orderly utilized in time through reasonable planning and scheduling.

In the Embodiments 1-4, each charging pile is further provided with a payment-

Date Reçue/Date Received 2020-07-15

enabling control module, which is connected with the control module. A user can pay to purchase charging quantity on site through the payment-enabling control module to charge the electric vehicle quantitatively. In the Embodiment 4, the following payment modes can also be adopted: the electricity quantity navigation server provides the planned charging quantity of the electric vehicle to an operation platform; the operation platform charges the user according to the planned charging quantity and feeds charged information back to the electricity quantity navigation server; and the electricity quantity navigation server controls the payment-enabling control module to enable the quantitative charging service through the control module of the charging pile. The electricity sold to the designated electric vehicle will not be sold to other electric vehicles for charging.

To improve the monitoring, each charging pile is also provided with a user detection module such as a monitoring camera, an infrared monitoring device, WIFI, Bluetooth or radar, for determining a proximity state and a working state of each electric vehicle and each charging pile.

The navigation system provided by the present invention can also be used for tourism promotion, social activities, commercial activities and other applications by embedding the interface of the power navigation server into related application software, such as tourism electronic maps, social electronic maps, commercial electronic maps and service robot management software.

Date Reçue/Date Received 2020-07-15

Claims

1. A navigation method for electric vehicles based on electricity quantity guidance of energy-storage charging piles, wherein the charging piles are provided with energy storage modules; and the electric vehicles select charging piles that can meet own charging quantity demands to charge according to location information of the charging piles and real-time stored electricity information of the energy storage modules of the charging piles; the method comprising:

planning dynamically, by an electricity quantity navigation server, a travel charging solution for the electric vehicle, comprising:

sending, by the charging pile, self-state detection information to the electricity quantity navigation server; wherein the self-state detection information comprises the location information of the charging pile and the real-time stored quantity information of the energy storage module;

sending, by the electric vehicle, information of a destination and electricity quantity and energy consumption information of the electric vehicle to the electricity quantity navigation server through a navigation module; and

respectively predicting, based on the self-state detection information together with the information of the destination and electricity quantity and energy consumption information of the electric vehicle, by the electricity quantity navigation server, re-charging time of the energy storage module of the charging pile, charging time of the electric vehicle, energy consumption of a route to the destination and average driving time, dynamically planning, by the electricity quantity navigation server, a travel and charging solution for the route to the destination, and predicting, by the electricity quantity navigation server, total time consumption of the electric vehicle in a travel process to the destination,

providing, by the electricity quantity navigation server, the travel and charging solution to the navigation module; and

guiding, by the navigation module, the electric vehicle to travel according to the

Date reçue/date received 2022-10-11

travel and charging solution.

2. The navigation method for electric vehicles based on electricity quantity guidance of energy-storage charging piles according to claim 1, further comprising guiding, by the navigation module, each electric vehicle to one charging pile for charging, wherein specifically, the charging pile sends location information of the charging pile and real-time stored electricity information of the energy storage module to the navigation module; and the navigation module guides the electric vehicle to the charging pile that is able to meet the own charging quantity demands to charge according to the received location information of the charging pile and real-time stored electricity information of the energy storage module.

3. The navigation method for electric vehicles based on electricity quantity guidance of energy-storage charging piles according to claim 1, further comprising guiding, by the electricity quantity navigation server and the navigation module, the electric vehicle to the charging pile for charging, wherein specifically, the charging pile sends the location information of the charging pile and the real-time stored electricity information of the energy storage module to the electricity quantity navigation server; the electric vehicle sends real-time location information and charging quantity demands of the electric vehicle to the electricity quantity navigation server through the navigation module; the electricity quantity navigation server determines a matched charging pile that can meet the charging quantity demands of the electric vehicle and sends the location information of the matched charging pile and the real-time stored electricity information of the energy storage module to the navigation module; and the navigation module guides the electric vehicle to charge.

4. The navigation method for electric vehicles based on electricity quantity guidance of energy-storage charging piles according to claim 1, further comprising a step that the electricity quantity navigation server formulates a charging planning solution for the electric vehicle, wherein specifically, the charging pile sends self-state

Date reçue/date received 2022-10-11

detection information to the electricity quantity navigation server; the self-state detection information comprises the location information of the charging pile and the real-time stored electricity information of the energy storage module; the electric vehicle sends destination information and real-time remaining electricity quantity and energy consumption information of the electric vehicle to the electricity quantity navigation server through the navigation module; the electricity quantity navigation server formulates the charging planning solution according to the received information and sends the charging planning solution to the navigation module; and the navigation module guides the electric vehicle to the designated charging pile for charging according to the charging planning solution.

5. A navigation system for electric vehicles based on electricity quantity guidance of energy-storage charging piles, adopting the navigation method for electric vehicles based on electricity quantity guidance of energy-storage charging piles of claim 1, wherein each charging pile is provided with a control module, a positioning module, an energy storage module and a communication module; each electric vehicle is provided with a communication unit; and the control module respectively collects positioning information of the positioning module and collects stored electricity information of the energy storage module in real time, and sends the information to the communication unit of the electric vehicle through the communication module, wherein the navigation system further comprises the navigation module, which is connected with the communication unit of the electric vehicle, and the electricity quantity navigation server, wherein the navigation module is connected with the electricity quantity navigation server through the communication unit; and the control module is connected with the electricity quantity navigation server through the communication module.

6. The navigation system for electric vehicles based on electricity quantity guidance of energy-storage charging piles according to claim 5, wherein each charging pile is also provided with a meteorological monitoring unit, which is connected with

Date reçue/date received 2022-10-11

the control module of the charging pile; a control switch is electrically connected between a power supply of the energy storage module and the energy storage module; the control switch is controlled by the control module of the charging pile; each charging pile is also provided with a self-state monitoring unit, which monitors temperature, electricity quantity and electric parameters of an input end and an output end of the energy storage module in real time and sends to the electricity quantity navigation server through the control module.

7. The navigation system for electric vehicles based on electricity quantity guidance of energy-storage charging piles according to any one of claims 5-6, wherein the charging piles are power grid-powered charging piles with energy storage modules, new energy charging piles with energy storage modules and energy-storage charging piles attached to distributed new energy street lamps; the new energy refers to wind power generation, solar power generation, tidal power generation, hydroelectric generation or combustible gas power generation; the power supply of each energy storage module is one or more of a power grid, a wind power generation device, a solar power generation device, a tidal power generation device, a hydroelectric generation device and a combustible gas power generation device; and the charging piles are provided with one or two of alternating current (AC) charging interfaces and direct current (DC) charging interfaces.

Date reçue/date received 2022-10-11

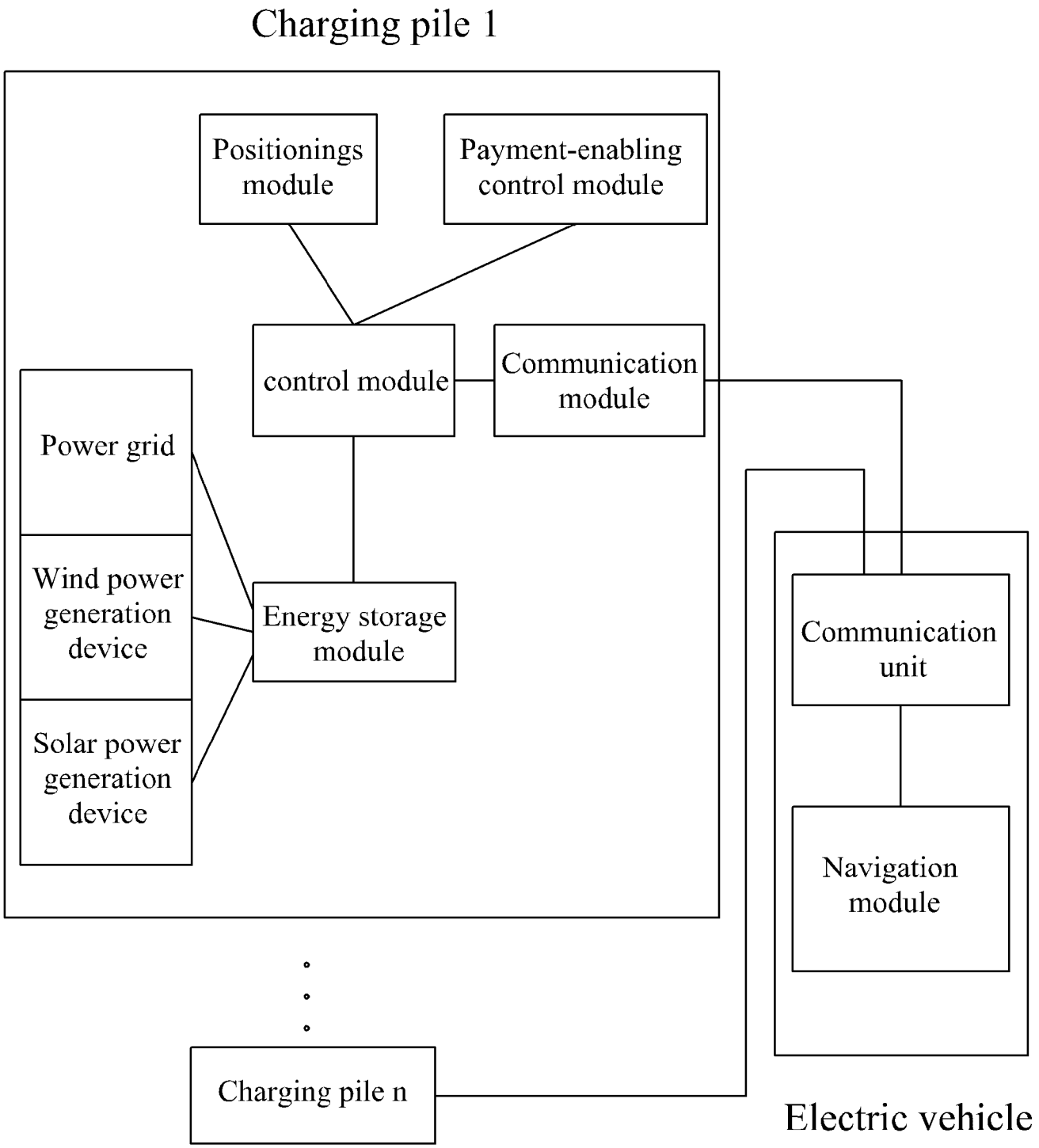


FIG. 1

Date Reçue/Date Received 2022-01-19

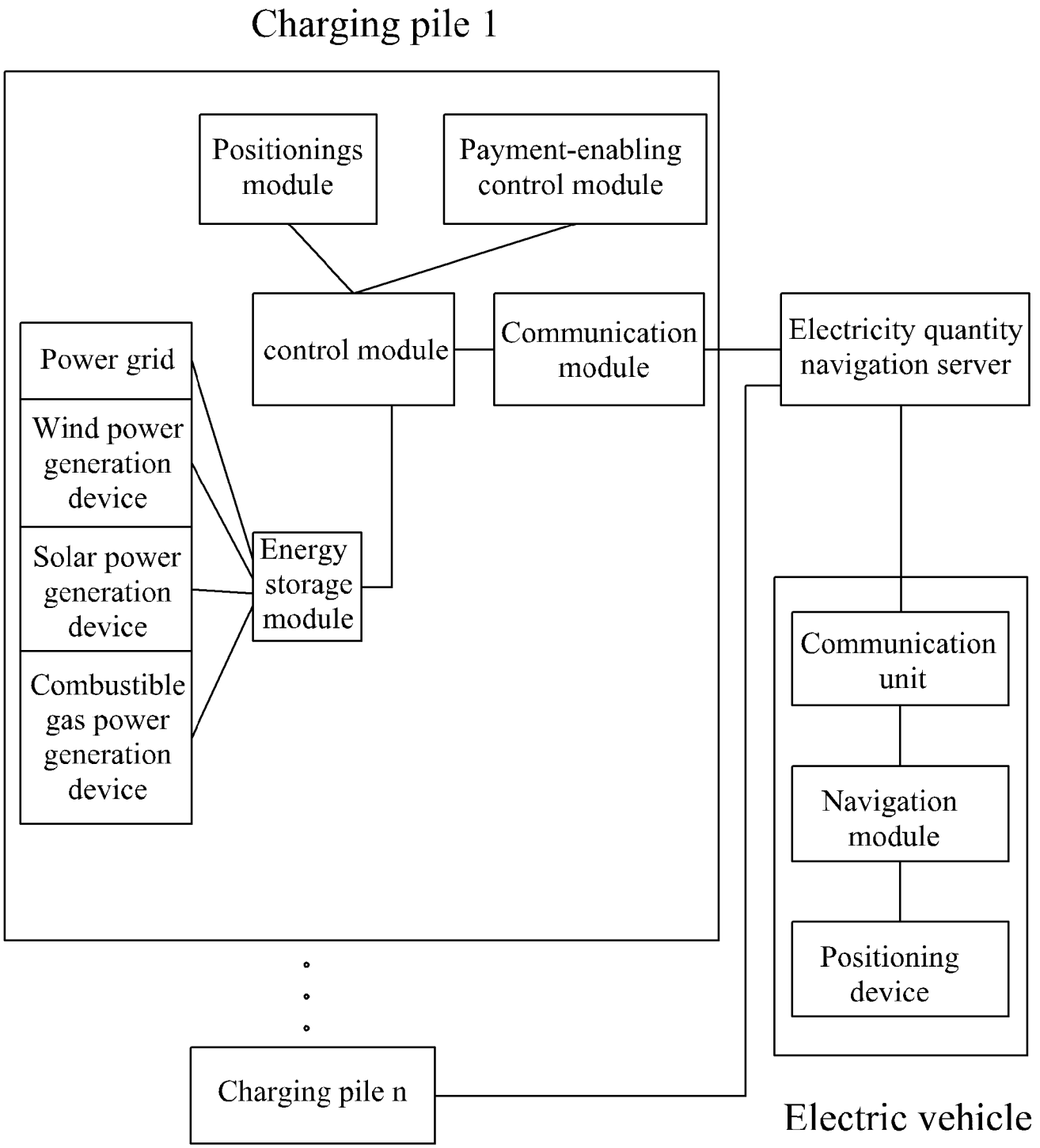


FIG. 2

Date Reçue/Date Received 2022-01-19

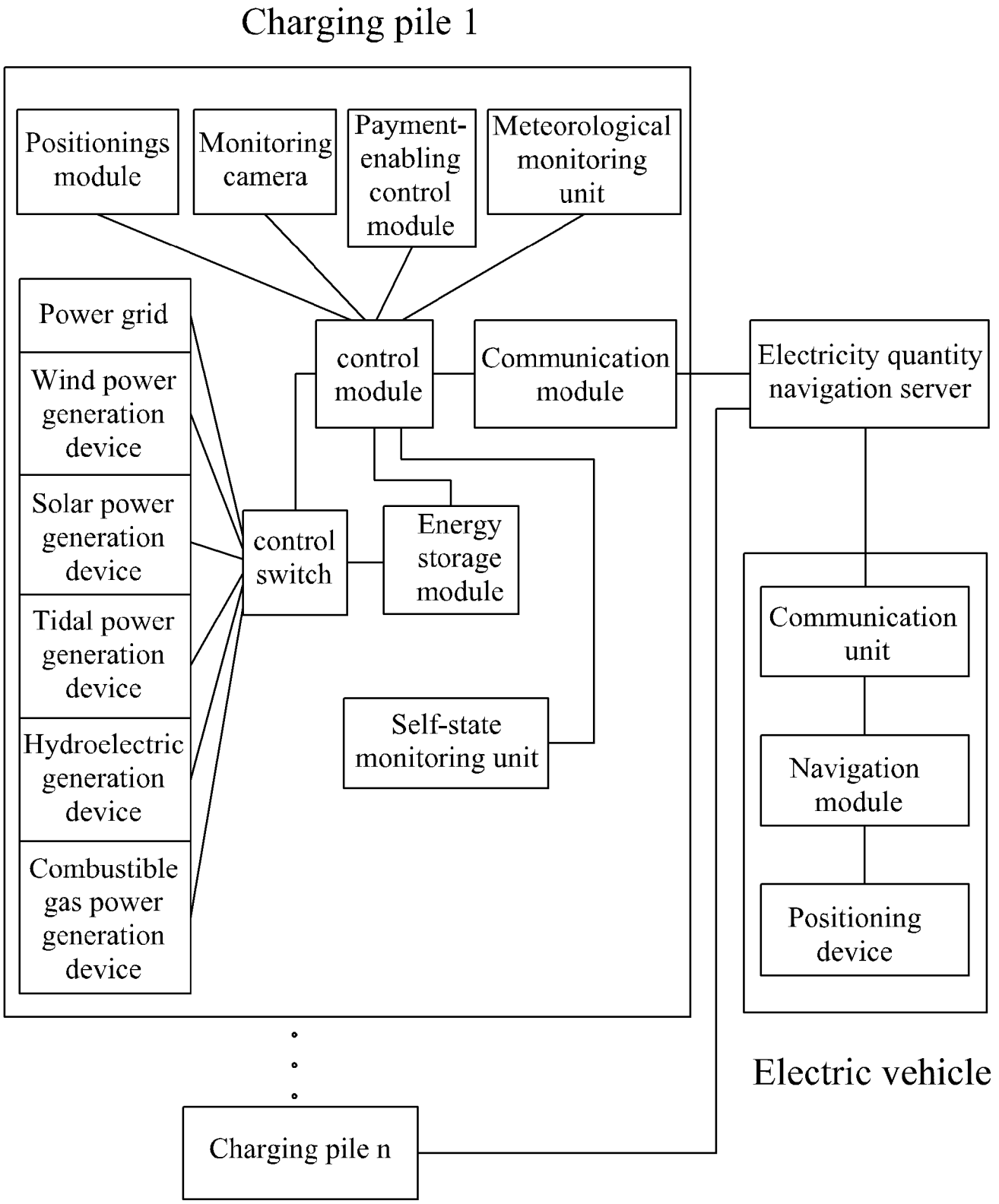
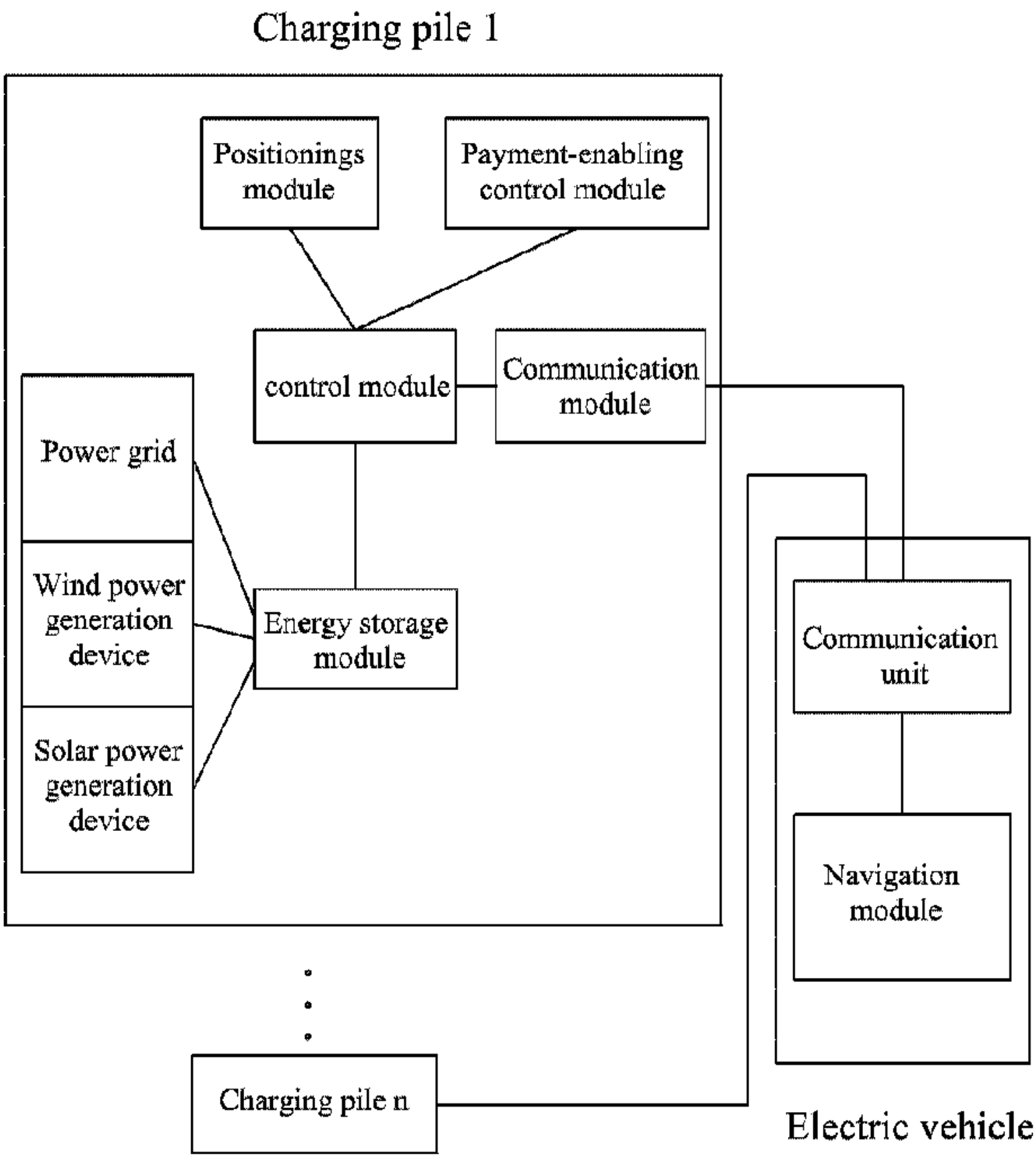


FIG. 3

Date Reçue/Date Received 2022-01-19


Charging pile 1
Positionings module
Payment-enabling control module
control module
Communication module
Power grid
Wind power generation device
Solar power generation device
Energy storage module
Communication unit
Navigation module
Charging pile n
Electric vehicle