

ENGINE ECU FLASHING METHOD AND DEVICE, AND ENGINE ECU FLASHING DIAGNOSIS METHOD AND DEVICE

[0001] The present application claims the priority to Chinese patent application No.
5 202111537420.X, titled "ENGINE ECU FLASHING METHOD AND DEVICE, AND
ENGINE ECU FLASHING DIAGNOSIS METHOD AND DEVICE", filed on December 15,
2021 with the China National Intellectual Property Administration, which is incorporated
herein by reference in its entirety.

10 FIELD

[0002] The present disclosure relates to the technical field of vehicle engines, for example,
to a method for flashing an ECU (Electronic Control Unit) of an engine, a method for
diagnosing flashing of an ECU of an engine, and devices thereof.

15 BACKGROUND

[0003] With the continuous development of vehicle electronic technology, an ECU has been
widely used in modern vehicles. With the continuous improvement of vehicle requirements,
an electronic control system including the ECU has become more and more complex.
Therefore, the requirements for vehicle related diagnosis and detection technology have also
20 been raised accordingly.

[0004] Generally, ECU data will not be modified after a vehicle enters the market. However,
in reality, it is very common in the market for illegal flashing of the ECU of the vehicle. After
illegal flashing, the service life of the engine may be shortened and failure rate may be
increased. Therefore, it is necessary to determine whether the ECU of the vehicle has been
25 illegally flashed during vehicle maintenance, so as to provide a basis for maintenance ideas
and responsibility identification.

SUMMARY

[0005] According to the present disclosure, a method for flashing an ECU of an engine, a

method for diagnosing flashing of an ECU of an engine, and devices thereof are provided, which can handle a situation in which it is impossible to determine whether an ECU of a vehicle is illegally flashed in the related technology.

[0006] In a first aspect, according to an embodiment of the present disclosure, there is provided a method for flashing an ECU of an engine, which is applied to an ECU flashing device, including the following steps:

receiving an ECU flashing request instruction;

forming in advance a flashing temporary record according to the ECU flashing request instruction and storing the flashing temporary record;

performing ECU flashing according to the flashing temporary record; and

recording and forming automatically a first ECU flashing record after the ECU flashing is completed, and sending outwardly the first ECU flashing record.

[0007] In some embodiments of the present disclosure, the information categories of the first ECU flashing record include an ECU serial number, a data record number, a record issuing time, a flashing completion time, the number of flashing times, an item number, a version number, and/or an ECU running time.

[0008] In some embodiments of the present disclosure, the information categories of the first ECU flashing record are customized by a user to be increased or decreased.

[0009] In a second aspect, according to an embodiment of the present disclosure, there is provided a method for diagnosing flashing of an ECU of an engine, which is applied to a flashing diagnosis device, including the following steps:

receiving a flashing diagnosis request instruction;

obtaining, according to the flashing diagnosis request instruction, a first ECU flashing record obtained by a method for flashing an ECU of an engine; and

determining the first ECU flashing record as an illegal flashing record when a corresponding second ECU flashing record in the flashing diagnosis device lacks a data record number and/or a record issuing time of the first ECU flashing record.

[0010] In some embodiments of the present disclosure, after obtaining the first ECU flashing record according to the flashing diagnosis request instruction, the method further includes:

determining the first ECU flashing record as an illegal flashing record when a data record number and/or a record issuing time in the corresponding second ECU flashing record in the flashing diagnosis device are inconsistent with the data in the first ECU flashing record.

[0011] In some embodiments of the present disclosure, after determining the first ECU flashing record as an illegal flashing record, the method further includes:

issuing a warning of illegal flashing and recovering normal data of the ECU.

[0012] In some embodiments of the present disclosure, the information categories of the second ECU flashing record include an ECU serial number, a data record number, a record issuing time, a flashing completion time, the number of flashing times, an item number, a version number, and/or an ECU running time.

[0013] In some embodiments of the present disclosure, the information categories of the second ECU flashing record are customized by a user to be increased or decreased.

[0014] In a third aspect, according to an embodiment of the present disclosure, there is further provided a flashing diagnosis device, including:

a memory for storing a computer program; and

a processor for implementing the method for diagnosing flashing of an ECU of an engine as described above when executing the computer program.

[0015] In a fourth aspect, according to an embodiment of the present disclosure, there is further provided an engine ECU flashing device, including:

a memory for storing a computer program; and

a processor for implementing the method for flashing an ECU of an engine as described above when executing the computer program.

[0016] According to the present disclosure, a method for flashing an ECU of an engine, a method for diagnosing flashing of an ECU of an engine, and devices thereof are provided.

The method for flashing an ECU of an engine, which is applied to an ECU flashing device, includes the following steps: receiving an ECU flashing request instruction; forming in advance a flashing temporary record according to the ECU flashing request instruction and storing the flashing temporary record; performing ECU flashing according to the flashing temporary record; and recording and forming automatically a first ECU flashing record after

the ECU flashing is completed and sending outwardly the first ECU flashing record. The method for diagnosing flashing of an ECU of an engine, which is applied to a flashing diagnosis device, includes the following steps: receiving a flashing diagnosis request instruction; obtaining, according to the flashing diagnosis request instruction, a first ECU flashing record obtained by a method for flashing an ECU of an engine; and determining the first ECU flashing record as an illegal flashing record when a corresponding second ECU flashing record in the flashing diagnosis device lacks a data record number and/or a record issuing time of the first ECU flashing record. The present disclosure can handle a situation in the relevant technology in which it is impossible to determine whether an ECU of a vehicle is illegally flashed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Figure 1 shows the flow chart of a method for flashing an ECU of an engine according to an embodiment of the present disclosure;

[0018] Figure 2 shows the flow chart of a method for diagnosing flashing of an ECU of an engine according to an embodiment of the present disclosure;

[0019] Figure 3 shows the flow diagram of a method for flashing an ECU of an engine and a method for diagnosing flashing of an ECU of an engine according to an embodiment of the present disclosure;

[0020] Figure 4 shows the structural diagram of an engine ECU flashing diagnosis device according to an embodiment of the present disclosure; and

[0021] Figure 5 shows the structural diagram of an engine ECU flashing device according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0022] As described above, it is very common in the market for illegal flashing of the ECU of the vehicle. After illegal flashing, the service life of the engine may be shortened and failure rate may be increased. Therefore, it is necessary to determine whether the ECU of the vehicle has been illegally flashed during vehicle maintenance, so as to provide a basis for

maintenance ideas and responsibility identification.

[0023] In order to solve the above technical problems, according to the embodiment of the present disclosure, a method for flashing an ECU of an engine, a method for diagnosing flashing of an ECU of an engine, and devices thereof are provided. The method for flashing an ECU of an engine, which is applied to an ECU flashing device, includes the following steps: receiving an ECU flashing request instruction; forming in advance a flashing temporary record according to the ECU flashing request instruction and storing the flashing temporary record; performing ECU flashing according to the flashing temporary record; and recording and forming automatically a first ECU flashing record after the ECU flashing is completed and sending outwardly the first ECU flashing record. The method for diagnosing flashing of an ECU of an engine, which is applied to a flashing diagnosis device, includes the following steps: receiving a flashing diagnosis request instruction; obtaining, according to the flashing diagnosis request instruction, a first ECU flashing record obtained by a method for flashing an ECU of an engine; and determining the first ECU flashing record as an illegal flashing record when a corresponding second ECU flashing record in the flashing diagnosis device lacks a data record number and/or a record issuing time of the first ECU flashing record. The present disclosure solves the problem in the prior art that it is impossible to determine whether an ECU of a vehicle is illegally flashed.

Exemplary method

[0024] Reference is made to Figure 1, which is the flow chart of a method for flashing an ECU of an engine according to an embodiment of the present disclosure. The method is applied to an ECU flashing device, and includes the following steps.

[0025] At step S101, receive an ECU flashing request instruction.

[0026] At step S102, form in advance a flashing temporary record according to the ECU flashing request instruction and store the flashing temporary record.

[0027] In the embodiment of the present disclosure, the temporary record is formed in advance to avoid that the record cannot be formed again due to flashing failure.

[0028] At step S103, perform ECU flashing according to the flashing temporary record.

[0029] At step S104, record and form automatically a first ECU flashing record after the

ECU flashing is completed, and send outwardly the first ECU flashing record.

[0030] In the embodiment of the present disclosure, after the flashing is completed, a message broadcasting mode of J1939 can be used for sending outwardly, including sending to a flashing diagnosis device.

5 **[0031]** In a possible implementation, the information categories of the first ECU flashing record include an ECU serial number, a data record number, a record issuing time, a flashing completion time, the number of flashing times, an item number, a version number, and/or an ECU running time.

[0032] In a possible implementation, the information categories of the first ECU flashing
10 record are customized by a user to be increased or decreased.

[0033] Reference is made to Figure 2, which is the flow chart of a method for diagnosing flashing of an ECU of an engine according to an embodiment of the present disclosure. The method is applied to a flashing diagnosis device, and includes the following steps.

[0034] At step S201, receive a flashing diagnosis request instruction.

15 **[0035]** At step S202, obtain, according to the flashing diagnosis request instruction, a first ECU flashing record obtained by a method for flashing an ECU of an engine.

[0036] At step S203, determine the first ECU flashing record as an illegal flashing record when a corresponding second ECU flashing record in the flashing diagnosis device lacks a data record number and/or a record issuing time of the first ECU flashing record.

20 **[0037]** In a possible implementation, the method further includes: determining the first ECU flashing record as an illegal flashing record when a data record number and/or a record issuing time in the corresponding second ECU flashing record in the flashing diagnosis device are inconsistent with the data in the first ECU flashing record.

[0038] Specifically, after determining the first ECU flashing record as an illegal flashing
25 record, the method further includes: estimating the data record number and/or the record issuing time of the first ECU flashing record. The time for being flashed can be roughly estimated by the current ECU running time, the previous ECU running time, and the previous flashing completion time.

[0039] In a possible implementation, after the first ECU flashing record is determined as an

illegal flashing record, a warning of illegal flashing will be issued, and normal data of the ECU will be recovered.

[0040] In a possible implementation, the information categories of the second ECU flashing record include an ECU serial number, a data record number, a record issuing time, a flashing completion time, the number of flashing times, an item number, a version number, and/or an ECU running time.

[0041] In a possible implementation, the information categories of the second ECU flashing record are customized by a user to be increased or decreased.

[0042] Reference is made to figure 3, which is the flow diagram of a method for flashing an ECU of an engine and a method for diagnosing flashing of an ECU of an engine according to an embodiment of the present disclosure.

[0043] The method for flashing an ECU of an engine and the method for diagnosing flashing of an ECU of an engine according to the present disclosure will be better explained as reference is made to Figure 3. Specifically, a flashing diagnosis device includes a server, a TBOX (TelematicBOX) remote terminal and a diagnosis instrument. An ECU flashing device includes two parts of BT (BootLoader) and ASW (Applications SoftWare).

[0044] Firstly, during ECU flashing, the diagnosis instrument can obtain flashing data from the server, and execute the flashing process to input the data from the server into the ECU. The diagnosis instrument mentioned herein is an authorized diagnosis instrument, which can be connected to an enterprise server, while other illegal flashing tools cannot be connected to the enterprise server.

[0045] Next, the BT is responsible for ECU flashing, and the ASW is responsible for ECU control.

[0046] The ASW is responsible for forming a temporary record of the number of flashing times, an item number, a version number and an ECU running time and storing the temporary record into an EE (Electrically Erasable Programmable read-only memory). The BT executes the flashing process and sets the temporary record as a formal record when it starts erasing the corresponding area.

[0047] After the flashing is finished, the flashing record is stored. The function of flashing

record in the ECU can record information of the last three flashings, including the number of flashing times, an item number, a version number, and an ECU running time.

[0048] After the ECU is restarted, the TBOX will be notified actively by a message broadcasting mode of J1939, and the flashing record will be stored in the server. The server
5 will record a flashing completion time, the number of flashing times, an item number, a version number, and an ECU running time.

[0049] Then, during ECU flashing diagnosis, the server is responsible for ECU data management and can provide information on the ECU flashing record, including an ECU serial number, a data record number, a record issuing time, a flashing completion time, the
10 number of flashing times, an item number, a version number, an ECU running time, etc. The information on the flashing record can be customized.

[0050] When a vehicle needs to be repaired, a diagnosis instrument will be connected for fault reading and troubleshooting. At this time, the diagnosis instrument will read the flashing record in the ECU through 0x22 service and transmit this information to the server. This
15 information will be discarded if the server has the latest flashing record. Otherwise, it will be recorded.

[0051] When the flashing record in the server does not include the data record number and the record issuing time, it is determined as illegal flashing information. And, the time for being flashed can be roughly estimated by the current ECU running time, the previous ECU
20 running time, and the previous flashing completion time.

[0052] When it is determined that the ECU is flashed illegally, the server will issue an alert to help service personnel to restore normal data to protect the vehicle.

[0053] Therefore, according to the present disclosure, the ECU can actively record the flashing information, and all of the flashing information can be captured. The information is
25 recorded validly when the flashing process is executed to an erase stage, which is more accurate for the flashing record. A temporary record can be formed in advance to avoid that the record cannot be formed again due to flashing failure. After completion of flashing, a message is sent outwardly to facilitate the TBOX to notify the server in time. Information on the ECU flashing record can be read from either the BT or the ASW.

[0054] According to the embodiment of the present disclosure, there is provided a method for flashing an ECU of an engine, which is applied to an ECU flashing device, including the following steps: receiving an ECU flashing request instruction; forming in advance a flashing temporary record according to the ECU flashing request instruction and storing the flashing temporary record; performing ECU flashing according to the flashing temporary record; and recording and forming automatically a first ECU flashing record after the ECU flashing is completed and sending outwardly the first ECU flashing record. According to the present disclosure, the flashing information can be recorded actively. The flashing record information can be customized to meet different needs. A temporary record is formed in advance to avoid that the record cannot be formed again due to flashing failure. A message of J1939 is sent outwardly after flashing to avoid failure of recording when flashing fails. It can meet the needs of different customers, avoid that the record cannot be formed again due to flashing failure, and make the flashing record more accurate.

[0055] According to the embodiment of the present disclosure, there is provided a method for diagnosing flashing of an ECU of an engine, which is applied to a flashing diagnosis device, including the following steps: receiving a flashing diagnosis request instruction; obtaining, according to the flashing diagnosis request instruction, a first ECU flashing record obtained by a method for flashing an ECU of an engine; and determining the first ECU flashing record as an illegal flashing record when a corresponding second ECU flashing record in the flashing diagnosis device lacks a data record number and/or a record issuing time of the first ECU flashing record. The present disclosure solves the problem that it is impossible to determine whether an ECU of a vehicle is illegally flashed in the prior art.

Exemplary device

[0056] Reference is made to Figure 4, which is the structural diagram of an engine ECU flashing diagnosis device according to the embodiment of the present disclosure. The engine ECU flashing diagnosis device 400 includes:

a memory 402 for storing a computer program; and

a processor 401 for implementing the method for diagnosing flashing of an ECU of an engine as described above when executing the computer program.

[0057] Those skilled in the art can understand that Figure 4 is only an example of the engine ECU flashing diagnosis device 400, which does not constitute a limitation of the engine ECU flashing diagnosis device 400. The engine ECU flashing diagnosis device 400 can include more or fewer components than shown in the figure, or a combination of some components, or different components. For example, the engine ECU flashing diagnosis device 400 can further include an input and output device, a network access device, a bus, etc.

[0058] The so-called processor 401 (Central Processing Unit, CPU) can also be another general-purpose processor, a DSP (Digital Signal Processor), an ASIC (Application Specific Integrated Circuit), a FPGA (Field-Programmable Gate Array), or another programmable logic device, a discrete gate or transistor logic device, a discrete hardware component, etc. The general-purpose processor can be a microprocessor or the processor 401 can also be any conventional processor, etc. The processor 401 is a control center of the engine ECU flash diagnosis device 400, and is connected to various parts of the engine ECU flashing diagnosis device 400 by various interfaces and lines.

[0059] The memory 402 can be used to store a computer readable instruction. The processor 401 implements various functions of the engine ECU flashing diagnosis device 400 by running or executing the computer readable instruction or module stored in the memory 402 and invoking the data stored in the memory 402. The memory 402 may mainly include a storage program area and a storage data area. The storage program area may store an operating system, an application program required for at least one function (such as a sound playback function, an image playback function, etc.), etc. The storage data area may store data created by using the engine ECU flash diagnosis device 400 and the like. In addition, the memory 402 may include a hard disk, an internal memory, a plug-in hard disk, a SMC (Smart Media Card), a SD (Secure Digital) card, a FC (Flash Card), at least one disk storage device, a flash memory device, a ROM (Read-Only Memory), a RAM (Random Access Memory), or another non-volatile/volatile storage device.

[0060] If an integrated module of the engine ECU flashing diagnosis device 400 is implemented in the form of a software function module and sold or used as an independent product, it can be stored in a computer-readable storage medium. Based on this understanding,

the present disclosure can also implement all or part of the processes in the methods of the above embodiments by instructing related hardware through computer-readable instructions. The computer-readable instructions can be stored in a computer-readable storage medium. When being executed by a processor, the computer readable instructions can implement the steps of the methods of the above embodiments.

[0061] Reference is made to Figure 5, which is a schematic structural diagram of an engine ECU flashing device according to an embodiment of the present disclosure. The engine ECU flashing device 500 includes:

a memory 502 for storing a computer program; and

a processor 501 for implementing the method for flashing an ECU of an engine as described above when executing the computer program.

[0062] Those skilled in the art can understand that Figure 5 is only an example of the engine ECU flashing device 500 and does not constitute a limitation on the engine ECU flashing device 500. The engine ECU flashing device 500 may include more or fewer components than that shown in the figure, or a combination of some components, or different components. For example, the engine ECU flashing device 500 may further include an input and output device, a network access device, a bus, etc.

[0063] The so-called processor 501 (Central Processing Unit, CPU) can also be another general-purpose processor, a DSP (Digital Signal Processor), an ASIC (Application Specific Integrated Circuit), a FPGA (Field-Programmable Gate Array), or another programmable logic device, a discrete gate or transistor logic device, a discrete hardware component, etc. The general-purpose processor can be a microprocessor or the processor 501 can also be any conventional processor, etc. The processor 501 is a control center of the engine ECU flashing device 500, and is connected to various parts of the engine ECU flashing device 500 by various interfaces and lines.

[0064] The memory 502 can be used to store a computer-readable instruction. The processor 501 implements various functions of the engine ECU flashing device 500 by running or executing the computer-readable instruction or module stored in the memory 502 and invoking the data stored in the memory 502. The memory 502 may mainly include a storage

program area and a storage data area. The storage program area may store an operating system, an application program required for at least one function (such as a sound playback function, an image playback function, etc.), etc. The storage data area may store data created by using the engine ECU flashing device 500 and the like. In addition, the memory 502 may
5 include a hard disk, an internal memory, a plug-in hard disk, a SMC (Smart Media Card), a SD (Secure Digital) card, a FC (Flash Card), at least one disk storage device, a flash memory device, a ROM (Read-Only Memory), a RAM (Random Access Memory), or another non-volatile/volatile storage device.

[0065] If an integrated module of the engine ECU flashing device 500 is implemented in the
10 form of a software function module and sold or used as an independent product, it can be stored in a computer-readable storage medium. Based on this understanding, the present disclosure can also implement all or part of the processes in the methods of the above embodiments by instructing relevant hardware through computer-readable instructions. The computer-readable instructions can be stored in a computer-readable storage medium. When
15 being executed by a processor, the computer readable instructions can implement the steps of the methods of the above embodiments.

[0066] On the basis of the above embodiments, according to the embodiment of the present disclosure, there is further provided a computer-readable storage medium. A computer program is stored on the computer-readable storage medium. The steps of the method for
20 flashing an ECU of an engine and the method for diagnosing flashing of an ECU of an engine as described above are implemented while the computer program is processed and executed.

[0067] According to the embodiment of the present disclosure, by means of the engine ECU flashing device, the flashing diagnosis device and the computer storage medium, the flashing information can be recorded actively. The flashing record information can be customized to
25 meet different needs. A temporary record is formed in advance to avoid that the record cannot be formed again due to flashing failure. A message of J1939 is sent outwardly after flashing to avoid failure of recording when flashing fails. Therefore, the following technical effects are obtained: it can meet the needs of different customers, avoid that the record cannot be formed again due to flashing failure, and make the flashing record more accurate.

[0068] The computer-readable storage medium can include a U disk, a mobile hard disk, a ROM (Read-Only Memory), a RAM (Random Access Memory), a magnetic disk, an optical disk, or another medium which can store a program code.

CLAIMS

1. A method for flashing an ECU of an engine, which is applied to an ECU flashing device, comprising:

5 receiving an ECU flashing request instruction;

forming in advance a flashing temporary record according to the ECU flashing request instruction and storing the flashing temporary record;

performing ECU flashing according to the flashing temporary record; and

10 recording and forming automatically a first ECU flashing record after the ECU flashing is completed, and sending outwardly the first ECU flashing record.

2. The method according to claim 1, wherein the information categories of the first ECU flashing record comprise at least one of an ECU serial number, a data record number, a record issuing time, a flashing completion time, the number of flashing times, an item number, a version number, and/or an ECU running time.

15 3. The method according to claim 1, wherein the information categories of the first ECU flashing record are customized by a user to be increased or decreased.

4. A method for diagnosing flashing of an ECU of an engine, which is applied to a flashing diagnosis device, comprising:

receiving a flashing diagnosis request instruction;

20 obtaining, according to the flashing diagnosis request instruction, a first ECU flashing record obtained by the method for flashing an ECU of an engine according to any one of claims 1-3; and

determining the first ECU flashing record as an illegal flashing record when a corresponding second ECU flashing record in the flashing diagnosis device lacks a data record number and/or a record issuing time of the first ECU flashing record.

25 5. The method according to claim 4, after obtaining the first ECU flashing record according to the flashing diagnosis request instruction, the method further comprises:

determining the first ECU flashing record as an illegal flashing record when a data record number and/or a record issuing time in the corresponding second ECU flashing record

in the flashing diagnosis device are inconsistent with the data in the first ECU flashing record.

6. The method according to claim 4, wherein after determining the first ECU flashing record as an illegal flashing record, the method further comprises:

issuing a warning of illegal flashing and recovering normal data of the ECU.

5 7. The method according to claim 4, wherein the information categories of the second ECU flashing record comprise at least one of an ECU serial number, a data record number, a record issuing time, a flashing completion time, the number of flashing times, an item number, a version number, and/or an ECU running time.

10 8. The method according to claim 4, wherein the information categories of the second ECU flashing record are customized by a user to be increased or decreased.

9. An engine ECU flashing diagnosis device, comprising:

a memory for storing a computer program; and

a processor for implementing the method for diagnosing flashing of an ECU of an engine according to any one of claims 4-8 when executing the computer program.

15 10. An engine ECU flashing device, comprising:

a memory for storing a computer program; and

a processor for implementing the method for flashing an ECU of an engine according to any one of claims 1-3 when executing the computer program.