

VEHICLE INTEGRATED CONTROL CIRCUIT

TECHNICAL FIELD

[0001] The present subject matter relates to a vehicle. More particularly, the present subject matter relates to an integrated control circuit for the vehicle.

BACKGROUND

5 [0002] Currently, the use of electronics and software in automotive applications has increased many folds. With the growing demand for advanced driver assistance functionalities and features in automobiles, the use of software and embedded applications in automotive or any automated applications has also augmented significantly. Software and embedded solutions are progressively
10 being used in a variety of applications in automotive parts like the power trains, electronic control units (ECU), engine controls, control functions for braking, guidance systems, audio and video equipments, etc.

[0003] Conventionally, electronic control units (ECUs) provide control of a variety apparatus and functions on vehicle. A plurality of electronic control units
15 (ECUs) provided on the vehicle are electronically connected to the different vehicle components and systems. Typically, each ECU includes a microcontroller to store software and parameters for controlling the specific ECU related apparatus or functions. The ECUs are interconnected into a vehicle network via communication protocol designed to allow ECUs and devices to communicate with
20 each other. One such vehicle communication protocol in common usage is a controller area network (CAN).

[0004] In a known vehicle electronics system, said plurality of ECUs are installed on the vehicle for controlling and monitoring at least one function of the vehicle. Generally, each ECUs of the plurality of the ECUs includes one
25 microcontroller comprising of an executable program installed therein. Generally, the ECUs controlling different functions of the vehicle by execution of the

program are located at different locations in vehicle and hence communicate with each other through the communication network like CAN, LAN, Ethernet, etc.

[0005] However, with said plurality of the ECUs installed on the vehicle at different location, the overall number of components of the vehicle is increased.

5 Moreover, each ECU of the plurality of the ECUs includes the microcontroller. Generally, each microcontroller corresponding to the ECUs of the plurality of the ECUs includes different executable program for controlling and monitoring different functions on the vehicle. Typically, the executable programs installed in the microcontroller of each Electronic Control Unit (ECU) in vehicle are usually
10 broken into a number of modules. Each module typically contains the source codes for one or more procedures used in the program.

[0006] Generally, in a software solution deal between two stakeholders, one stakeholder (e.g. a software solutions customer) acquires developed software from a second stakeholder (e.g. a software solutions vendor). However, many a times,
15 the vendor provides secured source codes by sharing only the binary/executable version of the software product. Hence, disallowing the decryption and access to the source code of a software product by the other stakeholder.

[0007] However, the conventional vehicle control system with the provision of the plurality of the ECUs installed on the vehicle and each ECUs including the
20 microcontroller with a different pre-determined source code module installed therein and being provided by different stakeholders, results in overall increase in the number of components on the vehicle and hence results in high cost.

[0008] Hence, it is desirable to provide an improved vehicle control system which comprises one or more ECUs and one or more source code modules
25 corresponding to each ECUs of the one or more ECUs to be installed on a single hardware circuit. Thus, reducing the number of communication protocols to be installed on the vehicle and additionally reducing the number of the micro controllers to be installed in the Electronic Control Unit of the vehicle. Thus, subsequently resulting the reduction in requirement for installing more number of
30 the components including the communication protocol, microcontroller, etc. on

the vehicle. Furthermore, facilitating cost effective installation of the one or more source code modules corresponding to each ECUs on the vehicle. Further, said single hardware circuit with different source codes provided by the different stakeholders installed therein are kept secured, protected and confidential and hence can only be decrypted by the stakeholder providing that specific source code.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The detailed description is described with reference to the accompanying figures. The same numbers are used throughout the drawings to reference like features and components.

[00010] **Fig.1** is a schematic block diagram of a conventional vehicle control system including a plurality of ECUs and each ECU of the plurality of ECUs includes a microcontroller

[00011] **Fig.2** is a schematic block diagram of the vehicle control system illustrating a master microcontroller architecture with integrated at least two source code modules embedded therein, as per one embodiment of the present invention.

[00012] **Fig.3** is a schematic diagram of the vehicle control system illustrating at least one integrated control circuit including the plurality of the ECUs and the master microcontroller architecture integrally installed therein as per one embodiment of the present invention.

DETAILED DESCRIPTION

[00013] Generally, in-vehicle communication network includes a plurality of electronic control units (ECUs) in a vehicle configured to control various electrical and electronics components installed on the vehicle. The ECUs communicates with each other over a controller area network (CAN). Each ECU of the plurality of electronic control units (ECUs) in a vehicle includes a microcontroller. Generally, each microcontroller includes a different predetermined source code module executing a control algorithm and hence

controls at least one vehicle electrical system coupled to a corresponding ECU of said plurality of electronic control units (ECUs).

5 **[00014]** Typically, the plurality of electronic control units (ECUs) are used at the vehicle to carry out a number of vehicle functions. ECUs include microcontrollers that are programmed to carry out specific tasks at the vehicle, such as monitoring vehicle performance or controlling vehicle operation.

10 **[00015]** Typically, the number of the ECUs mounted on a vehicle has been gradually increasing as the number of functions for convenience and safety of the vehicle increases. Thus, increasing the number of communication protocols for executing the communication between ECUs of the plurality of the ECUs. Hence, increasing the number of components on the vehicle. Further, the microcontroller including a different source codes are installed in the ECUs and hence this results in overall cost increase for installing the microcontroller with different executable program for each ECU on the vehicle. Furthermore, the software solutions
15 customer acquires developed software in the form of a secured source codes from the software solutions vendor. And hence, can only be decrypted by the software solutions vendor. Hence, the security and the protection of the software corresponding to the source code and provided in the microcontroller of each ECUs becomes significant.

20 **[00016]** Hence, it is desirable to provide at least one integrated control circuit for the vehicle control system which provides integration of ECUs and the source codes corresponding to the microcontroller installed in each ECU of the plurality of ECUs and hence provides a cost effective installation of the plurality of the ECUs on the vehicle and additionally results in less number of the components
25 required on the vehicle.

30 **[00017]** With the above objective in view, the present invention provides an improved vehicle control system with said at least one integrated control circuit installed therein. It is an object of the present invention, to provide said at least one integrated control circuit for the vehicle which includes ECUs and one or more source modules corresponding to said each ECU of said plurality of ECUs

installed therein. Hence, reducing the number of components on the vehicle, reducing the requirement for installing more number of the microcontroller on the vehicle and subsequently providing a cost-effective installation of the vehicle control system on the vehicle.

5 **[00018]** According to one embodiment of the present invention, the improved vehicle control system comprises the plurality of electronic control units (ECUs) performing at least one activity and monitoring at least one function of the vehicle. In one embodiment, said each of the ECU of said plurality of electronic control units (ECUs) includes the microcontroller. In one embodiment
10 of the present invention, each of the microcontroller includes the different predetermined source code module. As per one embodiment, said different predetermined source code modules executes the control algorithm which controls at least one vehicle electrical system coupled to the corresponding ECU of said plurality of electronic control units (ECUs). Referring to one embodiment of the
15 present invention, said vehicle control system further comprises said at least one integrated control circuit controlling at least one function of the vehicle. In one embodiment, said at least one integrated control circuit includes at least two ECUs of said plurality of electronic control units (ECUs) and master microcontroller architecture integrally installed therein. Further, as per one embodiment of the
20 present invention, said master microcontroller architecture comprises a library including at least one library module. As per one embodiment of the present invention, each library module comprises said at least one source code module integrated therein. As per one embodiment of the present invention, said integrated at least two source code modules generating said at least one library
25 modules are embedded in the master microcontroller architecture. In one embodiment, each source code module of said at least two source code modules is coupled to said at least one ECU of the plurality of ECU.

[00019] It is an object of the present invention to provide the master microcontroller comprising of said at least one library module including at least
30 one source module executing at least one executable program, embedded therein.

Hence, reducing the cost of installing at least executable program contained in said at least one source code module on the vehicle by the reduction in requirement for installing more number of said micro controllers on the vehicle.

[00020] The present invention provides the library generation through the library mode executed by a computer system. The library comprises of at least one executable program corresponding to said at least one source code module in an encrypted data form and hence protects and maintains the confidentiality of the said at least one source code modules in the form of the executable program provided by other stakeholders. Hence, protecting said at least one source code module from unauthorised decryption and hence access. In one embodiment, generation of the library includes at least one library module and each library module of said at least one library module includes said at least one source code module corresponds to a specific executable program for performing different functions of the vehicle. Hence, the library comprising integrated said at least one source code modules maintains the confidentiality of said at least one source code modules when embedded on said master microcontroller architecture being integrally installed on the vehicle. Thus, when compared with the conventional vehicle control system with source code provided in the plain text and contained in the microcontroller, the present invention with the provision of generation of the library provides more security and the protection to the source codes provided by different stakeholders.

[00021] As per one embodiment, the present invention provides for the security and protection of said at least two source code module embedded in the master micro controller. Hence, disallowing the access of the executable program embedded in the source code module to be decoded by other stake holder.

[00022] The present invention provides the improved vehicle control system including said at least one integrated control circuit including said at least two ECU controlling and monitoring said at least one function of the vehicle and said at least one source code module comprising said at least one executable program installed therein. Hence, reducing the requirement of installing more number of

microcontrollers on the vehicle and hence facilitating cost effective installation of the vehicle control system on the vehicle.

[00023] As per one embodiment, the present invention provides the improved vehicle control system including said at least one integrated control circuit
5 installed in the vehicle. In one embodiment, said at least one integrated control circuit is a single hardware control circuit adapted for integrally installing said master microcontroller architecture including the library comprising said integrated at least two source code modules embedded therein and said at least one ECU of the plurality of the ECUs. Hence, reducing the need of installing
10 more number of microcontrollers and the communication protocols on the vehicle.

[00024] The present invention provides the integration of said at least two source modules from two different stakeholders namely the software solutions customer and software solutions vendor into the master microcontroller architecture being integrally installed in said at least one integrated control unit.

15 **[00025]** The present invention provides for integrating at least two software including said at least two source codes modules received from two different stakeholders into said at least one integrated control circuit. Hence, the security and the software confidentiality gets maintained with the desired functionality achievement in an effective manner.

20 **[00026]** Referring to one embodiment, the present invention provides for integrating said at least two software including the executable program each and provided from different stakeholders into the master microcontroller architecture being integrally installed in said at least one integrated control circuit. Hence, as per one embodiment, the present invention facilitates said at least one source code
25 module corresponding to said at least one executable programs from any possible unauthorised access and reverse engineering by the different stakeholder who is not the owner of the software including the executable program.

[00027] The present invention provides for the integration of said at least two source code modules corresponding to different executable programs embedded in

said master microcontroller architecture being integrally installed in the integrated control circuit. Hence, the improved vehicle control system with said master microcontroller architecture provides for a robust protection and security of the source codes contained in said at least two source code modules. Thus, preventing
5 unauthorised decryption and hence access to the source codes.

[00028] As per one embodiment, the present invention is directed to provide said at least one integrated control circuit including said master microcontroller architecture and said at least two ECUs corresponding to the different executable programs in the form of source codes embedded in the master microcontroller
10 architecture. In one embodiment, the master microcontroller architecture integrally installed into said at least one integrated control circuit of the vehicle control system is capable of performing at least one function of said at least one electrical and electronic systems installed on the vehicle. Thus, as per one embodiment, said master microcontroller architecture can multitask several
15 different and independent programs of one or more electrical and electronics system and sub-systems installed on the vehicle.

[00029] As per the present invention, one embodiment provides the library generation for integration of said at least two source code modules on the vehicle. In one embodiment, said master microcontroller comprises the library including
20 said at least one library module including the plurality of the source codes integrated to form said at least one source module. In one embodiment, the library generation with the integration of the library modules maintains and secures the confidentiality of the source codes provided on the vehicle by different stake holders. Hence, facilitating cost effective installation of said at least one ECUs
25 and corresponding said at least one source code module on the vehicle.

[00030] As per one embodiment, the present invention proposes a new and improved vehicle control system comprising the single hardware circuit in the form of said at least one integrated control circuit. In one embodiment, said at least one integrated control circuit provides for integrally installing said at least
30 executable programs contained in said at least one source code module and

additionally secures the embedded said at least two source code modules in the master microcontroller architecture.

[00031] As per one embodiment of the present invention, said each ECU of the plurality of the ECUs comprises 'n' number of the functionality. In one
5 embodiment of the present invention, each functionality of said 'n' number of the functionality comprises said different source code module corresponding to a microcontroller of same microcontroller family.

[00032] In one embodiment of the present invention, said at least one integrated control circuit with said at least two ECUs and said at least two source
10 code modules integrally installed therein facilitates a cost effective installation of the vehicle control system on the vehicle by reduction in the need and requirement of installing more number of micro controllers and the communication protocols on the vehicle.

[00033] The present invention provides said at least one integrated control
15 circuit installed in the vehicle. In one embodiment, said at least one integrated control circuit in the form of the single hardware circuit includes said master microcontroller and said at least two ECUs integrally therein. In one embodiment said master microcontroller includes embedded at least two source code modules and each source code modules of said at least two source code modules
20 corresponds to said each ECU of said at least two ECUs. As per one embodiment, said at least two source code modules embedded in the master microcontroller are provided by different stakeholders in encrypted forms and when embedded in said master microcontroller architecture remains confidential and secured and hence protects the executable programs corresponding to said at least two source code
25 modules from unauthorised access.

[00034] The object of the present invention is to provide the improved vehicle control system including said at least one integrated control circuit comprising said master microcontroller architecture integrally installed therein. In one
30 embodiment, additionally, the master microcontroller architecture comprises said at least two source code modules embedded therein. In one embodiment, said at

least two source code modules corresponding to the executable program are provided by different stakeholder and hence remains in encrypted form. Thus, ensuring thereby a secure, confidential integration of said at least two source code modules in the master microcontroller architecture.

5 **[00035]** The present invention as per one embodiment of the present invention provides with the master microcontroller architecture being integrally installed in the integrated control circuit. As per one embodiment, said master microcontroller architecture comprises of said at least two source code modules including the plurality of source codes embedded therein. In one embodiment, the source codes
10 contained in the master microcontroller architecture performs the monitoring and controlling functions of said at least one electrical and electronic component installed on the vehicle. Thus, reducing the need for installing more number of microcontrollers on the vehicle and hence, facilitating a cost effective and economical installation of the vehicle control system on the vehicle. Additionally,
15 said at least one integrated control circuit with said master microcontroller architecture and said at least two ECUs installed therein maintains the security and confidentiality of encryption and decryption algorithms of said at least two source code modules embedded in said master microcontroller architecture. Thus, as per one embodiment of the present invention said at least two source code
20 modules obtained from two different stake holders are secured and protected when embedded in said master microcontroller architecture without compromising on software code security.

[00036] It is advantageous to install said at least one integrated control circuit on the vehicle, thereby providing the improved vehicle control system. As per one
25 embodiment of the present invention, said at least one integrated circuit includes said master microcontroller architecture and said at least two ECUs installed therein. Hence, with the installation of the master microcontroller architecture on said at least one integrated control circuit, said at least two source code modules obtained from different stakeholders are secured and hence said at least two
30 executable program performing different monitoring and controlling functions on

the vehicle are confidential and hence prevented from unauthorised access. Finally, it is advantageous to provide said at least one integrated control circuit on the vehicle including the master microcontroller architecture and said at least two ECUs. In one embodiment said one at least one integrated control circuit
5 comprises said at least two ECUs and said at least two source modules performing said at least one functions on the vehicle. Hence, resulting the reduction in requirement for providing more number of the communication protocols and the microcontrollers on the vehicle and thus facilitating the installation of the vehicle control system on the vehicle with less number of parts and components.

10 **[00037]** Various other features and advantages of the invention are described in detail below with reference to the accompanying drawings. In the drawings, like reference numbers generally indicate identical, functionally similar, and/or structurally similar elements. The drawing in which an element first appears is indicated by the leftmost digit(s) in the corresponding reference number. With
15 reference to the accompanying drawings, wherein the same reference numerals will be used to identify the same or similar elements throughout the several views. It should be noted that the drawings should be viewed in the direction of orientation of the reference numerals.

[00038] Exemplary embodiments detailing features of the vehicle integrated
20 control circuit, in accordance with the present invention will be described hereunder. Application of the present invention will be extended to two-wheeled vehicles, three-wheeled vehicles and four -wheeled vehicles.

[00039] **Fig.1** is a schematic block diagram of a conventional vehicle control system **(1)** including the plurality of ECUs **(n)** and each ECU **1, 2 (100), (200)** of
25 the plurality of ECUs **(n)** includes the microcontroller **1, 2 (300), (301)**. The conventional control system **(1)** for the vehicle comprises the plurality of electronic control units (ECUs) **(n)** performing at least one activity and monitoring at least one function of the vehicle. Typically, an electronic control unit (ECU) **1, (100)** from the plurality of the ECUs **(n)** includes a microcontroller
30 **1, (300)** and at least one control component **(100a)**. Further, an electronic control

unit (ECU) **2 (200)** from the plurality of the ECUs (**n**) includes a microcontroller **2 (301)** and at least one control component (**200a**). As per one embodiment of the present invention, said each microcontroller **1, 2 (300), (301)** is programmed differently. In the conventional vehicle control system (**1**), the microcontroller **1 (300)** and microcontroller **2 (301)** belongs to different microcontroller family and hence each said microcontroller **1, 2 (300), (301)** comprises different predetermined source code modules (**101a**), (**201a**)....,**(n)** executing different software programs/control algorithm and hence controlling and monitoring different functions for said at least one electrical and electronic component on the vehicle. In the conventional vehicle control system (**1**), said plurality of the ECUs (**n**) installed on the vehicle at different locations communicates with each other through said at least one communication protocol (**3**). The vehicle communication protocol (**3**) includes CAN (Controller Area Network), Local Interconnect Network (LIN), FlexRay, Vehicle Area Network (VAN) and others. Hence, the conventional vehicle control system (**1**) comprises said plurality of the ECUs (**n**) installed therein and each ECU (**100**), (**200**) of the plurality of the ECUs (**n**) including the microcontroller **1, 2 (300), (301)** and at least one control components (**100a**), (**200a**) for executing different functions and monitoring different activities of the vehicle. Further, since the plurality of the ECUs (**n**) installed on the vehicle communicates through the number of the communication protocol (**3**) thus resulting an increase in the number of components and simultaneously, increase in the cost for installation of the vehicle control system (**1**) on vehicle.

[00040] Further in **Fig.1**, for the conventional vehicle control system (**1**), the microcontroller **1, 2 (300), (301)** coupled to each ECU **1,2 (100), (200)** of the plurality of the ECUs (**n**) comprises 'n' number of said different predetermined source code modules (**101a**), (**201a**)....,**(n)** (shown in Fig.2) including the executable programs for monitoring and performing different functions of the vehicle. Conventionally, the microcontroller **1, 2 (300), (301)....,(n)** including said different predetermined source codes modules (**101a**), (**201a**)....,**(n)** contained therein are provided by different stakeholders namely the first

stakeholder as the software solutions customer and the second stakeholder as the software solutions vendor. Typically, the source code modules (101a), (201a) ..., (n) (shown in Fig.2) contained in each microcontroller 1, 2 (300), (301) comprises data in the form of a plain ordinary text and hence performs various function of the vehicle through executing the 'n' number of different predetermined source code modules (101a), (201a) by a computerized process. Generally, the source code is often transformed by an assembler or compiler into binary machine code understood by the computer.

[00041] Fig.2 is a schematic block diagram of the vehicle control system (10) illustrating the master microcontroller architecture (400) with embedded said at least two source code module (700) therein, as per one embodiment of the present invention. In one embodiment, the vehicle control system (10) comprises the plurality of electronic control units (ECUs) (n) including the ECU 1 (100) and the ECU 2 (200) for performing at least one activity and monitoring at least one function of the vehicle. In one embodiment, said each ECU 1, 2 (100), (200) of the plurality of the ECUs (n) comprises 'n' number of the functionality 1, 2 (101), (102), ..., (n). As per one embodiment of the present invention, each functionality 1, 2 (101), (102) of said 'n' number of the functionality 1, 2 (101), (102), ..., (n) comprises said different source code module (101a), (201a) ..., (n) corresponding to a microcontroller (not shown) of same microcontroller family (not shown). As per one embodiment of the present invention, said different source code module (101a), (201a) ..., (n) are provided by different stakeholders. In one embodiment, said each of the ECU 1, 2 (100), (200) of said plurality of electronic control units (ECUs) (n) includes the 'n' number of the microcontroller (not shown) of same microcontroller family (not shown). As per one embodiment of the present invention, said each of the microcontroller of the 'n' number of the microcontroller corresponding to said same controller family includes 'n' number of said different predetermined source code modules (101a), (201a) ..., (n). In one embodiment, said different predetermined source code module (101a), (201a) ..., (n) executes the control algorithm which controls at least one vehicle electrical system coupled to the corresponding ECU 1, 2 (100), (200) of said

plurality of electronic control units (ECUs) **(n)**. Further in **Fig.2**, referring to one embodiment, said **n**' number of said different predetermined source code modules **(101a), (201a)...**, **(n)** corresponding to different functions and tasks on the vehicle are integrated to generate the library **(600)**. Referring to one embodiment, said 'n'

5 number of said different predetermined source code modules **(101a), (201a)...**, **(n)** are precompiled under the specified library generation mode in the embedded development environment of the 'n' number of the microcontroller corresponding to said same controller family being used for development, thus generating 'n' number of different library modules including library module **1 (601)**, library

10 module **2 (601)**, library module **(n)** which is inaccessible when shared with other stake holders. As per one embodiment of the present invention, at least one function declaration contained in said library **(600)** in the form of source codes are accessible which can be utilized to call the specific functionality of said vehicle. However, said control algorithm contained in the executable program is

15 inaccessible. According to one embodiment of the present invention, said at least one source code module **(101a), (201a)...**,**(n)** contained in said library module **1 (601)**, library module **2 (601)**, library module **(n)** of said library **(600)** are integrally contained in the master microcontroller architecture **(400)** in the form of the embedded source code module **(700)**.

20 **[00042]** **Fig.3** is a schematic diagram of the vehicle control system **(10)** illustrating said at least one integrated control circuit **(500)** including the plurality of the ECUs **(n)** and the master microcontroller architecture **(400)** integrally installed therein as per one embodiment of the present invention. In one embodiment, the vehicle control system **(10)** comprises the plurality of electronic

25 control units (ECUs) **(n)** performing at least one activity and monitoring at least one function of the vehicle. As per one embodiment of the present invention, said each ECU **1, 2 (100), (200)** of the plurality of the ECUs **(n)** comprises said 'n' number of the functionality **1, 2 (101), (102),....**,**(n)** including said different source code modules **(101a), (201a)...**,**(n)** corresponding to the microcontroller

30 (not shown) of same microcontroller family (not shown). In one embodiment, said different predetermined source code modules **(101a), (201a)...**,**(n)** embedded in

said master microcontroller (400) executes the control algorithm which controls at least one vehicle electrical system coupled to the corresponding ECU 1, 2 (100), (200) of said plurality of electronic control units (ECUs) (n) As per one embodiment of the present invention, said ECU 1 (100) and said ECU 2 (200) includes said at least one control component 1 (100a) and said at least one control component 2 (200a), respectively.

[00043] Further in Fig.3, as per one embodiment, the vehicle control system (10) further comprises said at least one integrated control circuit (500) controlling at least one function of the vehicle. As per one embodiment, said at least one integrated control circuit (500) includes said at least two ECUs 1, 2 (100), (200) of said plurality of electronic control units (ECUs) (n) and the master microcontroller architecture (400) integrally installed therein. Referring to one embodiment, said master microcontroller architecture (400) comprises the library (600) including said library module 1 (601), library module 2 (602), library module (n). In one embodiment, said each library module of said at least one library module (601), (602)...,(n) comprises at least two source code module (101a), (201a) embedded therein. Further, as per one embodiment, said at least one ECU 1, 2 (100), (200) of the plurality of ECU 1, 2 (100), (200) (n) is an engine control unit, a motor control unit, a hybrid control unit, an electronic brake control unit. In one embodiment, said at least one at least one integrated control circuit (500) executes at least one control program of the system. Further, in one embodiment of the present invention, said at least one control program selectively operates one or more vehicle security functions. Further, as per one embodiment of the present invention, said at least one source code module (101a), (201a) includes one or more functions corresponding to said at least one vehicle systems.

[00044] Advantageously, as per one embodiment of the present invention, said at least one integrated control circuit installed on the vehicle provides a simple, compact and cost effective installation of the vehicle control systems on the vehicle.

[00045] Further, as per present invention said at least two ECUs and said master microcontroller architecture including embedded said at least two source code modules corresponding to each ECU of said at least two ECUs are integrally installed on at least one integrated control circuit, as per one embodiment. Hence,
5 facilitating reduction in requirement for installing less number of components including the microcontroller and the communication protocol on the vehicle. Additionally, as per one embodiment, said at least two source code modules embedded in the master microcontroller remains confidential and secured and hence protects the executable programs corresponding to said at least two source
10 code modules from unauthorised access.

[00046] Improvements and modifications may be incorporated herein without deviating from the scope of the invention.

We claim:

1. A vehicle control system **(10)**, said system **(10)** comprising:

a plurality of electronic control circuits (ECUs) **(n)** performing at least one activity and monitoring at least one function of a vehicle, each ECU **1, 2 (100), (200)** of said plurality of electronic control circuits (ECUs) **(n)** includes a
5 microcontroller **1, 2 (300), (301)**, each microcontroller **1, 2 (300), (301)** includes a different predetermined source code module **(101a), (101b)**, and

said different predetermined source code module **(101a), (101b)** executing a control algorithm which controls at least one vehicle electrical system coupled
10 to a corresponding ECU **1, 2 (100), (200)** of said plurality of electronic control circuits (ECUs) **(n)**;

wherein said vehicle control system **(10)** further comprises at least one integrated control circuit **(500)** controlling at least one function of the vehicle;
and wherein said at least one integrated control circuit **(500)** includes at least
15 two ECUs **1, 2 (100), (200)** of said plurality of electronic control circuits (ECUs) **(n)** and a master microcontroller architecture **(400)** integrally installed therein.

2. The vehicle control system **(10)** as claimed in claim 1, wherein said master microcontroller architecture **(400)** comprises a library **(600)** including at least
20 two source code modules **(101a), (101b)** embedded therein.

3. The vehicle control system **(10)** as claimed in claim 1, wherein said at least one ECU **1, 2 (100), (200)** of plurality of ECU **(n)** is an engine control unit.

4. The vehicle control system **(10)** as claimed in claim 1, wherein said at least one ECU **1, 2 (100), (200)** of plurality of ECU **(n)** is a motor control unit.

25 5. The vehicle control system **(10)** as claimed in claim 1, wherein said at least one ECU **1, 2 (100), (200)** of plurality of ECU **(n)** is a hybrid control unit

6. The vehicle control system **(10)** as claimed in claim 1, wherein said each ECU **1, 2 (100), (200)** of the plurality of the ECUs **(n)** comprises ‘**n**’ number of the functionality **1, 2 (101), (102),..., (n)**.
7. The vehicle control system **(10)** as claimed in claim 6, wherein said each
5 functionality **1, 2 (101), (102)** of said ‘**n**’ number of the functionality **1, 2 (101), (102),..., (n)** comprises said different source code modules **(101a), (201a)...., (n)** corresponding to a microcontroller of same microcontroller family.
8. The vehicle control system as claimed in claim 1, wherein said at least one
10 integrated control circuit **(500)** executes at least one control program of said at least one vehicle electrical system on the vehicle.
9. The vehicle control system **(10)** as claimed in claim 1, wherein said at least one control program selectively operates one or more vehicle security functions.
10. The vehicle control system **(10)** as claimed in claim 1, wherein said at least
15 one source code module **(101a), (101b)** includes one or more functions corresponding to said at least vehicle systems.