

implemented by the different manufacturers are connected to a service-oriented network. The reason is that, by way of example, an SOA is not a compulsory standard but rather is merely a recommendation. The result of this can be that, although encapsulations implemented by different manufacturers are all SOA compliant, they are not at all compatible with one another or are compatible only to a restricted degree.

Against the background of the prior art described, the present invention is therefore based on the object of providing a way of allowing sensors which are originally without SOA capability to be integrated into an SOA network structure in as simple and inexpensive a manner as possible.

An embodiment of~~In order to achieve this object,~~ the present invention proposes the use of a connecting module for connecting at least one appliance to a service-oriented architecture (SOA) network termed SOA, wherein a functionality of the at least one appliance is mapped as a service in the SOA network. The connecting module has at least one first interface for connecting the at least one appliance and at least one second interface for connecting the SOA network. Furthermore, the connecting module has a computation appliance for executing a computer program for implementing an encapsulation of an appliance to be connected, wherein the computer program is stored in a memory of the connecting module and comprises two portions and at least one prescribed portion of the computer program is programmed and stored in the memory from a manufacturer of the connecting module before the latter is delivered to a manufacturer of the appliance to be connected characterized in that the prescribed portion of the computer program represents a framework and is prescribed by the manufacturer of the connecting module on the basis of information regarding the appliance and the functionality to be mapped in the service-oriented network, wherein design and manner of operation of the appliance-specific software interfaces are known exclusively to the manufacturer of the appliance, wherein one portion of the computer program that is to be executed is prescribed and another portion of the computer program is freely programmable by a manufacturer of the at least one appliance with program code

for realizing the functionality to be mapped of the appliance to be mapped or with references to the program code and insertable in the framework in order to implement customization of a piece of firmware which is present on the at least one appliance to the SOA network in the sense of allowing addressing of the at least one appliance as a service form the service-oriented network, wherein programming of the second portion of the computer program is effected by the appliance manufacturer without requiring knowledge concerning the SOA environment and a Simple Object Access Protocol on the appliance manufacturer's side.

The prescribed portion of the computer program is stored in a suitable memory, for example in a ROM, an EEPROM or a flash memory, preferably by the manufacturer of the connecting module before the latter is even delivered to a customer, that is to say

Patent Claims

1. A connecting module-(3) for connecting at least one appliance-(2) to a service-oriented network-(4) of a service-oriented architecture, termed SOA, wherein the connecting module-(3) is adapted to map a functionality of the at least one appliance-(2) as a service in the service-oriented network-(4), wherein the connecting module-(3) has at least one first interface-(3.2) for connecting the at least one appliance-(2) and at least one second interface-(3.4) for connecting the network-(4), and the connecting module-(3) has a computation appliance-(7) for executing a computer program for implementing an encapsulation of an appliance-(2) to be connected, wherein the computer program is stored in a memory of the connecting module-(3) and comprises two portions-(8.1, 8.2) and at least one prescribed portion-(8.1) of the computer program is programmed and stored in the memory from a manufacturer of the connecting module-(3) before the latter is delivered to a manufacturer of the appliance-(2) to be connected characterized in that the prescribed portion-(8.1) of the computer program represents a framework-(62) and is prescribed by the manufacturer of the connecting module (3) on the basis of information regarding the appliance-(2) and the functionality to be mapped in the service-oriented network-(4), wherein design and manner of operation of the appliance-specific software interfaces-(3.2) are known exclusively to the manufacturer of the appliance-(2) and the other portion-(8.2) of the computer program is freely programmable by a manufacturer of the at least one appliance-(2) with program code-(61') for realizing the functionality to be mapped of the appliance-(2) to be mapped or with references to the program code-(61') and insertable in the framework-(62) in order to implement customization of a piece of firmware which is present on the at least one appliance (2) to the service-oriented network-(4) in the sense of allowing addressing of the at least one appliance (2) as a service from the service-oriented network-(4), wherein programming of the second portion (8.2) of the computer program is effected by the appliance manufacturer without requiring knowledge concerning the SOA environment and a Simple Object Access Protocol on the appliance manufacturer's side.
2. The connecting module-(3) as claimed in claim 1, characterized in that the appliance-(2) to be connected to the SOA network-(4) comprises a sensor, effector or actuator.
3. The connecting module-(3) as claimed in claim 1 or 2, characterized in that the first interface (3.2) comprises an RS232 interface, a USB interface, a LAN connection, an Ethernet connection or an optical connection.
4. The connecting module-(3) as claimed in claim 1 or 2, characterized in that the second interface-(3.4) comprises a bus connection, particularly a CAN, TTCAN, LIN, MOST, ByteFlight, D2B Optical or FlexRay bus connection.

5. The connecting module-(3) as claimed in one of claims 1 to 3, characterized in that the second interface-(3.4) is in the form of a radio interface.
6. The connecting module-(3) as claimed in claim 5, characterized in that the radio interface (3.4) is designed for data transmission between the connecting module-(3) and the SOA network-(4) with a short delay time, particularly in realtime.
7. The connecting module-(3) as claimed in one of claims 1 to 5, characterized in that the computation appliance-(7) is designed to execute the computer program as a microprocessor.
8. The connecting module-(3) as claimed in one of claims 1 to 5, characterized in that the computation appliance-(7) is designed to execute the computer program as a digital signal processor, termed DSP.
9. The connecting module-(3) as claimed in one of claims 1 to 7, characterized in that the computation appliance-(7) controls the first and/or the second interface-(3.2; 3.4).
10. The connecting module-(3) as claimed in one of claims 1 to 7, characterized in that the computation appliance-(7) does not actuate the first and/or the second interface-(3.2; 3.4) and in that the connecting module-(3) has a further computation appliance, particularly a digital signal processor, termed DSP, which controls the first and/or the second interface-(3.2; 3.4).
11. The connecting module-(3) as claimed in one of claims 1 to 10, characterized in that the customizations of the appliances-(2) to the service-oriented network-(4) are implemented by service descriptions which are stored in a service registry-(21) of the connecting module-(3), and wherein the service registry-(21) delivers a suitable WSDL (Web-Service Definition Language) file for different service-oriented networks-(4).

12. The connecting module-(3) as claimed in one of claims 1 to 11, characterized in that a heartbeat function is integrated in the connecting module-(3) for ensuring that the appliance-(2) and the encapsulation are still active and available.
13. The connecting module-(3) as claimed in one of claims 1 to 12, characterized in that the connecting module-(3) comprises a watchdog-timer-(15).
14. The connecting module-(3) as claimed in claims 12 and 13, characterized in that the watchdog-timer-(15) receives messages from the heartbeat function, if the encapsulation works properly.
15. The connecting module-(3) as claimed in claim 13, characterized in that programming of the second portion of the computer program by the appliance manufacturer does not require the latter to have any knowledge about a statefulness of the appliance-(2) and a statelessness of services in the SOA environment of the service-oriented network-(4) and the allowance for the services.
16. The connecting module-(3) as claimed in one of the claims 1 to 15, characterized in that the connecting module-(3) stores and effects coordinated execution of SOA calls from the service-oriented network-(4).

17. The connecting module-(3) as claimed in one of claims 1 to 16, characterized in that SOA encapsulation of a functionality of the appliance-(2) is implemented such that the SOA encapsulation can process priorities for SOA calls from the SOA network-(4) such that the functionalities of the appliance-(2) which correspond to the SOA calls can be executed in an order which corresponds to the priorities.

18. The connecting module-(3) as claimed in one of claims 1 to 17, characterized in that the connecting module-(3) has a sandbox-(11) which is separate from the other components of the connecting module-(3) and which stores the customizations of the appliances-(2) to the service-oriented network-(4) and which protects the appliance manufacturer's intellectual property.

19. The connecting module-(3) as claimed in one of claims 1 to 18, characterized in that the connecting module-(3) has means in order to convert errors, which occur in the encapsulation of the appliance-(2),

into error messages, as a result of which the service-oriented network-(4) can process said error messages.

20. The connecting module-(3) as claimed in one of claims 4 to 19, characterized in that the connecting module-(3) comprises a first module unit-(10), which maps the connected appliance-(2) as a service in the service-oriented network-(4), and a second module unit-(22), which conditions the service mapped by the first module unit-(10) for transmission via a radio network-(35) with low bandwidth while retaining the SOA functionality.

21. The connecting module-(3) as claimed in claim 20, characterized in that the second module unit-(22), which allows the consumption of SOA services via the radio network-(35), comprises a radio adapter-(31) for connecting conventional radios-(34).