Design of Data Management Software System Supporting Rendezvous and Docking with Various Spaceships

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Abstract : The function of the two spacecraft docking network, the communication and control of a docking target with various spacecrafts is realized in the space lab data management system. In order to solve the problem of the complex data communication mode between the space lab and various spaceships, and the problem of software reuse caused by non-standard protocol, a data management software system supporting rendezvous and docking with various spaceships has been designed. The software system is based on CCSDS Spcecraft Onboard Interface Service(SOIS). It consists of Software Driver Layer, Middleware Layer and Appliaction Layer. The Software Driver Layer hides the various device interfaces using the uniform device driver framework. The Middleware Layer is divided into three lays, including transfer layer, application support layer and system business layer. The communication of space lab plaform bus and the docking bus is realized in transfer layer. Application support layer provides the inter tasks communitaion and the function of unified time management for the software system. The data management software functions are realized in system business layer, which contains telemetry management service, telecontrol management service, flight status management service, rendezvous and docking management service and so on. The Appliaction Layer accomplishes the space lab data management system defined tasks using the standard interface supplied by the Middleware Layer. On the basis of layered architecture, rendezvous and docking tasks and the rendezvous and docking management service are independent in the software system. The rendezvous and docking tasks will be activated and executed according to the different spaceships. In this way, the communication management functions in the independent flight mode, the combination mode of the manned spaceship and the combination mode of the cargo spaceship are achieved separately. The software architecture designed standard appliction interface for the services in each layer. Different requirements of the space lab can be supported by the use of standard services per layer, and the scalability and flexibility of the data management software can be effectively improved. It can also dynamically expand the number and adapt to the protocol of visiting spaceships. The software system has been applied in the data management subsystem of the space lab, and has been verified in the flight of the space lab. The research results of this paper can provide the basis for the design of the data manage system in the future space station.

Keywords : space lab, rendezvous and docking, data management, software system

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