APPLICATION OF SPACEWIRE TO FUTURE SATELLITE DATA PROCESSING SYSTEM

Session: SpaceWire Missions and Applications

Short Paper

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ABSTRACT

In managing project of development of satellites, development period, cost and risk have been a pain in the neck. One of the reasons of this is that many different communication protocols have needed to be developed for each satellite or communication line to connect many electrical components because those protocols were chosen as the most adequate protocol for each communication line. We aim to adopt SpaceWire protocol for all communication lines in satellite to shorten development period and reduce cost and risk of the development.

1 INTRODUCTION

Up to now, we have often developed satellite in which electrical equipments are connected as shown in fig.1. In this system, all equipment or system is designed for the best performance to a satellite as a whole. That is, different types of analogue sensors output raw measured data, and after processing those data, they are transmitted to satellite bus system through a dedicated communication line or by many different protocols. Therefore, Analogue sensor components, data processing components, communication protocol between them and sometimes communication

protocol between data processing components and satellite bus system needed to be developed individually. That has caused long development period, high-cost, and high-risk development.

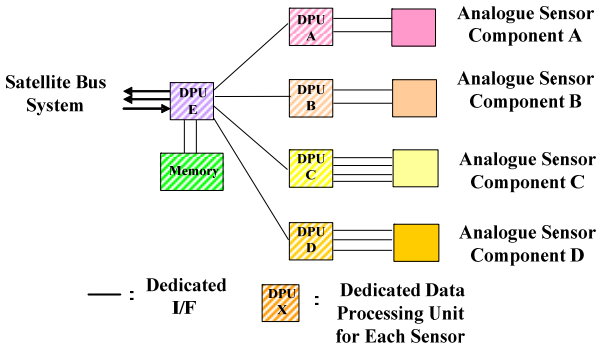

Fig. 1 Ordinary Satellite System

2 OUR SATELLITE DEVELOPMENT

2.1 DEVELOPMENT POLICY

To resolve the above mentioned issue, we develop our product based on the following policy; (1) To use SpaceWire protocol as the only one protocol that is used as inter-component protocol. (2) To link data processing units together. (3) To develop standard hardware. (4) To use standard software platform (TRON-OS).

2.2 OVERALL SYSTEM

We are about to organize a network between electrical components in satellite as shown in fig.2. The feature of this system is as follows; all of the communication protocol between all components (between analogue sensor component and data processing unit, between data processing unit and other data processing unit and between data processing unit and satellite bus system) is SpaceWire protocol. Thus, we are trying to shorten development time and reduce the cost of development, although the development of the very first satellite that is designed by this concept may take some time and money. One failure tolerance is achieved by having one extra data processing unit and linking them as a ring, because even if one component or one cable is disabled, data can be transferred via another cable or component.

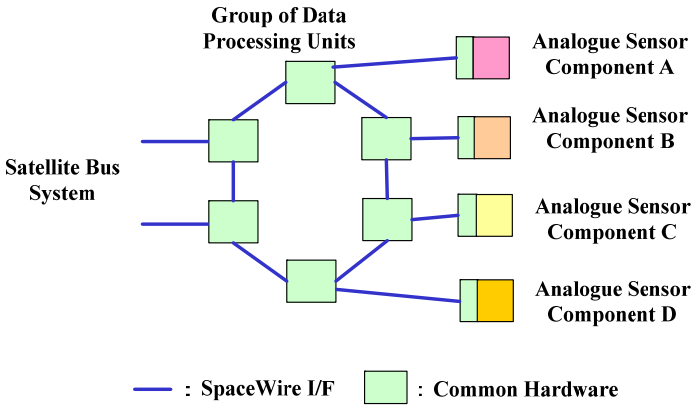

Fig. 2 New Satellite System

2.3 COMPOSITION OF EACH COMPONENT

Next, we would like to focus on the each component itself. Fig.3 shows an example of composition of an analogue sensor component. SpaceWire Interface Section is standardized and communication protocol between SpW Interface Section and User Section is provided as a well-defined protocol for efficient development, so SpaceWire Interface Section and User Section can be developed at the same time if necessary.

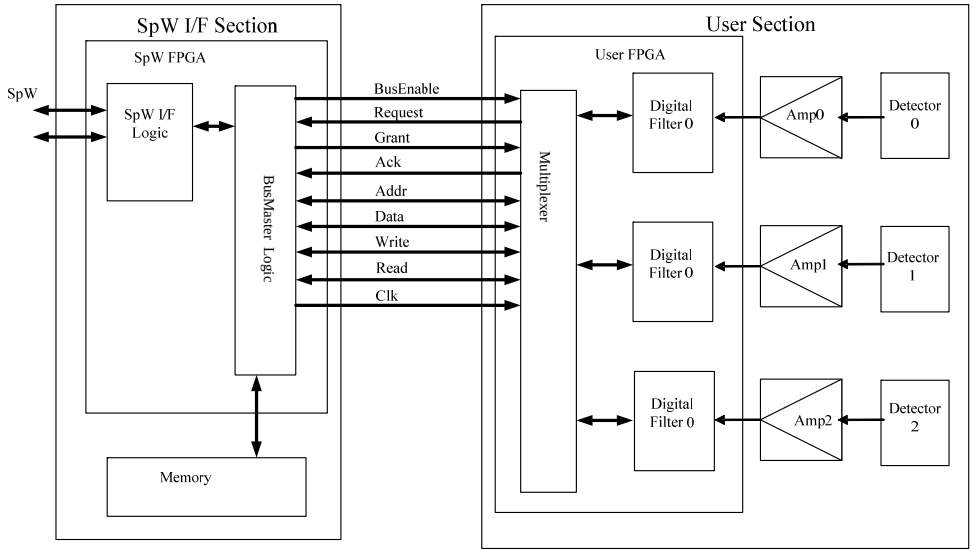

Fig. 3 Analogue Sensor Component

Construction of a data processing unit is illustrated in fig.4. It has SOI-SOC (Silicon on Insulator – System on Chip), SRAM, SDRAM, and EEPROM and can deal with processing of data such as image processing. SOI-SOC consists of RISC, memory interface and even SpaceWire interface in one chip, and features SEU-tolerance and is SEL-free. And it works on TRON-OS, which many engineers are familiar to use, for the reduction of the period of the development of software.

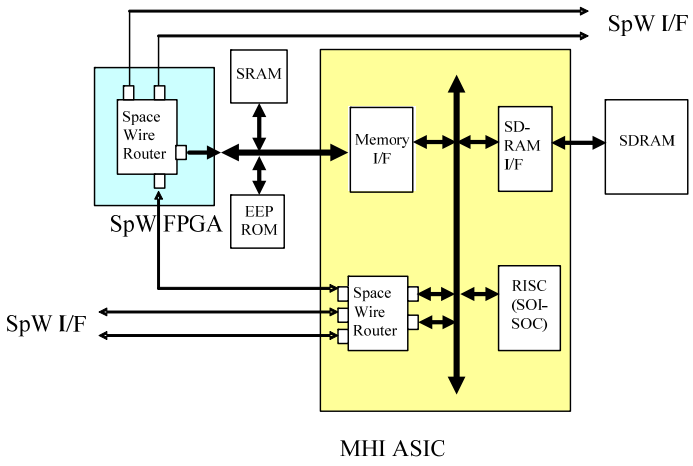

Fig. 4 Data Processing Unit

3 SUMMARY

For the purpose of shortening of development period and reduction of cost and risk of development of satellite, we use SpaceWire protocol for the communication not only between satellite bus system and data processing unit but also between data processing unit and analogue sensor unit. Furthermore, we are trying to achieve redundancy without too much components and cables by linking data processing unit together like a ring. This concept will be applied to the NeXT (New X-ray Telescope) satellite, which is scheduled to be launched in 2012 by JAXA.