Development of the information-logical scheme for Earth remote sensing small spacecraft

Maksim Ivanushkin
Samara National Research University
Image Processing Systems Institute RAS –Branch of the FSRC "Crystallography and Photonics" RAS
Samara, Russian Federation
ivanushkin.mks@gmail.com

Sergey Safronov
Samara National Research University
Samara, Russian Federation
safronov@ssau.ru

Maksim Korovin
Samara National Research University
Samara, Russian Federation
korovin.md@ssau.ru

Anastasiia Krestina
Samara National Research University
Samara, Russian Federation
krestina.av@ssau.ru

Ivan Kaurov
Samara National Research University
Samara, Russian Federation
kaurov.iv@ssau.ru

Ivan Tkachenko
Samara National Research University
Samara, Russian Federation
tkachenko.is@ssau.ru

***Abstract*— The article considers approaches to the design of Earth remote sensing small spacecraft using information technologies. The purpose of this study is to develop an information-logical scheme that describes the external and functional characteristics of the supporting on-board systems and payloads of Earth remote sensing small spacecraft.**

Keywords*— *Earth remote sensing, small spacecraft, ER-diagram, information-logical scheme

I. INTRODUCTION

The design process of small remote sensing spacecraft is nowadays increasingly carried out with the assistance of information technology [1]. The core of advanced technologies for design of modern small spacecraft is an electronic model of the product, which in addition to mass and geometrical characteristics provides a set of information about the operation of the spacecraft and its onboard systems. Analysis of existing variety of on-board systems, units and devices and development of information-logical scheme taking into account numerous processes occurring in on-board spacecraft systems, as well as their mutual influence and interaction, is an important scientific and technical task. Solution of such a task will make it possible, already at the design stage, to promptly form onboard composition of a spacecraft, taking into account efficiency of joint functioning of these or those devices, as well as to significantly reduce the time of design work on creation of small spacecraft.

II. DEVELOPMENT OF THE STRUCTURAL DIAGRAM FOR EARTH REMOTE SENSING SMALL SPACECRAFT

Spacecraft are developed in accordance with the tactical and technical specifications, which define the performance characteristics of the spacecraft. These characteristics are determined by the results of designing a system consisting of ground and space components.

Figure 1 shows the block diagram of the subsystems of the spacecraft used to create the information system. In this diagram elements without frames (leaves of the tree) are groups of specific components, information about which is contained in the database of the developed system. Blocks within the framework represent more abstract systems and are needed on the diagram for clarity.

Thus, the main onboard systems of the Earth remote sensing spacecraft are:

- the payload;
- the power supply system;
  - the thermocontrol system;
  - the control system;
  - the onboard control complex;
  - the system for receiving and transmitting target and telemetric information.

The scheme of dividing the spacecraft into subsystems, shown in Figure 1, was chosen from the considerations of grouping individual components into blocks that approximately correspond to the typical structure of departments of design organizations, which allows, on the one hand, to preserve the traditional process of making specific decisions within the framework of designing individual subsystems within the relevant departments, and on the other hand, to provide an opportunity to assess the status of the project as a whole in real time, thus expanding the opportunities for cooperation.

III. DEVELOPMENT OF THE INFORMATION-LOGICAL SCHEME FOR EARTH REMOTE SENSING SMALL SPACECRAFT

When developing the information-logical scheme, in addition to the block diagram shown in Figure 1, descriptions of hardware interfaces were added that ensure the operation of subsystems as part of the spacecraft. Interface matching is used as the primary criterion for component compatibility. As an information-logical scheme, it was decided to use the ER-diagram [2].

Surrogate primary keys are used in tables describing spacecraft hardware and components. Intermediate tables that represent many-to-many relationships use composite primary keys. Due to the relatively small size of some tables, intermediate tables of universal interfaces are used to connect all subsystems, that is, separate intermediate tables "subsystem-interface" were not created. Instead, an additional subsystem field has been introduced in the interface intermediate table, which is part of the composite key and contains the name of the corresponding table, which makes it possible to ensure the uniqueness of the primary key. Detailed information about the interfaces is contained in a separate table.

Based on the developed information-logical scheme of small remote sensing spacecraft, a database equipped with a user interface was created.

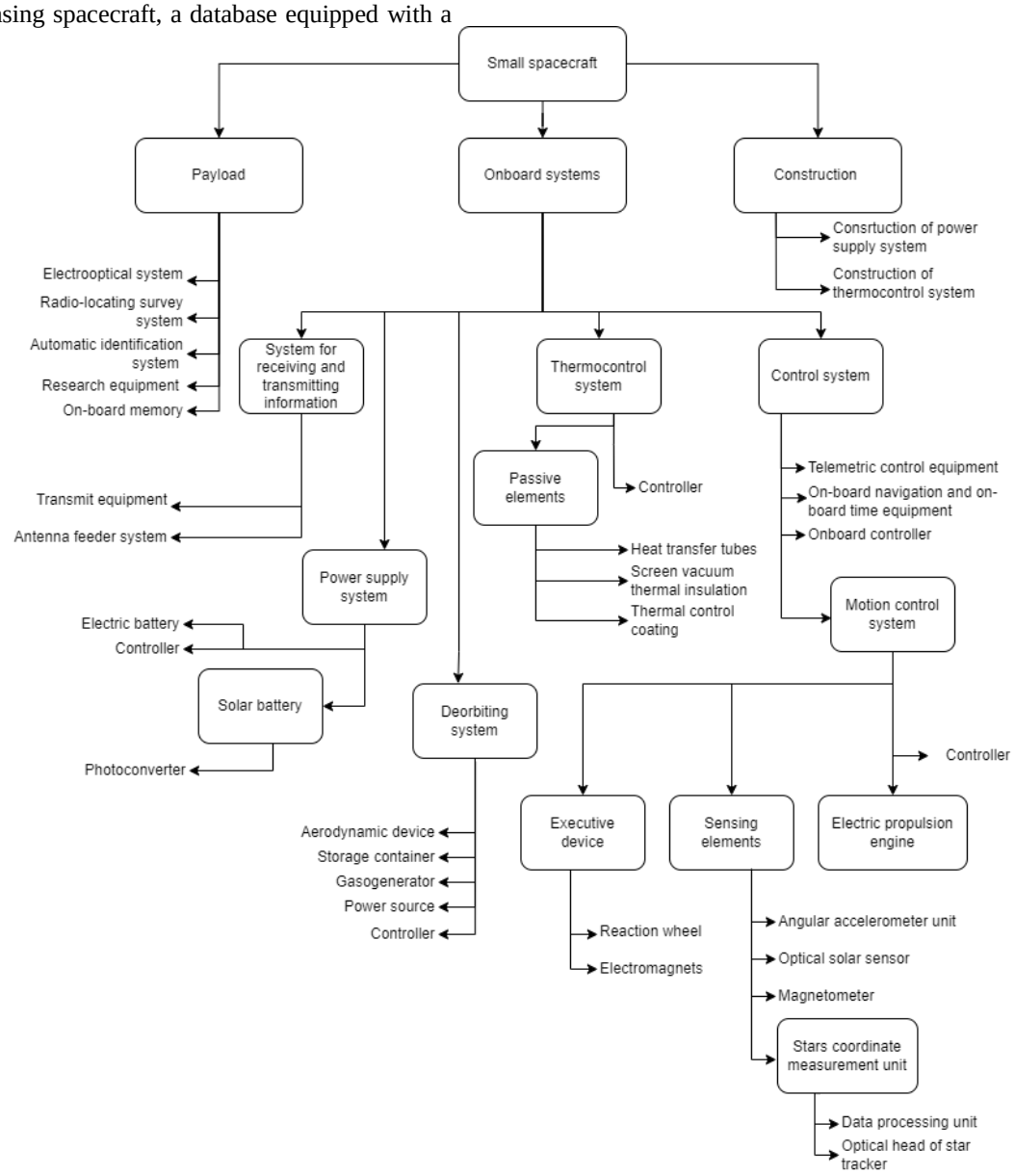

Fig. 1. The block diagram of the subsystems of the Earth remote sensing small spacecraft

IV. Conclusion

As a result, an information-logical scheme has been developed and an array of data has been formed. The external and functional characteristics and connections of devices that are part of the supporting on-board systems and payloads of small spacecraft for Earth remote sensing are described. Elements of the information-logical scheme by unique codes for each element are identified. Design information into functional blocks is grouped, between which one-to-many and many-to-many relationships are defined. The information-logic system is designed to quickly find analogues of components. It also provides the opportunity to form the cooperation of on-board system developers in the development of new products in the shortest possible time.

A database containing information about the functionality of engineering products can be an important tool in improving the efficiency of project activities. Using these kinds of tools allows designers to quickly find the information they need, which can reduce design time and ultimately lead to a better design solution.

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References

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