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DEVELOPMENT OF A FRAMEWORK FOR CONCEPTUAL DESIGN OF RTS (FCD_RTS)

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Abstract. *The paper proposes new results in improving the CoDeCS framework for the conceptual design of complex systems. A new architecture consisting of a subsystem for generating variants of enterprise information architectures (GEntA) and a subsystem for conceptual analytics (ConAn) for characterisation of real-time computer systems (RTSCS) is considered. Both subsystems rely on a common intellectual knowledge bank consisting of a base of facts, a base of production rules and a base of goals formed on the basis of the known experience of conceptual design of complex information-management computer systems. The paper describes the information-technological structures of formalised production lines and presents the first results of subsystems development.*

Keywords: *Conceptual system design, it-architecture, GEntA, FCD_RTS, ConAn.*

Introduction

The problem of effective use of computer control systems operating in real time is currently topical. This applies to microprocessor-based control systems for unmanned aerial vehicles, in particular, as well as in critical technological processes in which strict time constraints on signal processing time (deadline) are set. For example, the launch of an American spacecraft was delayed due to a 20 ms mismatch in signal processing times. The effectiveness of weapon systems is determined by the minimum time to perform the procedures: signal input, decision making, and target engagement.

For conceptual design of real-time systems, the author developed a methodology of system design of structurally complex real-time systems [1]. To automate the design procedures, the CoDeCS framework was proposed, which is currently being improved to enable its use in the educational process by masters of specialty 123 during the course design of socio-technical or cyber-physical systems. These processes are sometimes referred to as real-time system of systems design.

The paper discusses the architecture of the new FCD_RTS framework and an example of fragments of software implementation of its analytical subsystem ConAn.

2. General architecture of the FCD_RTS framework

The general structure of the framework is presented in Fig. 1. It consists of two interconnected subsystems: the subsystem of generation it enterprise architectures GEntA and analytical subsystem ConAn. The basis of the unifying subsystem is an intellectual knowledge bank containing fact bases, a base of fuzzy rules of production type and a base of goals, system design tasks.

The analytical subsystem ConAn uses as input data the enterprise architecture generated by it, containing as technological objects a set of technological processes (TPi), a set of dispatching centres (DCj), where the production personnel of the enterprise is located.

Fig. 2 shows one technological line of the process consisting of separate technological sections (sections), which are equipped with sensors that generate signals about the state of the equipment and the occurrence of certain events (ISg). This is a set of input signals to the designed system. To control the automation devices in the section, the designed system forms and outputs a set of control signals in this section (CSg). To work with signals, each section is assigned a set of functional program blocks (FPBg). All FPBk are linked together in a φ-transaction [1].

The complexity of the FPBg functionality is determined by the number of machine operations of different complexity (example in Fig. 3). This allows us to estimate the average time of application processing, information flows between technological objects (Fig. 3, 4, 5).

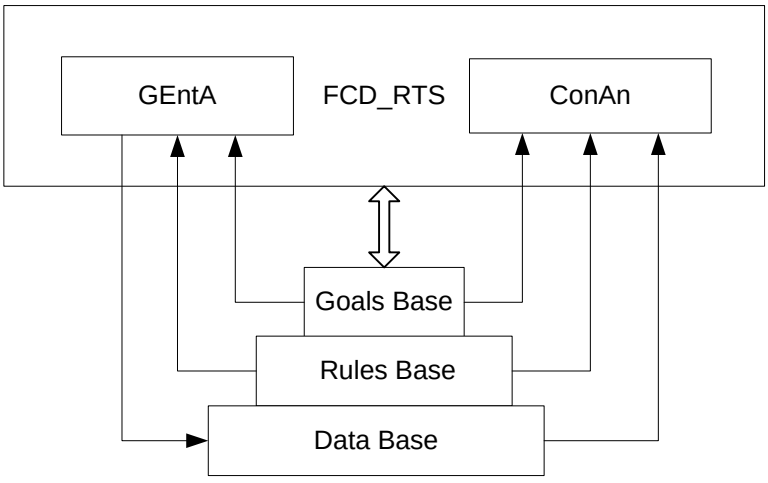
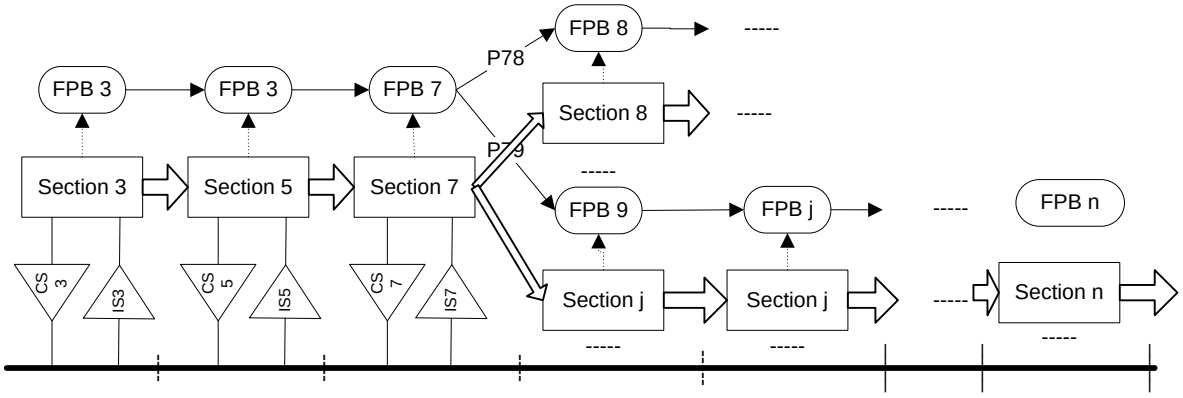


Figure.1 - General architecture of the FCD_RTS Framework
Knowledge bank

Fig. 1 General architecture of the FCD_RTS Framework



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Fgure 2 - Technological process line models

Addition	Multiplication	Division	Moving
6 899 365	2 404 689	1 183 523	12 746 454

Figure 3 - Calculating the number of operations per φ-transaction

TP1, Byte / s	DC1, Byte / s	DC3, Byte / s
	644.05	
3.00		202.52
		491.37

Figure 4 - Calculating the amount of data per φ-transaction

τ_{ap}, ms - Celeron Medocino	τ_{ap}, ms - Celeron Tualatin	τ_{ap}, ms - Intel Core 2 Kensfield
8 650.80	2 452.99	1 313.70
8 514.39	2 414.24	1 292.94
9 251.51	2 618.61	1 402.40

Figure 5 - Calculation of the application processing time τ_{ap} by the processor

Conclusions

The software is currently being developed to take into account the specifics of φ-transaction processing in real-time computer systems [3]. Special attention should be focused on the development of the system of fuzzy production rules, you change them in conditions of incompleteness and inaccuracy of initial data in real projects to the design of complex cyber-physical systems.

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РОЗРОБКА FRAMEWORK ДЛЯ КОНЦЕПТУАЛЬНОГО ПРОЕКТУВАННЯ СИСТЕМ РЕАЛЬНОГО ЧАСУ (FCD_RTS)

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Анотація. *У статті запропоновано нові результати в удосконаленні фреймворку CoDeCS для концептуального проектування складних інформаційних систем. Запропоновано нову архітектуру, що складається з підсистеми генерації варіантів АйТі-архітектур підприємств (GEntA) та підсистеми концептуальної аналітики (ConAn) для оцінки характеристик комп'ютерних систем реального часу (RTS_CS). Обидві підсистеми спираються на спільний інтелектуальний банк знань, що складається з бази фактів, бази продукційних правил і бази цілей, сформованих на основі відомого досвіду концептуального проектування складних інформаційно-управляючих комп'ютерних систем. У статті описано інформаційно-технологічні структури формалізованих виробничих ліній та представлено перші результати розробки підсистем.*

Ключові слова: *Концептуальне проектування систем, it-архітектура, GEntA, ConAn, FCD_RTS..*