SPIN '17

ŠTEDLJIVO (*LEAN*) UPRAVLJANJE RESURSIMA U PRIVREDI REPUBLIKE SRBIJE

XI SKUP PRIVREDNIKA I NAUČNIKA SPIN '17
Beograd, 09-10. novembar 2017.

ZBORNIK RADOVA

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FAKULTET ORGANIZACIONIH NAUKA

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SADRŽAJ

PROJEKTOVANJE INFORMACIONOG SISTEMA STUDENTSKE SLUŽBE

DESIGNING THE STUDENTS' SERVICE INFORMATION SYSTEM

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Apstrakt: *U ovom radu se prikazuje deo projekta informacionog sistema studentske službe fakulteta i primena štedljivog modela korišćenja resursa. Racionalizacijom poslovnih procesa informacionog sistema ostvaren je napredak u štedljivom korišćenju resursa. Smanjenje rasipanja resursa kao što su: vreme, ljudi, energija i novac, a bez smanjivanja funkcionalnosti informacionog sistema ostvaruje se postupnim i konstantnim razvojem sistema uz povećanje produktivnosti korisnika. Primer ovakvog pristupa koji je prikazan u ovom radu je unapređenje procesa "Upis godine" koji je deo složenih procesa u Studentskoj službi fakulteta.*
Ključne reči: *Informacioni sistem, Tok podataka, Agilna metodologija.*

Abstract: *This paper presents a part of the project information system of the students' faculty service and application of an economical model of resource application. By the rationalization of the business system of information processes progress in the resource-efficient use of resources has been made. Reduction of the waste of resources such as: time, people, energy and money, and without reducing the functionality of the information system is achieved by gradual and constant development of the system with the increase of the productivity of the users. An example of this approach presented in this paper is the improvement of the "Enrollment of the Year" process, which is the part of the complex processes in the Students' Service of the Faculty.*
Key words*: Information system, Data stream, Agile methodology.*

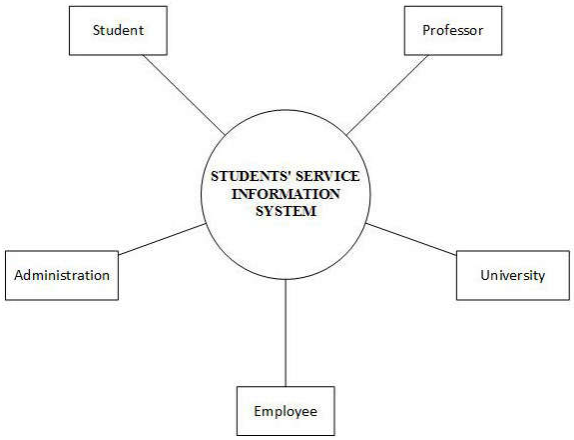
1. INTRODUCTION

Collecting, processing, archiving and analyzing data are the usual tasks of the information system of the students' service of the faculty. The term information system in his book, Lucas (1994) defines as a set of organized procedures, which, when implemented, provide information to support the organization. The Students' Service Information System is a system that supports the process of studying at the faculty. It contains a large number of data processing processes and complex connections of different system elements. Like any other organization it has its own business processes that contain tasks on one hand and activities and resources on the other, which are needed to achieve those objectives. These business processes are always interconnected with other processes. The goal is to implement such processes that provide lean (economized) use of resources. The resources we take into account can be material,

technological and human resources. IT experts who are engaged in the development of business information systems have a pressing need for defined business processes, so it is often the case that they participate in their modeling and analysis. Modern software applications and services are becoming more and more complex. In their development it is necessary to keep in mind that it is not only enough that the software does what it is intended for, that is to meet functional requirements. Non-functional requirements, such as stability, response time, speed, etc., significantly affect productivity. In this paper is shown the process of the rationalization of the enrollment process of the student, as a part of the continuous work on the project of the students' service information system of the faculty.

2. METODOLOGY

In dynamic business and technological conditions, the classical way of software development does not provide sufficient flexibility and speed of response to new requirements. Contrary to the classical approach with detailed planning at the beginning of development, the Agile methodology gives priority to the gradual recurring cycle of development. This methodology is suitable for changing requirements during the project. The flow of feedback from software users is the key element of this kind of software development. The Agile Manifesto states as the first principle of methodology that the client's satisfaction is the highest priority, which is accomplished by more regular, delivery of more efficient and better quality software. Extreme Programming (XP) is a popular version of agile methodology for small programming teams. This enables us to shorten development cycles and eliminate errors at an early phase and to accelerate the delivery of new software versions. In practice this means constantly re-updating the information system. This process of software development enables us a quick response to changes, but also the possibility of creating changes.

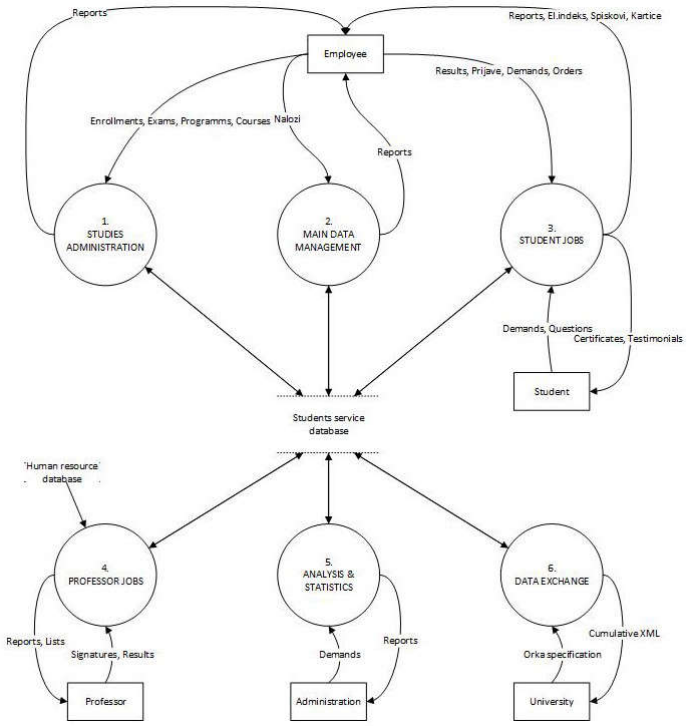


Pic. 1: Diagram of the context

Structural System Analysis (SSA) was used as a methodology for modeling and specification of this information system, that is, the software we are developing. The

authors of the structural system analysis described its advanced characteristics (Yourdon E., Constantine L. 1978) (DeMarco T. 1978). SSA is used as a methodological method of decomposition of the system into subsystems. Data processing processes are displayed as data flow diagrams. In this way, the system is observed from the point of view of the data. The most general data flow diagram of students' service information system is shown in Pic. 1 as a simple contextual diagram. The system is shown as one process. The identified interfaces with which the system communicates are shown.

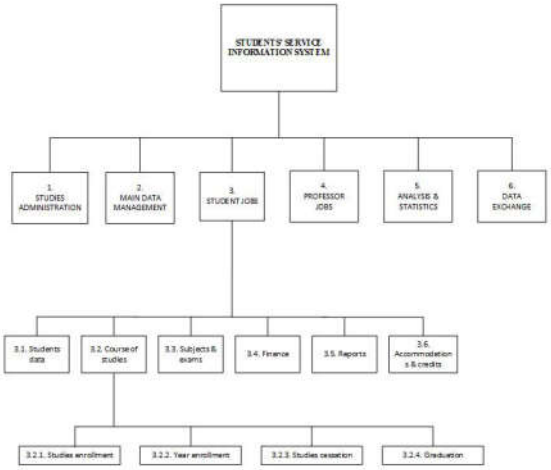
The basic goal of the development of the information system of the students' service is to support the essential processes that are taking place at the faculty in relation to teaching and studying. We consider the information system as a very complex processing process. Processing processes use input data and saved state of the system in the form of data storage and as a result produce output data. Through data streams in the Students' Service Information System, data are transmitted in various forms, as paper documents, data entered via the keyboard, or requests sent via web services, etc. By monitoring data flows it is possible to establish a complete picture of what is happening within the system, or how the system works.



Pic. 2: System diagram

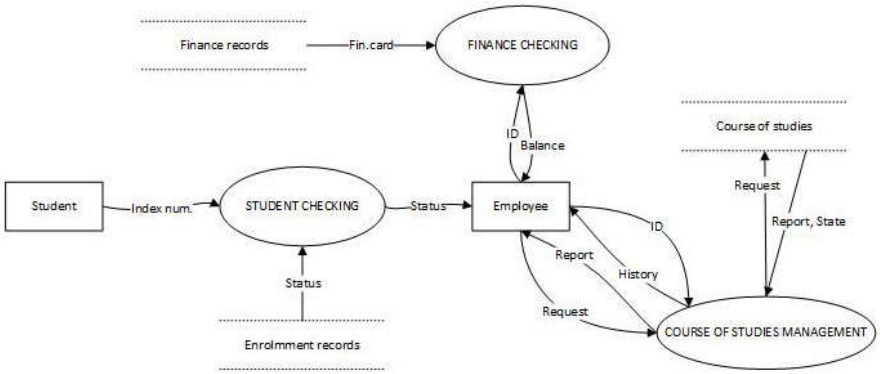
The system diagram or the first-level diagram for the information system of the students' service is shown in Pic. 2 and shows the roles and relationships of the individual interfaces in interaction with the system. It is also seen that at this logical level, the processes "speak" exclusively through the database, which is a feature of the classical data centric business systems. Such systems rely on the database system, making it even

more significant the choice of the relational database system during the implementation of the solution.



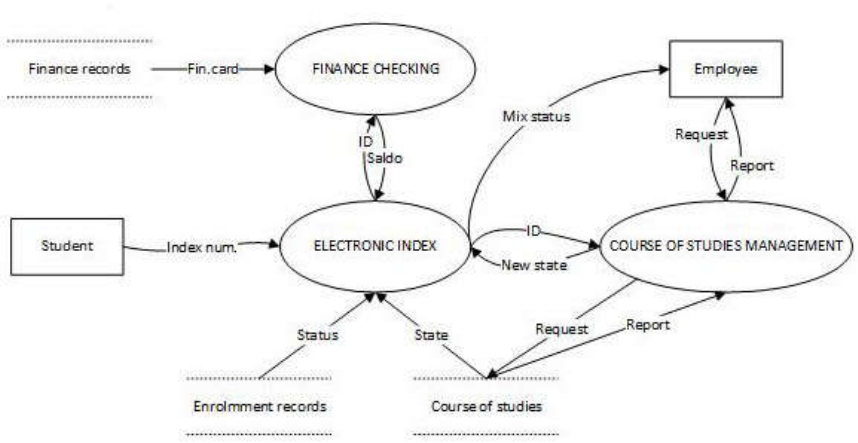
Pic. 3: Decomposition diagram

Pic. 3 shows a partial decomposition diagram. One of the complex processes of the first level, the process of "student jobs" has been decomposed into a set of simpler processes from which the process of "course of studies" is further decomposed. The process of "enrollment of the year" shown in the last row in Pic. 3 is the process that is observed for the aim of rationalization. In the Pic. 4 is shown a data flow diagram of this process before the changes that were made. It describes the process of student enrollment in the new school year. The student and the faculty member are involved in the process. The student gives his identity using the index number, and the official performs the necessary checks, examines the required statuses and information about the student. On the basis of all the information obtained, he performs the work of enrolling the student in the school year by entering the data into the course of student's studies. From the diagram in Pic. 4, it is clear that the dominant node of the data flow in this process solution is a faculty employee. From him and to him go data, queries, requests, confirmations and therefore in every implementation of such a logical model will be burdened resource.



Pic. 4: Data flow diagram "enrollment of the year" – old solution

An analysis of the process from the point of consumption of resources was carried out. When designing a new solution, internal and external constraints were taken into account, and the need not to lose any of the previously provided functionalities. The basic idea was to introduce a new combined set of data into the process and enable a simpler role for the employees. This set of data is presented in the new diagram shown in Pic. 5 presented as a "mix status" data stream. It consists of the following elements: student's basic information, student photos, ESPB data, student's finances, status and history of the course of studies. To enable this, a new "electronic index" process is envisaged, which takes over most of the data flow and relieves the "employee" interface. As a significant difference before and after, it is visible that in the new solution, the processes communicate directly with each other instead via the interface. It can be noted that now the central element of a diagram is a process and not an interface. As in the implementation the process "electronic index" is an automated software component, and interface "employee" a person, this transition of responsibility can make significant changes.



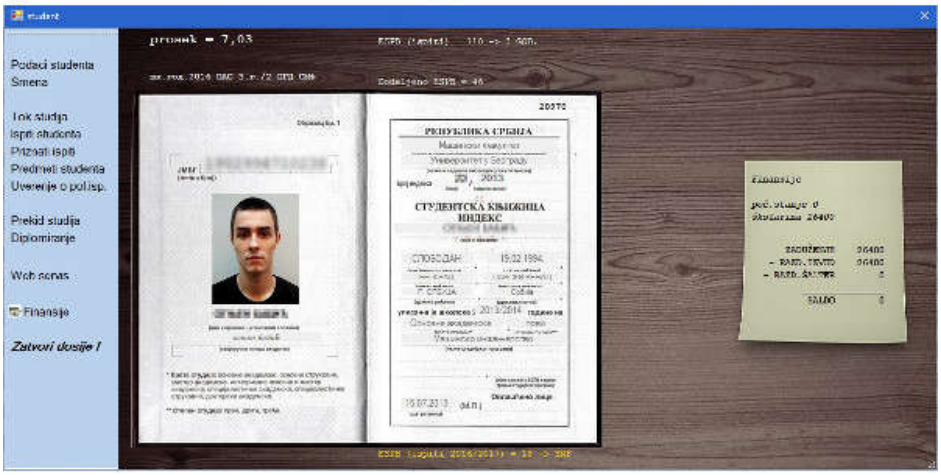
Pic. 5: Data flow diagram "enrollment of the year" – new solution

When creating a new solution, we were guided by the following rules:
1. Provide the user with all necessary information in one place.
2. The information displayed must be linked to a exactly specified subject.
3. The processing procedure should be as simple and straightforward as possible.

3. IMPLEMENTATION

At the logical level, the solution shown in the data flow diagram shows what the system should do, but it is just in the implementation exactly defined how to work. The solution was implemented in the C # programming language and in the .Net framework. Data storages have been implemented by SQL databases. The application part consists of a set of graphic desktop applications and libraries. The basic software application contains 21920 lines of code in the current version. It is clear that this is a complex application. The "course of studies management" process from the presented diagram was realized as

one class with the corresponding methods. The newly introduced "electronic index" process is realized by modifying the class that inherits the class "Form" of the .Net framework and has the full functionality of the Windows operating system window, shown in Pic. 6. Thanks to the rich user interface, it displays a mix of information about the currently selected student. It also provides access to various activities through the menu system by invoking methods of other classes where the most important classes are related to student jobs. The "new state" data flow from the diagram in Pic. 5, in the realization, is manifested as a feature of automatic refreshment of student's data on the screen immediately after the change. The appearance of the user interface is thus designed to give the user the feeling that he works in a familiar and logical environment. Work and performance of all operations with both the mouse and the keyboard is enabled, giving the user the choice between comfort and speed while working. Data storages from the diagram are implemented as groups of linked tables in the SQL database. The software is fully multiuser and the user can simultaneously work on multiple tasks, in multiple running instances of the application and in parallel with other users.



Pic. 6: Working display "El. index"

The software application with the described modifications was tested in October 2017. The implemented changes in the process of "enrollment of the year" in the application gave positive feedback from operational users. Table 1 gives data on completed enrollment jobs for the year 2015, for 2016 and for 2017 with an improved process. The data presented relate to successfully executed processing in a database that is stored very close to the actual instant of the event, so the timing parameters can be considered as valid for assessing the performance of the changes made.

Table 1: Data on records in the table "tok studija" for the year enrollment

year	2015	2016	2017
Number of operators	7	8	6
Number of records day 1	96	124	176
Number of records day 2	105	124	136
Number of records day 3	125	140	169
Number of records	326	388	481
Number of records per operator	47	49	80
Approx. time for input	152s	149s	77s
Total used time	13,77h	16,06h	10,29h
Number or reentered records	4,29%	5,15%	1,46%
Total with corrections	340	408	488

4. CONCLUSION

By changing the way of data processing in the observed process, savings in the engaged resources have been achieved. The presented process of changing the information system process directly led to the saving resource - time. During the implementation of the implemented software, the time required for performing the tasks in the students' service of the faculty has been reduced. Faster processing of the cases allowed the engagement of a smaller number of people engaged in these jobs, reduction of the need for equipment and reduction of the energy consumption. Finally, all this means saving money. If more widely observed savings were also made on the side of clients who saved their time.

The rationalization of the students' service information system was achieved on saving on important resources: time of employees, time of clients, people, equipment, money, energy. By changing the role in the observed process, shifting focus on software components, and increasing their quality, the productivity of employees has increased. Increased productivity came as a result of more efficient decision-making by faculty officials and shorter way of performing the job, and thanks to the more improved version of the software component.

In the further development of the students' service information system it is possible to continue the trend of increasing the role of advanced software components, while reducing the role of employees. Introducing an intelligent agent into the system instead of man's work will lead to even more significant savings.

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