IMPLEMENTATION OF ELECTRONIC STUDENT SERVICES AT UKIM

Dejan Gjorgjevikj Ana Madevska Bogdanova Ivan Chorbev Marjan Gusev

Faculty of Computer Science and Engineering, Skopje, Macedonia

ABSTRACT

iKnow is a new university information system that provides electronic services for both university management and students. It is a system enabling complete electronic student services within University management avoiding the need for paper based document processing. The system is web based and implemented using state of the art modular service oriented technologies. This paper presents the current status of the implementation of electronic student services at the University Ss. Cyril and Methodius (UKIM). We give an overview of the implemented functionalities and point out the milestones in development and implementation processes. Dealys in implementation and change management are also reported, along with explanations about changes done in specification or implementation.

I. INTRODUCTION

The eStudent Information System iKnow is designed to store and administer student's records and personal files, as well as related university data. It is developed by using innovative approach and knowledge management techniques that allow exchange of information among all stakeholders (students, professors, administration, university management and the Ministry of Education).

The paper is organized as follows: Section 2 gives a short overview of the implemented functionalities and an insight into the general quality and applicability of the delivered software and documentation. Section 3 presents a detailed evaluation of the enrollment module, while Section 4 contains the status of the eStudent services.

II. OVERALL IMPLEMENTATION AND SOFTWARE QUALITY

The overall implementation status of the iKnow system at UKIM is in the final stages of completion.

A. Implementation status

The main modules: the new students Enrolment module and the Core module (CM) are already implemented and used in most of the faculties. The Existing student's data migration into iKnow and the automatic migration of candidates from the enrolment into the Core module are not implemented yet. Forms have been developed for data from legacy software applications to be imported into iKnow using Excel template files, but it is up to the faculties to decide whether they will import the existing students, or they will use iKnow only for new students starting from 2011.

1) Enrolment module overview

The Enrolment module consists of candidate's enrolment wizard, the enrolment forms for manual entry of candidate's data, processing, ranking module and the enrolment results publishing.

2) Core module overview

The Core module includes:

- the Administration services (for university and all faculties) which encompass users management, study programs management, courses management, exams sessions, semesters and the integration with the learning management system (LMS) Moodle;
- the Students online services, with its components: semester enrolment, exam application, courses selection, documents and certificates request, grades overview, diploma thesis management and the payments processing;
- services for corresponding department that deals with student services for overall student data processing;
- the teachers' module with listing of enrolled students listing and management of grades.

B. General software quality impression

The Core module has generally been accepted as quite usable, easy to learn and work on. User's requirements have been implemented using agile development. Procedures and the user interface have been remodeled according to interviews with the initial system users. Adaptations of the interface have been made based on feedback from both teachers and employees from student services department. Students have also confirmed the high usability of the application on regular reviews.

The enrollment module is in the process of adaptation and customization based on the experiences during the first use of the system in August and September 2011. Problems in its use were noted, passed to the developers and the updated version is expected for the next term of enrollments (August 2012).

III. DETAILED EVALUATION OF THE ENROLMENT MODULE

The initial version of enrolment module was implemented with all planned functionalities in the enrolment realized in August-September 2011. Only the automatic transfer of the data for the enrolled students in the core module was not finished in the deadline. Some faculties at the University completely relied on the iKnow system for enrolment (FCSE), while others used it in parallel with legacy systems, achieving identical results (Faculty of Natural Sciences, etc.) The faculties successfully completed the enrolment process using the iKnow system. A listing of minor problems and small bugs was generated during the enrolment process and all relevant bugs were fixed promptly by the developer team confirming very agile response during the enrolment period.

The second and third cycle of enrolment had different regulations for ranking in comparison to the first cycle. Therefore some developed software modules were unusable and new have to be compiled. The university changes the ranking rules every year, making the enrollment module prone to changes with the same dynamics. The adaptation into a universal and flexible solution is active at the moment. We are waiting for this year's version of the enrolment regulations to update the module accordingly.

A. Functional requirements

In this section we present the functional requirements.

1) Student interfaces

According to regular reviews and questionnaires students are generally satisfied with the solution. Its' use is straight–forward and intuitive. A very few mails were sent by the students to the support team declaring problems. The mails were often targeting inconsistencies in the data entered by the system administrators, and almost no mails were targeting issues of the system features and usability.

2) Application processing, ranking and reporting

There was an issue concerning the usability and quality of the functionality for processing the applications, ranking the applicants as well as the reporting functionality as described in the design specification.

The problem was the ranking process, because the second and the third term of enrollment had different rules as opposed to the first and the most important term due to the large number of applications and extensive processing. Therefore some ranking modules were not applicable in the later terms. However, the number of applicants was insignificant in the later terms, and no major problems arouse.

The processing of candidate applications had initially some bugs that were corrected quite fast. Two interfaces were developed to process applications: a wizard similar to the candidates interface for detailed analysis, and a short form for quick processing and updating. The later short form enhanced usability and significantly reduced the applications processing time for the enrollment committee. The experiences from the initial use are being implemented into the new version aiming to further enhancement of usability, reduction of complexity, discarding unnecessary steps and stages of each application. Automation of certain checks are also implemented (client side validators, consistencies of specific data types).

The main ranking was very rigorously tested prior to exploitation phase and system usage and no inconsistencies were detected.

The reporting was generally satisfactory. Certain statistical data was extracted directly from the database and automatic generation of those reports will be integrated in the next version.

3) Application and management functionality

The quality and status of the management functionality of the enrolment module is on the satisfactory level. The functionality includes: the creation of accounts, the management of master data, study programs, ranking rules and other functionalities available for the system administrator and the management of the application procedure.

The management of master data in the enrolment module was functional, but there were some usability issues. While most of the data was pre-imported by the developers, adding new records in the master tables was rather slow and demanded more steps than necessary. Later in the process, a much better interface was implemented in the core module and it is also expected for the new version of the enrollment module to include it.

B. Nonfunctional requirements

In this section we present the nonfunctional requirements.

1) Usability and speed

The response time was measured during the testing phase and several optimizations were demanded. By the time the enrolment process started, the application had satisfactory response times.

The most frequently used forms by the students and the enrolment committee were optimized for its best usability. The main focus of optimization and design was aimed at the interface for student candidates, since the number of such users was to be measured in thousands.

The strain of the servers was reduced to minimum, and the user satisfaction had to be high. Also, these users could receive no training; therefore they ought to face a trivially simple, yet fully functional error proof interface.

Last minute optimizations were also made in the interface for the enrollment committees. Although of secondary importance, the speed of operation and the user satisfaction among the enrollment personnel was essential for complete adoption of the system in the entire university.

2) Documenation and training

The quality of the system documentation and the professional support met the needs of the users. Extensive and detailed materials were developed for training the users of the system. Also, multiple training sessions in various places were held. Certain small inconsistencies in the documentation were found due to last minute changes in the user interface because of the optimizations.

3) Stability and reliability

The stability and reliability of the software was merely corrupted due to concurrent transaction issues in the enrolment data model. Some stability problems were occasionally noticed, but the updates in the new version are expected to overcome the problems. The new data layer of the multilayered software architecture used in the system is expected to overcome the previously detected issues. The core module that uses the new data layer has no such issues.

C. *Organizational issues and workflow changes*

A new workflow is introduced for enabling student services, changing procedures that require paper based application forms and manual data processing.

1) Transactions

The final goal is to achieve complete electronic workflow, eliminating any paper based processing among students and service department. However, although the software enables complete electronic transactions, according to the existing legislation, UKIM has decided to realize simplified version of paper delivery to keep track of all required paper forms signed by the students and keep them in their files.

As mentioned before, new regulations of the enrolment process are expected in April 2012. The software is designed to be flexible as much as possible, due to expected changes in future. The "owner" of the enrolment processes in the faculties is the University. The University management is actually responsible for the enrolment. The real enrolment process is realized by the faculties and therefore the final responsibility is transferred to the faculties.

The students submit paper based applications and filled forms only at the beginning of the semester. It is expected that all information will also be processed electronically. Most of the information is already in the system entered by the students. Before generating the application forms the students will need to print and sign the documents. The student services staff also prints the reports and certificates as required by current legislation in paper form and store them in the students' files. All other processes are realized completely electronically.

2) Workflow re-design

Operationalization of this process will cause certain changes in workflow procedures for students:

- Semester enrolment for students
- Selection of courses and enrolment regarding pre-requisites
- Student applications for exams
- Semester registration by a student

Several changes are also realized for workflow procedures targeting the staff at student services:

- Management of the student records
- Checking and registering the tuition fee payments
- Issuing different types of certificates to the students.

Several activities that were usually carried out by the student services staff will now be realized by the system itself. This includes for example:

- Issuing lists of enrolled students or students registered for exam to the teaching staff;
- Issuing different types of reports to the faculty or university management;
- Manual checking for prerequisites before enrolling a student on a course.

3) Migration of results

The data records for the student enrolled using other systems from the previous enrollment systems are needed to be incorporated to the new iKnow system. The migration of this data is a big piece of the puzzle. The enrolment module stores data about the faculties in the university, as well as all study programs that are active in the enrolment process. The core module is to be connected to the enrolment module, retrieving the records of the candidates that have enrolled.

The first version of the enrolment module did not provide the functionality for archiving past enrolment terms. The archive ought to be instantly available for reporting. The second version is expected to provide instant access to the passed enrolment terms.

4) Back-up, maintenance and storage

Paper-based documents are also required by legislation. Regulations require that candidate's signatures are mandatory on the official paper enrolment applications. Paper proof of payments was also demanded from candidates, due to the legal requirements.

The software and hardware maintenance is organized by the central IT department of the university. It is responsible for the database backups as well.

The new procedures will require much less paper forms to be filled. The new procedures also mean much less manual checking by the student services staff - most of the checking is done by the system automatically. The existence of the system also gives the students access to theirs record, is expected to lower the pressure on the student services staff for issuing different types of reports to students.

The measure of success of the implemented system is very important issue in order to improve its functionalities in the future. We are using social media as Facebook and twitter to reach to the end users and gather their experience of their eventual difficulties when using the system as well as gathering ideas for further improvements.

IV. E-STUDENT SERVICES SYSTEM OVERALL STATUS

Most of the functionalities in the e-student services are fully implemented. Few of them are dropped out in the agile development phase and several functionalities are pending - mostly reporting modules postponed for later stage.

A. *Status report*

According to the specification document [2], there are 76 functionalities. Fully implemented are 46 functionalities, 24 will be implemented in the near future, and 5 are signed off - not implemented in this phase, since there are no preconditions - other external systems should be established first. Only one functionality is discarded as irrelevant and an unnecessary burden to the system (administration of seminar thesis and reports, since mandatory seminar thesis are treated as any other course in the e-learning system).

There are few open issues in the implementation process, but mostly they address reporting modules. They are not completed since other modules and functionalities had higher priority. Also, there were several changes that had to be implemented. The student mobility module should be defined more precisely in order to be implemented properly.

At this moment, we can give a report on practical experiences with the services system module. Various faculties and universities have different regulations for the functionalities containing conflicting requirements that need to be balanced and solved. Fine tuning of the interface and functionalities is always necessary after the first users of all categories have used the software.

B. Functional requirements

1) Module for study programs and schedules

The question of status and quality of the system's functionality regarding the module for study programs and schedules in particular defining student programs, courses, prerequisites and rules for studies, is very important. These functionalities are implemented with special concern focused on making this interface easy to use with minimal steps in achieving results.

For example, as result of agile development, import of excel files with simple predefined templates was provided for several modules. Also, there are multiple different forms with the same functionality, offering options to various users to insert the data using several different methods, depending on the structure of the available data, user habits, the amount of data etc.

The functionalities of mapping of faculty staff to courses are also implemented. Teachers can be mapped in the courses menu, one teacher for all occurrences of the course in programs, or in the programs menu, with a different teacher for each course-program link.

The possibility for checking equivalence of courses, modules and programs is implemented, but the functionality of schedule – mapping groups, rooms and teachers is yet to be implemented. We are working on designing the easiest interface for inserting the prepared schedule.

2) Student activities module

System's functionality regarding the student activities module with respect to the functionality of enrolment in a semester and selection of courses is implemented. Both students can do it by themselves or the student services can do that for them. It was tried with students enrolling in the summer semester of 2012, and it was successful. Adaptations are underway for accommodating migrated older students anticipating the inconsistencies in the migrated data.

Forming groups on the beginning of each semester is very important functionality in order to begin the course activities on time. This functionality is implemented. Students can be assigned to groups for each course they have selected, both individually, or multiple student at once, using excel import or multiple selection.

3) Module for the administration

The system's functionality regarding the module of administration with respect to the administration of faculties and accredited study programs is implemented.

Administration of faculty members is also implemented. Creation of users in the system is implemented in parallel.

The administration of classrooms, rooms and laboratories is implemented, but there are some fine-tuning plans in the near future.

4) Module for administration of academic results

The administration of exams is part of the LMS, but the administration of earned ECTS credits and grades from exams passed is fully implemented.

5) Module for personal identification and access control

This module is implemented regarding the access control - currently, teachers can record the attendance of each student in the system. MS .NET membership access control is implemented. Based on special demands by the Faculty of computer Science and Engineering (FCSE), authentication was integrated with the Central Authentication Service used only by the FCSE users (both students and staff).

6) Module for personal records of students

The functionality for storing and administration of personal records for students is implemented. Only storing student photographs in their profile have not been added so far.

7) *Module* for presence monitoring and student activities

This module is just planned at current stage. The university is waiting for legislative documents required to specify a distinct system for attendance control using RFID cards. Integration of both systems is planed. Currently teachers can manually enter the attendance of each student in the system.

8) Module for electronic payment and use of resources

Administration of payments by the students is implemented by automatic retrieval of SMS payments for administrative tax for students. Other payments are entered manually by student services department so far.

The administration of the use of learning management systems (LMS) is implemented by Moodle integration. In the iKnow system, teachers can demand creation of a Moodle course, and all students enrolled in the course in iKnow are automatically enrolled in the Moodle course as well.

C. Non-functional requirements & organizational issues

1) Usability and response times

Since usability is a key issue in the overall adoption of the system by all users, great effort was focused on its optimization. The usability goes hand in hand with the response time. Users have so far not complained to the response time. Tests were made using special software for simulating massive use by thousands of users. The forms that showed greatest latency were presented to the developers and optimizations were demanded.

2) Documentation and support

Detailed training materials were prepared for the multiple training sessions. Also, there is context dependent help on every form in the web application. Certain inconsistencies might occur due to changes in functionalities, after the training material was written, but the final versions of the help materials are expected to be synchronized with the final version of functionalities.

3) System stability and reliability

The only occurrence of instability was detected in the first version of the enrollment module, due to the concurrent transactions issues in the data layer. The new version has

overcome the issues. Due to migration of data from legacy application for the FCSE, some instability was detected before all migrated data was checked for inconsistencies.

4) Changes in administrative procedures

The system is designed to imply new business procedures, with reduced paperwork. Some of the new ways are accepted while others are pending due to expected changes in legislation. However, in order to achieve higher acceptance among users, the current business flow is also supported.

5) Migration of old data, interfaces to other systems

The system supports easy migration of legacy data using imports of Excel templates filled with the old data. The imports are limited to students, exams passed, courses, study programs etc. However, FSCE being the first faculty that uses the system and having access of the database structure, achieved more thorough migration of enrolled semesters for legacy students and the courses taken in each semester.

6) Status of archiving

All data is stored permanently and only disabling of unused information is possible, while deletion is impossible due to database consistency.

7) In-house training and support

Each faculty has appointed its faculty administrator charged with maintenance of users and administrator data in the system. They have all coordinated with the main UKIM administrator and the project managers.

8) In-house system maintenance and hosting

The system is hosted on UKIM in-house servers, and the administrators in UKIM have full access.

V. CONCLUSION

We can conclude that most of the planned modules and activities are successfully implemented or carried out. The system is generally accepted as quite usable, easy to learn and work on. Some of the activities were postponed due to some objective reasons. There are few open issues in the implementation process, mainly addressing the reporting modules that are not completed giving higher priority to other modules and functionalities.

The new workflow introduced for enabling student services, gives different perspectives for students, teachers and faculty management.

For the students it will mean:

- electronic registrations of semester,
- electronic applications for exam,
- electronic registrations for courses

For the teaching staff it will mean:

- receiving lists of students enrolled on a course or registered for exam from the system directly
- electronic registration of student activities during the classes and exercises
- electronic registration of the student scores on the exams

For the faculty/university management it will mean automatic access to various most up to date reports about the

- number of student enrolled on different courses
- teaching staff obligations
- statistics about student scores
- financial reports, etc.

A redesign is undergoing and re-implementation for the enrolment module. Some of the functionalities are currently under development.

REFERENCES

[1] Project Tempus JPGR 511342 – iKnow http://iknow.ii.edu.mk
[2] I. Chorbev, M.Gusev, “iKnow Student services”, System documentation of Project Tempus JPGR 511342, 2010-2011
[3] D. Gjorgjevik, M. Gusev, “iKnow Enrolment module”, documentation of Project Tempus JPGR 511342, 2010 - 2011