Towards the Creation of a New Program in Informatics

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ABSTRACT

This paper describes a project, supported and funded by the Bulgarian Ministry of Education, which is directed to the design and implementation of seven, new, cutting-edge courses for a degree program in Informatics. The focus for the project was that the courses improve the quality of education and training in line with the needs of the ICT labour market to build an economy based on knowledge in the region. Critical factors in the development of these courses are that experts from industry are actively consulted over the design of the curricula, and that experts are also invited to give some lectures. The authors describe their experiences in the design and development of the courses.

Categories and Subject Descriptors

K.3.2 [**Computer and Information Science Education**]: Curriculum, Self-Assessment.

General Terms

Keywords

Curricula design, labour market, industry cooperation.

1. INTRODUCTION

In 2012, the Computer Science department at the American University in Bulgaria (AUBG) competed for, and was awarded a grant by the Bulgarian Ministry of Education (MoE) to develop seven new, cutting-edge courses in the field of Informatics.

A condition of the award was that experts from the software industry were to be actively consulted over the design of the curricula, and that experts were also invited to give some lectures. The authors describe their experiences in the design and development of the courses. The paper shares the experience accumulated in the design and development of these courses.

2. OVERVIEW

AUBG is a liberal arts institute of higher education. The authors, in earlier papers [1], [2], [3] have described this definitely non-European style of higher education and how professional disciplines such as Computer Science and Informatics fir in to it.

Like all university Computer Science departments, the department at AUBG is constantly reviewing its curriculum to keep it up-to-date and topical, at the same time making sure that the courses on offer are academically sound, but also related to the needs of the labour market. As much as possible, the department tries to follow the Computer Science Curricula Recommendations of the ACM/IEEE. However, the content of these recommendations is not always cutting-edge, and sometimes generates dissatisfaction among the student body. There is also the added pressure from accreditation agencies that our courses are such that our graduates are not disadvantaged when competing with graduates from other universities in the labour market.

By coincidence, at about the same time as these deliberations were taking place, in 2012, the Bulgarian Ministry of Education [4] announced funding for a new programme: BG051PO001-3.1.07 "Updating curricula in higher education in accordance with the requirements of the labour market" and encouraged project submissions from Bulgarian higher education institutions for an open, competitive selection procedure.

Activities envisaged for this programme included

1. Analysis of priority subjects according to specific business needs and requirements of the labour market, and involving experts from industry.

2. Inclusion of businesses in the educational process of higher education - creating a link between management and faculty

councils of the universities on the one hand and representatives of employers' organizations, employers and others. Essentially, to adopt measures to modernize the curriculum.

3. Create new curricula and/or updating current content.

4. Test new and/or updated curricula in academic settings. Introduce measures to modernize the way of teaching.

5. Engage businesses in the applicability of the new curriculum – students' visits to real working environments; student seminars with the participation of representatives of business; agreements between the University and its partners for joint future partnerships.

The total amount of funding to be made available for all funded projects was nearly 16 million BGN.

The Computer Science department at AUBG submitted a proposal for the creation of seven (in the first instance) new, cutting-edge courses in informatics, to be followed later by four extra new ones.

In December 2012, the Bulgarian Ministry of Education announced the names of 25 institutions whose project proposals had been accepted. AUBG was one of those, and was awarded 298K BGN funding.

3. BACKGROUND

In order to accommodate the activities proposed by the MoE programme, the Computer Science department for its project proposal surveyed a number of software development companies established by AUBG graduates in Sofia.

Additionally, the department also contacted two Bulgarian ICT professional organizations

i) the Bulgarian Association for Information Technologies (BAIT), the biggest, most representative and influential organization in the sphere of information and communication technologies in Bulgaria, with presently 135 member companies and organizations are enlisted in it.

ii) BASSCOM, an industry association of leading Bulgarian software development companies, with 43 member companies listed.

These contacts proved to be very fruitful and allowed us to identify a number of technologies that were high-profile and cutting-edge and for which there was a high demand of qualified developers in the ICT labour market and around which new courses may be developed.

These seven technologies identified are

i) Computer Forensics

ii) Mobile Computing

iii) Cloud Computing

iv) Unix System Administration

v) Business Intelligence and OLAP

vi) Data Mining Techniques

vii) Business Intelligence Applications

4. ACTIONS

The Bulgarian MoE established a number of actions to govern the development and delivery of the new courses as part of the funding contract with AUBG.

Action1: The update of curricula in partnership with experts from the business. Apart from the Computer Science faculty, 21 experts from the ICT business will assist in the development and finalizing of the courses.

Action 2: The creation of a council of the faculty and ICT business experts (drawn from BAIT and representatives of non-governmental ICT organizations). The council will meet on a monthly basis to discuss strategies for the development the courses in line with the needs of the ICT business sector.

Action 3: Test of the new courses. The AUBG faculty will be responsible for evaluating the courses as perceived by the student body.

Action 4: Part of the funding will be used to purchase the necessary hardware required by the courses.

Action 5: Develop publicity material about the project and its implementation for the public.

Action 6: Organize seminars and conferences to disseminate the results of the project.

Action 7: Organize administrative procedures for the correct implementation of the project.

Action 8: Hire an external firm of auditors to verify the correct financial controls are in place.

5. THE COURSES – IN DETAIL

The following gives a short description of each of the courses.

i) Computer Forensics

The growth of the Internet and the worldwide proliferation of computers have increased the need for computing investigations. Computers can be used to commit crimes, and crimes can be recorded on computers, including company policy violations, embezzlement, e-mail harassment, murder, leaks of proprietary information, and even terrorism. Law enforcement, network administrators, attorneys, and private investigators now rely on the skills of professional computer forensics experts to investigate criminal and civil cases. This course will focus on Computer Forensics Analysis and Validation, Virtual Machines, Network Forensics, and Live Acquisitions, and Cell Phone and Mobile Device Forensics, providing guidance on dealing with these constantly changing technologies.

ii) Mobile Computing

In recent year, mobile computing has exploded onto the mainstream of information technology. Mobile/smartphones are becoming the future dominant software platform as a result of the rapid convergence of computers and these phones.

Students in this course will study of mobile computing on smartphones with an emphasis on developing applications. Topics covered will include mobile operating systems and development environments, input modalities and user interfaces for mobile devices, power management issues for mobile devices, wireless mobile networking, thin clients and mobile Web, location-aware and other context-aware services, and virtualization The course

will focus on building mobile applications for Android and iOS devices.

There will be close cooperation with telerik, Bulgaria, and Melon Technologies, Bulgaria for the development of this course.

iii) Cloud Computing

Cloud computing is another technology that has entered the mainstream of information technology. From small businesses to large enterprises, cloud technologies are increasingly becoming the platform of choice for developing and deploying applications. In addition to lowering the total cost of ownership of applications and systems, cloud platforms provide several characteristics which allow software developers to build applications which have high performance, massive scalability, high availability and reliability.

This course will examine the most popular cloud services models such as Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) as offered by public cloud providers including Amazon, Google, Microsoft, Yahoo and more. The development and deployment of cloud applications will be described, with examples taken from MapReduce and Hadoop Enabling technologies behind cloud computing such as virtualization will be investigated. The installation and deployment of a private cloud (via oVirt, an open source tool used to create/manage virtual datacenters) will also be examined.

There will be close cooperation with VMWare, Bulgaria, and Microsoft, Bulgaria for the development of this course.

iv) Unix System Administration

UNIX/Linux OS environment is typical for the wide range of computational systems – from single personal installations up to the high performance computational clusters, GRID and supercomputers. Students in this course will be prepared for performing administrative operations, applying different techniques and skills for running highly effective computational environments – from pre-installation to security audit, network administration, data security and protection, performance tuning, large installation system administration.

vi) Business Intelligence and OLAP

The advancement of ICT and a deeper understanding of the value and the role played by information as a resource for success in business has led to the emergence of Business Information Systems in different directions. Among them we can name CRM, ERP, Knowledge Management and, of course, Business Intelligence, as the next step in the evolution of the Decision Support Systems.

This course aims to address mostly technological issues related to building analytical information infrastructure. The course addresses design of applications in a way to manage large and heterogeneous data sets, algorithms for efficient management of data, loading and refreshing data cubes, software and hardware solutions for distributed data processing, etc.

vi) Data Mining Techniques

This course is oriented to theoretical foundations of Business intelligence by emphasizing mathematical results in the basement of analytical algorithms developed for discovery knowledge in large databases.

vii) Business Intelligence Applications.

The course is aims to develop practical skills in developing BI applications by addressing the necessary business conditions and

identifying factors for success in implementing Business Intelligence application in a feasible way. This may include

- Launching conditions - how to re-design and adjust business processes in a way to allow implementation of Business Intelligence applications.

- Organizational issues - how to organize usage of inferences, achieved via Business Intelligence data analysis in a beneficial for the business success way.

- Informational issues - how to interpret results of different analytical techniques applied for given data sets.

6. CONCLUSION

Teaching emerging professional topics within a curriculum, designed for a broader rather than deeper education is always a challenge.. With the increasing dynamics in computers' related fields these challenges require innovative and adaptive solutions. Cooperation with industry is the right way to achieve the desired satisfaction for all involved parties - academy, students and business. The opportunity provided by the Ministry of Education via funding of such cooperative projects arms university with the needed motivation and instruments to engage professional expertise in curriculum design.

Much more work on the design of the curricula still has to be done, with the development of slides and practical exercises, and the setting up of industry-led seminars. We look forward to this challenge and hope to be able to report back at a later date the results of our endeavours.

7. REFERENCES

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