Study on the Rapid Prototyping Methodology of the Lecture Contents for the IT SoC Certificate Program

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Abstract

This paper describes the development methodology of the prototype applied to create the lecture contents of the IT SoC certificate Program at graduate school quickly. IT SoC Certificate Program (SoCCP) develops the lecture contents of the 16 major courses to educate high-level human talent in the MS and PhD courses of IT SoC design field. Specifically, the rapid prototype development methodology is to obtain contents successfully through role definition and collaboration between the subject matter expert (SME) and the instructional designer. The effectiveness of the rapid prototyping (RP) methodology to develop lecture contents is ensured and improved the quality them continuously through the review by college and industrial professionals in terms of the appropriateness of subcontents, feasibility of lecture, and wide applicability at participating universities of the SoCCP.

I. Rapid Prototype Development Methodology

The purpose of rapid prototype (RP) is to realize the conceptual structure of the final product while not incurring the expense of the full product development cycle [1]. Unlike traditional instructional design (ID) models, RP uses parallel processing if the various design and development tasks. The rapid prototyping methodology illustrated in [Figure 1] is based on the existing ID phases, showing the phases are processed concurrently and reiteratively, not linearly [2].

II. Development of Lecture Contents on IT SoCCP

IT SoCCP is a curriculum offered by graduate schools to educate MS and PhD degree in the area of SoC design. Currently, more than 350 professors at more than 80 departments of 60 universities nationwide are joining in this program, which is the SoC professionals development project implemented by the IT SoC Industry Promotion Center, ETRI under the Ministry of Information and Communication since 2003. A total of 16 major courses (8 common core lectures and 8 selective lectures) are offered through the regular graduate curriculum, and approximately 30 practical courses are offered by the IT SoC Academy Education Center as all-day training (2 weeks) during the vacation. For the MS program, students must complete 3 common core courses, 2 selective courses, and 2 practical courses. PhD students must complete 4 common core courses, 3 selective courses, and 4 design practical courses to acquire the certificate.

For the 16 major courses of the IT SoCCP, the participating universities are providing lectures by simply restructuring existing lectures instead of developing contents. In case the same course is established at the domestic 60 graduate schools, however, the standard lecture syllabus for each course is provided as a guideline to inform its level and contents. For the standard lecture syllabus, industry professional/professor/researchers select 15~20 modules through analysis of technology/task/knowledge requirements, and the professor, is participating, then determines the learning objective for his/her course and selects the detailed learning modules for the course. During 2006, the following five IT-SoC courses were developed:

- SoC Architecture
- SoC Design Methodology
- IP Development and System Integration
- Multimedia System Design
- Low Power System Design
An example of the SoC Design Methodology standard lecture syllabus is shown below.

- M1 - Introduction: Historical Perspective, Design Space (3hrs.)
- M2 - SoC Design Flow/Design Reuse and SoC Platform (3hrs.)
- M3 - System Specification and Modeling (3hrs.)
- M4 - Design Language/SystemC (3hrs.)
- M5 - System C Practice (3hrs., Practice)
- M6 - HW/SW Co-simulation (3hrs.)
- M7 - HW/SW Interface Design (3hrs.)
- M8 - SoC Design Space Exploration (3hrs., Practice)
- M9 – Synthesis (3hrs., Practice)
- M10 - Verification I (coverage-based verification, HVL (H/W verification language, assertion-based verification)) (3hrs., Practice)
- M11 - Verification II (formal techniques, semi-formal approach, assertion language (PSL, OVL)) (3hrs., Practice)
- M12 - SoC Testing and Testable Design (3hrs.)
- M13 - Analog/Mixed Mode Simulation (3hrs.)
- M14 - Physical Design (3hrs., Practice)
- M15 - Prototyping and Emulation (3hrs.)
- M16 - VDSM Design and Signal Integrity (3hrs.)
- M17 - Design for Manufacturability (3hrs.)
- M18 - Power Estimation and Management: Low Power Issues (3hrs.)

III. Rapid Prototyping Methodology for Lecture Contents of IT SoCCP

The RP methodologies of lecture contents on IT SoCCP begins with the formation of development team. As the lecture contents client, ETRI’s SoC Industry Promotion Center provides the educational needs, student analysis, and standard lecture syllabus. The development team then selects the appropriate details or subcontents for the modules presented in the standard lecture syllabus. The customer and development team come up with the design principle as well as learning and instruction strategies. In particular, the development team establishes learning objective for each module and selects the details that can serve as the actual knowledge imparted to complete the lecture contents design. If the SoC design practice is included, the practice subject as well as the language like verilog and CAD tool should be determined during the design phase.

The lecture contents are developed using the presentation material and lecture notes, while the practice module includes the practice subject, equipment, manual, and source file. The development output is submitted as the primary Rapid Prototype when the review is performed for complement and modification at the committee consisting of industry experts and professors who plan to teach the course next semester. Once the prototype is completed, the development team holds the lecture as a pilot test, with the customer producing the test lecture as online e-learning contents. The lecture contents as final rapid prototypes can be utilized at participating universities offering courses for IT SoCCP. Continuous update is available through feedbacks.

IV. Conclusion

This study describes the phases in the RP methodology introduced to create the lecture contents quickly while driving the delivery of IT SoCCP and contents development of the major courses concurrently. In 2006, the development of the lecture contents of 5 certified courses was initiated, with the evaluation, pilot lecture, and online contents production scheduled to be conducted in January and February 2007. The developed lecture contents through RP methodology are evaluated in terms of differentiation from other university professors at next semester, appropriateness of the course objective and contents, structure and presentation, learning level, understanding by the students, and learning and instruction strategies. In particular, the industries evaluate conformity to the requirements analysis, usability, and applicability. The final lecture contents can be used anytime by participating university wishing to offer the certified course for the IT SoCCP. Professors teaching the course submit the evaluation result, which takes into account the possible error of the contents, user-friendliness, and understanding by the students. The client and the professor then use the feedback as material for revising the lecture contents. Such cyclic process provides user feedback to enable the continuous improvement of the lecture contents, thereby gradually decreasing the time required to modify the rapid prototype lecture contents.

Bibliography