e-Assessment System based on ABET criterion for Computing Programs

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Abstract

Assessment is the important process for testing the ability of the institution program to meet the required criterions to get the accreditation. In this work we deals with ABET quality assurance agency dedicated with applied science, computing, engineering and technology education and we concerned with computer science program. A software agent, which provide difference facilities developed to achieve the assessment function. The developed agent(Assessment Agent) perceive the current institution program status from the system environment, then perform sequence control instructions included two cycles of verifications to generate the Self Assessment Report(SAR) and advices for getting accreditation.
Keywords: ABET criterion, assessment agent, quality assurance.

الخلاصة

التقييم هو عملية مهمة لاختبار قدرة برنامج المؤسسة لتلبية معيارا المطلوبة للحصول على الاعتماد. في هذا العمل الذي نقوم يتعامل مع وكالة ضمان الجودة ABET مخصصة مع العلوم التطبيقية، والحوسبة، والتعليم والهندسة والتكنولوجيا ونحن المعنية مع برنامج علوم الحاسوب. وكيل البرمجيات، والتي توفر مرافق الفرق وضعت لتحقيق وظيفة التقييم. وكيل وضعت (وكيل التقييم) ينظرون إلى الوضع الحالي من برنامج مؤسسة بيئة نظام، ثم نفذ شملت تعليمات التحكم تسلسل دورتين من التحقق لتوليد تقرير التقييم الذاتي (SAR) والنصائح للحصول على الاعتماد.
الكلمات الرئيسية: ABET المعيار، وكيل التقييم وضمان الجودة.

1. Introduction

Improving professional standards for a number of years has been developed by Quality Management Systems in Higher Education (QMSHE). In order being quality minded in higher education means caring about the expectations of students and other customers as well as all involved parties, and ensuring they are met. Students perceptions thus provide important information for lecturers if learners needs are to be fulfilled. An assessment of the quality of teaching programs comes at a time when the concern for quality in higher education is probably at an all time high. All processes in any organization (higher education institution) contribute directly or indirectly to quality as the customer (student) defines it. This will determine whether students' needs have been met. Quality systems in higher education have been important for decades. They help us improve professional standards by comparing them with international educational qualifications[Qual,2003]. Assessment is something which is 'experienced', though not always positively, by almost all involved in a higher education institution: students, teachers, administrators, managers, policy makers, institutional leaders, library staff, the students union and those supporting students in professional contexts in which learning is assessed, e.g. the nursing supervisor, teaching mentor or manager of the placement student in business. Given this complexity surely it is important for us to try to understand the relationships between these groups in some systematic way[Gibb,2003].

The following authors deals with ABET organization criterion and assessment procedure: Charies R. Lang and Hakan Gurokan[Char,2008] presents the curricular structure and assessment methods of a new science program and describes how it has met ABET-CACs current criteria. James Collofello[Jame,2004] begin to discussed the similarities of Capability Maturity Model CMM and ABET. Both technical and nontechnical similarities such as the impact of employee-faculty buy in and management- administrative support will be addressed. Eugene Essa et al. [Euge,2010] focuses on ABET program. They require that programs show student achievement and certain course outcomes. Documentation of this requirement is particularly burdensome. Deborah A. Trytten[Debo2010] Fined that the Exhibit Collection and Analysis Tool (ECAT) was created to electronically store and organize display materials for our program in a manner that was useful for ABET program evaluators.

2. ABET Organization
ABET is a United State association ,it was founded in 1932 as the Engineers' Council for Professional Development (ECPD), an engineering professional body dedicated to the education, accreditation, regulation, and professional development of the engineering professionals and students in the United States. It was headquartered at the Engineering Societies Building and then the United Engineering Center in New York City until it relocated to Baltimore in 1996.

2.1 ABET General criterion[3]
The ABET agency focused on eight general criterion starts with students and finished by the institutional support, table(1) present the general ABET criterions which are Students, Program Educational Objectives, Student Outcomes, Continues Improvement, Curriculum, Faculty, and Facilities [Accr,2012].

Table1: The General ABET criterion

Students	The student performance must be evaluated. Student progress must be monitored to foster success in attaining student outcomes, thereby enabling graduates to attain program educational objectives. Students must be advised regarding curriculum and career matters.
Program Educational Objectives	The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program's various constituencies, and these criteria. There must be a documented and effective process, involving program constituencies, for the periodic review and revision of these program educational objectives.
Student Outcomes	The program must have documented student outcomes that prepare graduates to attain the program educational objectives. There must be a documented and effective process for the periodic review and revision of these student outcomes. The program must enable students to attain, by the time of graduation: (a) An ability to apply knowledge of computing and mathematics appropriate to the discipline (b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution (c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs (d) An ability to function effectively on teams to accomplish a common goal (e) An understanding of professional, ethical, legal, security and social issues and responsibilities (f) An ability to communicate effectively with a range of audiences (g) An ability to analyze the local and global impact of computing on individuals, organizations, and society (h) Recognition of the need for and an ability to engage in continuing professional development (i) An ability to use current techniques, skills, and tools necessary for computing practice.
Continuous Improvement	The program must regularly use appropriate, documented processes for assessing and evaluating the extent to which both the program educational objectives and the student outcomes are being attained. The results of these evaluations must be systematically utilized as input for the continuous improvement of the program. Other available information may also be used to assist in the continuous improvement of the program.
Curriculum	The program's requirements must be consistent with its program educational objectives and designed in such a way that each of the student outcomes can be attained. The curriculum must combine technical and professional requirements with general education requirements and electives to prepare students for a professional career and further study in the computing discipline associated with the program, and for functioning in modern society.
Faculty	Each faculty member teaching in the program must have expertise and educational background consistent with the contributions to the program expected from the faculty member.
Facilities	Classrooms, offices, laboratories, and associated equipment must be adequate to support attainment of the student outcomes and to provide an atmosphere conducive to learning.

2.2 ABET criterion for computing programs
These program criteria apply to computing programs using computer science or similar terms in their titles and Table(2) present the specific criterions for the Computing program included Program Outcomes, Curriculum, and Faculty Qualifications[Accr,2012].

Table 2: The Computing program criterion

Program Outcomes	The program enables students to achieve, by the time of graduation: (j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices. (k) An ability to apply design and development principles in the construction of software systems of varying complexity.
Curriculum	Students have the following amounts of course work or equivalent educational experience: a. Computer science: One and one-third years that includes: 1. coverage of the fundamentals of algorithms, data structures, software design, concepts of programming languages and computer organization and architecture. 2. an exposure to a variety of programming languages and systems. 3. proficiency in at least one higher-level language. 4. advanced course work that builds on the fundamental course work to provide depth. b. One year of science and mathematics: 1. Mathematics: At least one half year that must include discrete mathematics. The additional mathematics might consist of courses in areas such as calculus, linear algebra, numerical methods, probability, statistics, number theory, geometry, or symbolic logic. 2. Science: A science component that develops an understanding of the scientific method and provides students with an opportunity to experience this mode of inquiry in courses for science or engineering majors that provide some exposure to laboratory work.
Faculty Qualifications	Some full time faculty members have a Ph.D. in computer science.

3. Software Agent and its Applications

The software agent define as " an autonomous system that receive information from its environment, processes it, and perform actions on that environment". And according to According to J. Ferber , an agent is a real or abstract entity, capable of acting on itself and on the environment. It can have a partial representation of this environment. It can communicate with other agent. And finally, its behavior is the result of its observations, its knowledge and its interactions.

As a result the definitions globally cover about the same scope. Thus, concerning software agents, it may be both more practical and more useful to define it by a set of characteristics. The principle structure of the software agent presented as in figure (1). The agent can be activated from the environment through the sensors, perform sequence of instructions and return the results to the environment through the actuators[Chri,2008].
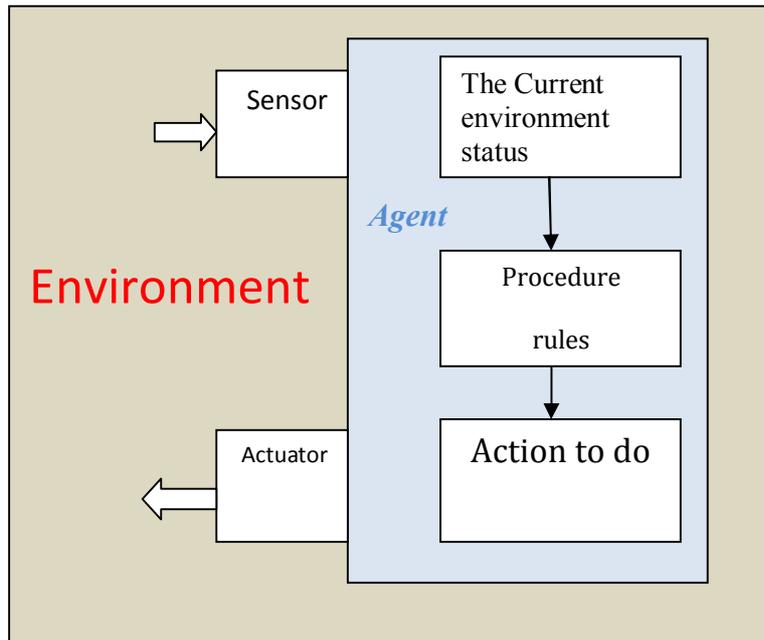
Figure(1) The principle structure of the software agent

Putsadee Pornphol[Puts06] presents an agent-based quality assurance assessment system for educational institution. Agents are used to check essential requirements that educational institution clients have to meet and prepare reports for assessors. The system proves useful and helps reduce assessment time from education expert assessors. Toshiyuki Sueyoshi and Gopalakrishna Reddy Tadiparthi[Tosh07] create an artificial wholesale market, where many different traders are equipped with learning capabilities. They validate the agent based model with the help of a data set from PJM electricity market. Han Yu, Zhiqi Shen and Chunyan Miao[Intelligent Software] proposes the Goal Net Designer which is an Integrated Development Environment (IDE) for modeling agent behavior based on Goal Net model, a goal orient methodology. Jianhua Liu[Jian10] designed an agent-oriented software design method. The Assessment Agent System is composed of five types of software agents: instructor agent, student agent, management agent, assessment agent, and reporting agent.

5. The Agent Based Assessment System

The proposed system designed for doing the self assessment procedure for the computer science institutions and institution have a similar term in this title. The designed system based on a software agent that perform the automatic auditing by perceiving the current institution status the doing a sequence of control instructions to achieve the self assessment report(SAR). The SAR is the main action for the assessment agent beside the advice massages for accreditation level.

The system consists of three phases as presented in figure (2). In the first phase agent verify the institution data base against the ABET general criterion data base(see ABET general criterion) if the verification to achieve the student outcome(for example *a to i*). The next phase verify the data resulted from previous phase to achieve the remaining conditions (*j to k*). In the third phase a new assessment institution data base generated. The system result is the SAR and report to us an advice of the institution accreditation level.
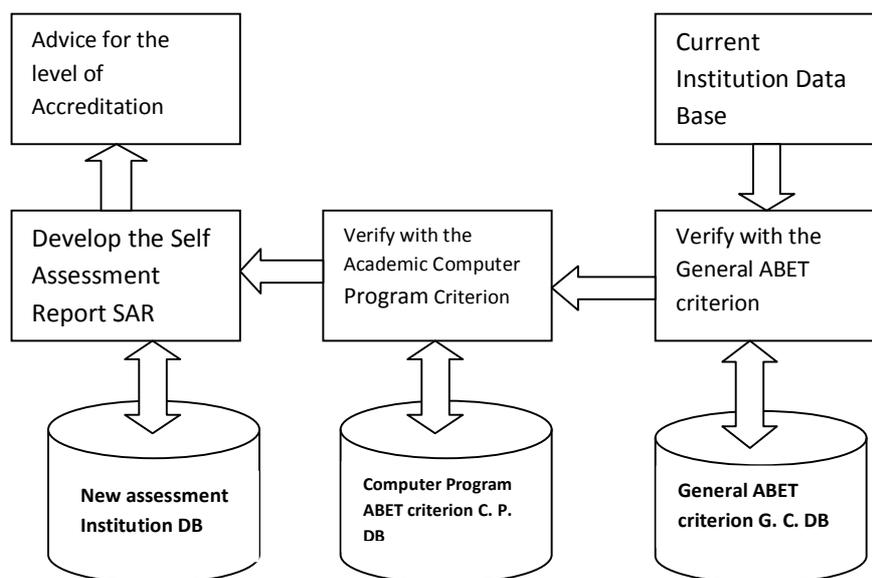
Advice for the level of Accreditation

Current Institution Data Base

Develop the Self Assessment Report SAR

Verify with the Academic Computer Program Criterion

Verify with the General ABET criterion

New assessment Institution DB

Computer Program ABET criterion C. P. DB

General ABET criterion G. C. DB

Figure (2) The Structure of the proposed system

5. The Assessment Agent structure.

The structure of the agent system based computing criterion presented in the figure(2). The assessor agent activated by receiving a signal to read the data base of the current institution to be tested, the fetched data verified against the ABET general criterion. The decision is advice to refine if the institution data not meet the requirement of ABET general conditions. From the other hand if the institution data meet the requirement of ABET general conditions then verified with the specific data (i.e. Computer Program) and again if the verification success to meet the specific program requirements then generate the Self Assessment Report SAR included in details all the institution states, the assessment data base for the current institution also developed and report advices for the institution to achieve the advancement.
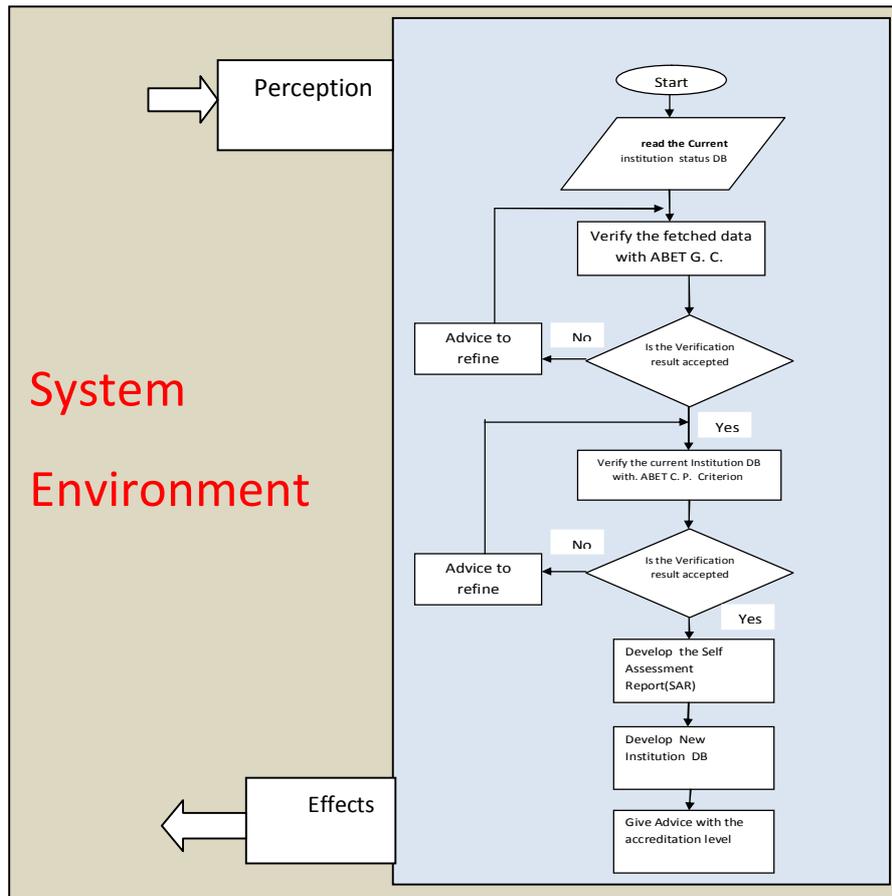
Figure(3) Structure of the Assessment Agent

The Assessment Agent algorithm

The assessment agent algorithm presented in figure(4) as an abstract instruction included *state, procedure and action*. The state represent a description for the current institution state and the procedure described by set of control instructions used to developed new assessment data base of the current institution to assess. The action which is the represent the results returned to the environment, the action is to develop SAR, and multi advices for upgrading and achieve enhancement for the institution.

Function Assessment-Agent(percept) return an action
   State: *Description of the current institution Data Base*
   Procedure: *set of control instructions to develop new institution Data Base*
   Action: *Developing the SAR and Advice for the level of the accreditation*

State is MODIFY current state (state, action, percept).
Procedure is VERIFICATION and UPDATE(state, procedure).
Action is VERIFICATION result(procedure)

Figure(4) Abstract Instructions of the Assessment Agent

5. CONCLUSIONS
The system achieve an active solution for the main challenge in the quality assurance program in higher edication institutions which assessment problem. The assessment procedure done before by team work od assessors and they achieve their work in a multitages.

The assessment function in the developed system achieved by the software agent(Assessment Agen), the autonomus feature of the agent facilitate the self auditing and enhancemet. The assessment agent precieve the current computing program status data base, perform two cycles of verifications then generate an efficient assessment data base for the current institution in the way to generate accreditation advices(enhancement recomondations) and develp the SAR.

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