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Automarking Web Service

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***Abstract*—The research team has leveraged the research conducted in recent Natural Language Processing studies and designed a computerized marking mechanism for marking students' short-answers based on the semantic meaning of those answers. An open access Automarking web service has been developed to provide short-answer marking service for everyone. Automarking service is also a self-sustainable complete online exam system which schools and teachers can use it to create their own item bank and tests, to manual and to auto mark students' answer sheets, and to review the results from various perspectives such as test, item, and individual student.**

Keywords-natural language processing; WordNet; short-answer question; computerized grading; web service

I. INTRODUCTION

A number of commercial assessment tools are in the market and most of them support only objective-style questions such as multiple-choice and fill-in-the-blank questions [8]. Objective-style questions can only assess students' recall ability instead of assessing students learning performance at the higher levels of Bloom's (1956) taxonomy of educational objectives [1][3]. It is necessary to include open-ended questions in an exam so students are given the task as well as the freedom to arrive at a response without recalling words and/or phrases.

The research team develops Automarking web service which integrates the computerized marking mechanism and provides users (i.e., schools, teachers, and students) an open access online exam solution. This paper starts with the introduction of background of the computerized short answer marking mechanism the research team has done in Section 2 and talks about the web service – Automarking – as well as its use cases in Section 3. Section 4 makes a simple conclusion and talks about the future work the research team plans for the next.

II. COMPUTERIZED SHORT ANSWER MARKING MECHANISM

Many approaches of automatic marking student answers of open-ended questions have received great success, i.e., 80-90% agreement with a human-grader) [2][6][7][9]. However, there are still considerations remained. First, many of these approaches require a large amount of previously evaluated results such as previously marked essays as knowledge base [10][11]. Secondly, it is possible for a student to receive high marks by simply writing down a number of keywords in their answers, yet not accurately or conversely answering the question, when the automatic assessment tool uses the 'closest match' and probability techniques to mark students' answers. On the other hand, a student may receive low marks even he or she could answer a question accurately but not include the proper keywords in his or her answers.

The research team intends to equate the meaning of the student answer to give it an appropriate mark. The research team has made use of the recent advances in Natural Language Processing to design a mechanism which is capable of automatically assessing student answers of open-ended questions in a manner that assesses the answers based on its linguistic features. More details of the proposed mechanism can be found in [4][5].

III. AUTOMARKING WEB SERVICE

The research team would like to make the computerized short answer marking mechanism available for any schools around the world as long as the answers are in English; hence, web service is good choice. We also would like to provide schools and teachers a complete open-access online exam solution; therefore, we design and implement all functions that teachers, students, and administrative staffs need. In this paper, we will focus on the use cases of teachers, students, and individuals who want to access the Automarking web service.

Automarking service [1] is comprised of a number of independent components. These components are developed in Java individually and as the project progressed, the components were integrated with one another when appropriate. Automarking web service is running at Linux server (i.e., Debian) with all other GNU General Public License servers and services. Due to one of the objective is to offer school teachers, students, and administrative staffs a complete, free, open-access online exam solution, Automarking service has pre-defined roles like administrator, teacher, student, assessor, and operator, and also allows schools to create roles and to custom privileges different roles have according to individual school's need.

Any researchers and teachers can freely access the web service by clicking the "Service" link on the bottom right of the screen. Any developers can benefit from the web service by sending SOAP Envelope in XML with three necessary data (i.e., question, expected answer and student answer), as Figure 1 shows, to Automarking server. Automarking web

[1] http://automarking.dyndns.info:4735

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service will send back the marking result to the developer in SOAP Envelope as Figure 2 shows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.
   <soapenv:Header/>
   <soapenv:Body>
      <sch:evaluateRequest>
         <sch:question>Describe channel conflict.</sch:q
         <sch:expectedAnswer>A situation in which variou
         <sch:studentAnswer>A situation when various par
      </sch:evaluateRequest>
   </soapenv:Body>
</soapenv:Envelope>
```

Figure 1. SOAP Envelope for utilizing Automarking web service.

```
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas
   <SOAP-ENV:Header/>
   <SOAP-ENV:Body>
      <evaluateResponse xmlns="http://www.athabas
         <mark>2.833333333333333</mark>
      </evaluateResponse>
   </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Figure 2. Marking result sent back from Automarking web service.

When a teacher signs in the system, he or she can have six things to do as Figure 3 shows. Before he or she can create an online test for students, he or she needs to establish item banks by clicking "Add Question" button.

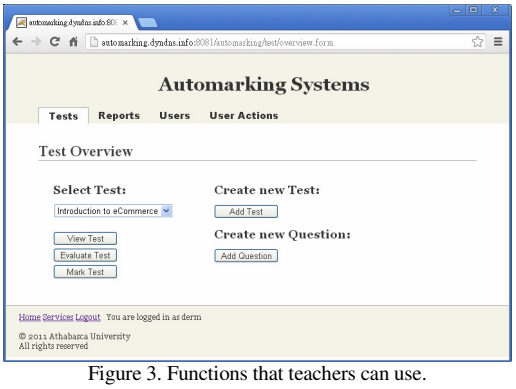


Figure 3. Functions that teachers can use.

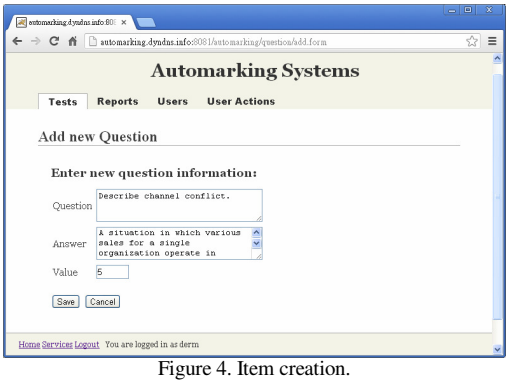


Figure 4. Item creation.

When creating new items, the teacher must provide the question as well as the key as Figure 4 shows. The question and the key must be free of any spelling or grammar errors because English is one of the native languages in Canada. The research team does have plan of follow-up research in order to make Automarking service capable of supporting teachers and students from non-English speaking countries. The teacher also needs to assign a value for the item so Automarking system can give students appropriate marks accordingly.

Once the teacher has enough items, he or she can create a test for his or her class. Automaking system allows teachers to create different versions of the test from time to time; therefore, the teacher needs to create his or her first version of the test at very beginning as Figure 5 shows.

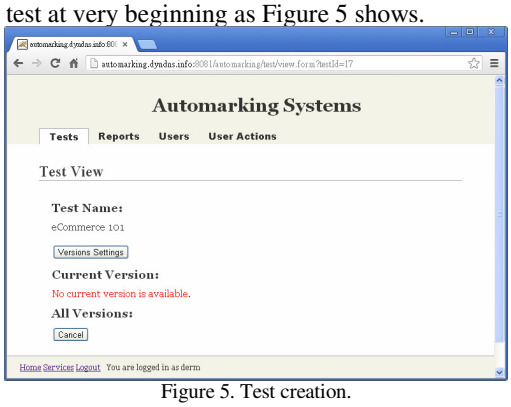


Figure 5. Test creation.

Figure 6 shows the test editing function. The teacher can "Edit" the test by choosing items from the item bank; "Assign" students to take the test; "View" the details of the test including its items and student list; "Delete" the test (i.e., the particular version of the test); and "Activate" the test for students writing this test online.

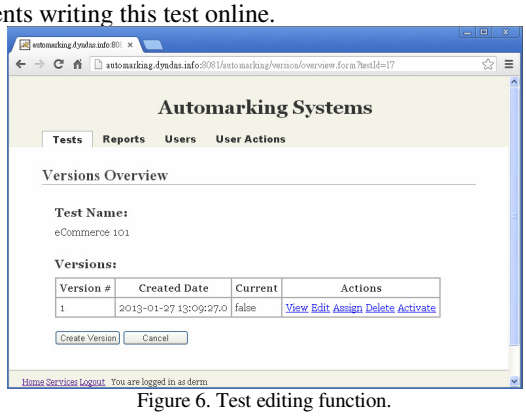


Figure 6. Test editing function.

Students can see the test, as Figure 7 shows, after the teacher "Activate" the test. Students can start writing the test by clicking "Take Test" button and can check the marking results for particular tests they have taken by clicking "View Result" button. When students are writing a test, they cannot change their answers for particular item in the test after they "Submit Response", as Figure 8 shows. At the end, students need to "Submit Exam" for teachers to either manual mark or use Automarking service to mark their answer sheets.

The teacher can manual mark students' answer sheets by clicking "Mark Test" button shown on Figure 3, or he or she can ask Automarking service to mark students' answer sheets by clicking "Evaluate Test" button instead. After all answer sheets have been marked by Automarking service, the teacher can check the test report (as Figure 9 shows) and see students' performances.

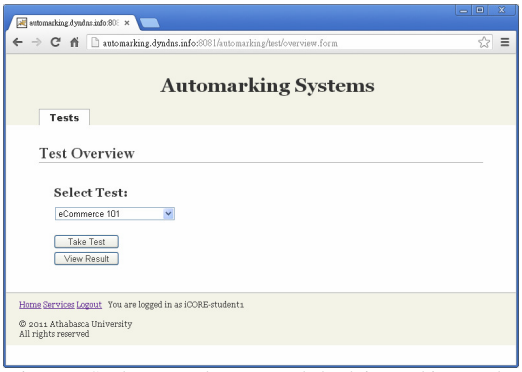


Figure 7. Student can take a test and check its marking result.

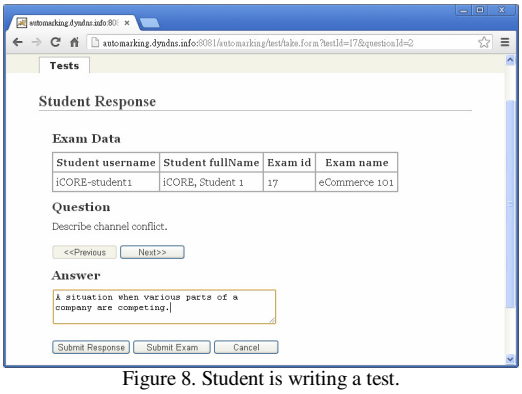


Figure 8. Student is writing a test.

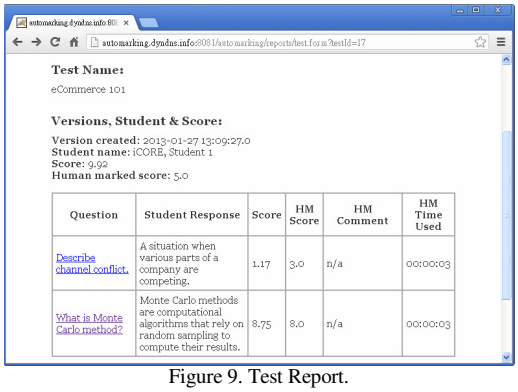


Figure 9. Test Report.

IV. CONCLUSION

Automarking web service is a completely open-access online exam system and marking service which realized the computerized short-answer marking mechanism proposed by the research team earlier. Not only schools, teachers, and students can benefit from the computerized marking service, but also developers and companies of computer-based test providers can integrate the mechanism into existing their CBT products and services, by communicating to Automarking web service with SOAP Envelope in XML. The component-based architecture selected seems appropriate as the ultimate goal of the system would be to support existing Learning Management Systems. As such, only those components required could be 'plugged into' an existing LMS to make the LMS capable of marking student responses of open-ended questions.

The system was developed under very strict constraints. The system in its current format is capable of processing answers containing a single sentence that is free of grammar and spelling mistakes. Future work is encouraged which would allow for multiple sentences to be graded based on their collective meaning. Additionally, future work could incorporate a spell and grammar checker and corrector, so schools in non-English speaking countries can also benefit from the Automarking web service.

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