DESIGN AND IMPLEMENTATION OF EASYTEST:
A WEB-BASED TEST GENERATOR

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ABSTRACT

With the advent of the web, more and more information systems are being built web-centric and
more recently, these systems are leveraging the promise of web services as well. To jump on the
bandwagon, this paper describes a comprehensive web-based test generator system that allows a
test writer to easily generate a test and manage the test takers. The test takers can in turn easily
take a test online and view the grade instantly. The system also makes use of web services to
generate statistical analysis of the test results.

Keyword: Test Generator, Web Services, Web-Based Systems

INTRODUCTION

With the advent of the web, more and more information systems are being built in a web-centric
manner to take advantage of the convenience, ubiquity, and cost-effectiveness of the web. To
leverage these advantages that are inherent in web-based systems, many test and survey writers
are developing their test/survey instruments online as well.

However, when these writers want to have an online test/survey developed, they often find
themselves creating everything from scratch and developing a lot of work manually. Also, when
the instruments are developed, the takers are typically constrained by time and location when it
comes time to actually take the test/survey. For example, evaluation (in the form of a test) and
survey activities are regularly conducted in educational institutions. Yet, in a typical institution,
the faculty and staff involved in such activities may not have the appropriate background to
create the needed web pages and host the resulting pages. Because of that, many resort to paper-
based solutions, which are more costly and less convenient. Additionally, it requires many hours
of efforts to simply proctor the test/survey.

From the test/survey takers’ perspectives, the time and location constraints of paper-based
approach are certainly inconveniences and they may even be inhibitors for some who cannot be
at a certain place on a certain time. Also, the instant response that can easily be incorporated into
web-based computer system is simply impossible for paper-based ones.

To approach the aforementioned shortcomings, many test/survey writers have turned to
commercial testing services. The most common ones allow for only simple test generations and
support multiple-choice, fill-in-the-blank, matching, short answer and true and false questions on
the same test. An example of this includes EasyTestMaker (2). But these services are only for generating tests and do not allow for test taking online and there is no test grading support.

Another class of test generators provides “services” only and there is no particular software being sold to the customer. Instead, it acts as a test service center. Users can use the service to generate, take, and analyze tests, which can be accessed as long as the users have Internet access. Test.com (5) is one of these centers.

The last type of test generators combines the functionality or products of the first two classes. They usually have multiple versions to satisfy different user requirements – a simple version that is similar to the first type, a version for intranet use, and a version for web use. An example of this class includes TG (Test Generator) from Fain & Company (6). Two others that are commonly used in educational institutions are BlackBoard (1) and WebCT (7). A comparison of the two with EasyTest is given later in this paper.

While the above services are readily available, many of them either do not offer online service (e.g., EasyTestMaker) or charge a high fee for the service (e.g., the annual fee for the service at Test.com is $3000). Even if one can afford the high price, the functionality and ease of use of the services remain something to be desired.

With the above challenges in mind, this project sets out to develop a system that targets non-profit organizations (educational institutions in particular) as a free web-based test/survey generator. It serves two main purposes, one from the instructor point of view and the other from the student’s:

1. EasyTest_Instructor: This is a web application for instructor use. Test makers can register to the system, create test, edit test, preview test, set up student accounts, grade test, and view statistical results of the test online.
2. EasyTest_Student: This is a web application for students to take test online and view grade instantly.

The system is intended to provide easy-to-follow, step-by-step guidance for inexperienced Internet and web users through its design template. Experienced users should also find it very convenient and customizable. The details of the system functionality in the form of the use cases supported are given in the next section.

This project makes use of .NET technologies (i.e., C#, ASP.NET, and XML Web services) from Microsoft for the design and implementation. Thus, it may also be used as a candidate case study for those educators who wish to study the web development technologies using .NET and Web services in particular.

**SYSTEM FEATURES (USE CASES)**

The web application and web service together provide a platform for the users to create, take, and see the results of online test, quiz, survey, or any other form of evaluation. There are two user roles in this service – the test creator and the test taker. They can be anybody who has
access to this service. The test creator can create, edit, and publish online tests through this system. They can set restriction and give permission to the users who can take their tests. They can also see the statistical results of the tests they create after they have been taken. As for the test takers, they can take the tests online anytime and anywhere as long as they are authorized and have Internet access. The various major components of the system are described below.

**Test/survey creation:** The user can create a test/survey instrument by using the design template. The template guides the user through the process by first asking for the test name, topic, and purpose. Then it lets the user select question type, enter question and the points for the question, and give correct answer and explanation. The system supports true/false, multiple choice, short-answer and open-ended questions.

**Test/survey hosting:** After the test/survey has been created, the test creator can publish it by simply clicking a button.

**Test/survey access control:** The test/survey designer can control the access to his/her instrument by adding the desired users’ usernames and passwords. The system can also give different privileges to different users. The tester/survey creator can only view the results of their own test/survey. The test/survey taker can only access his/her own and not others.

**Test/survey taking:** The test/survey taker can visit the host web site and select the appropriate instrument by entering his/her username and password. The system then authenticates the user and permits the user to take the test/survey if authenticated. The user can get feedback right after the test is submitted.

**Test/survey result collection:** The system can gather the test/survey results and allows the creator to view the statistic results in plain or graphical formats. The creator can also view individual’s results.

**Online help and user tutorial:** An easy-to-follow tutorial (using a step-by-step approach, with narrative examples and screenshots) is given to train the user.

The above components can be furthered classified into use cases according to the user role. Table 1 given below provides a list of the use cases from the two actors’ points of views.

<table>
<thead>
<tr>
<th>Actors</th>
<th>Use Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test/Survey Creator</td>
<td>Register online, Login, Login help, Create tests, Edit tests, Preview tests, Create test taker accounts, Upload test taker accounts, Grade tests online, Search for a test, View the statistic results of tests</td>
</tr>
<tr>
<td>Test/Survey Taker</td>
<td>Take tests, View test grade online</td>
</tr>
</tbody>
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Table 1: System Use Cases

Table 2 below illustrates the differences for creating/administering tests between EasyTest and two popular software packages – BlackBoard and WebCT.
<table>
<thead>
<tr>
<th>Feature</th>
<th>EasyTest</th>
<th>BlackBoard</th>
<th>WebCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>All applications are accessed Via World Wide Web</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tests - Time Released</td>
<td>Can administer online tests that are timed (released during certain periods of time).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test - Feedback</td>
<td>All applications provide programmed feedback to students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test – Grading</td>
<td>All applications provide mechanisms to record student’s performance.</td>
<td></td>
<td></td>
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<tr>
<td>Anonymous Test</td>
<td>All applications allow the creation of anonymous tests for which no grades are assigned.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tests – Question Types</td>
<td>EasyTest allows multiple-choice, true-false, fill-in-the-blank, multiple answer, and short answer/essay questions to be used in tests.</td>
<td>BlackBoard allows multiple-choice, true-false, fill-in-the-blank, multiple answer, ordering, and short answer questions to be used in tests.</td>
<td>WebCT allows multiple-choice, matching, short answer, true-false, calculated (generated on the fly based on rules and expressions) questions to be used in tests.</td>
</tr>
<tr>
<td>Test Bank</td>
<td>Allows the generation of a test bank.</td>
<td>Both BlackBoard and WebCT allow the creation of a question bank from which questions can be drawn for random inclusion in a test.</td>
<td></td>
</tr>
<tr>
<td>Ease of Use</td>
<td>While EasyTest offers less customization possibilities than BlackBoard and WebCT, selected faculty found EasyTest easier to use.</td>
<td>In order to use proficiently BlackBoard or WebCT some training may be required. The learning curve of BlackBoard and WebCT is higher than EasyTest.</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>Free</td>
<td>License Fee based on capabilities and version.</td>
<td></td>
</tr>
<tr>
<td>Source Code</td>
<td>Available for use/study</td>
<td>Not Available</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Comparison of the features of EasyTest, BlackBoard and WebCT.

**SYSTEM ARCHITECTURE**

EasyTest was developed using Microsoft .NET Technologies. The base user interface of the EasyTest was created using ASP.NET web pages (.aspx files) with Microsoft Visual Studio.NET 2002. Reusable user interface widgets, such as the navigation menus, are implemented as ASP.NET user controls (.ascx files). User controls are also used to create dynamic page contents, such as the list of questions in a test/survey. The data for EasyTest is stored in a Microsoft SQL Server Desktop Engine database and accessed via stored procedures. The ADO.NET database code to access these stored procedures is then encapsulated in a component layer. The test result statistical report facilities are implemented as an ASP.NET web service (see Figure 1).

![System Architecture Diagram](image_url)
For the operating environment, EasyTest requires Microsoft Internet Information Server Version 5.0+ to host the system. The application supports most current web browsers but in order to ensure total functionality, the clients may require Microsoft Internet Explorer version 6.0+.

As for the interface design, to ensure a usable system, EasyTest has been designed using a user-centered approach and has incorporated the various sound principles of user-interface design (3, 4).

There are two types of primary users for EasyTest – instructors and students. EasyTest provides distinctive services for each type of user. However, the style guides, screen layouts and navigation strategies used are consistent throughout the design of the application. Having a common interface design for “EasyTest-Instructor” and “EasyTest-Student” ease the communication about EasyTest issues between instructors and students. The home pages for EasyTest-Instructor (see Figure 2) and EasyTest-Student list and briefly explain all the available options.

A dynamic two-level navigation bar was designed to access EasyTest. The first level is a traditional tab navigation bar displaying the main options available to instructors and students. For example, the options available to instructors are: Home, Create Test, Edit Test, Preview Test, Student Account, Grade Test, Statistical Report, Help, and Logoff (see Figure 2). The tab is color-coded to indicate the current page. Certain tabs also display a “bread crumb” (second level navigation) that shows the progress of a user towards completion of a given task (see Figure 3). This navigation strategy is also effective to keep the user aware of his/her location within EasyTest at all times.

Figure 2: Easy Test-Instructor’s Home Page

EasyTest effective interaction design also facilitates the creation, grading and maintenance of online tests so that instructors can immediately be productive virtually without any training. Figure 4 depicts the web forms used and the coherent structured devised to create online exams using EasyTest.
An instructor can also view the statistical report of a test at any given time. By choosing the Statistical Report tab (see Figure 5), he/she can see a test’s average, high, low, and median scores as well as the number of students in the A, B, C, D, and F ranges. As mentioned, the portion of the system makes use of Web services technology. Namely, with the test data collected, Web services are called with the data and the statistics are computed. With Visual Studio.NET, the process of making a method a Web service is as easy as putting an additional attribute called WebMethod (written as [WebMethod] before the method definition) for the method. After that, the method is published as a service that can be consumed over the Internet via SOAP message.
SUMMARY AND CONCLUSION

This paper describes a system that eases the process of constructing test, survey, or other form of evaluation. There will be no need for the users to do any formatting as the generator produces not only web pages that adhere to the standard user interface and human factor guidelines but also printer-friendly pages. The users can print out the test/survey instruments they create and distribute them to the test/survey takers if they do not want them taken online.

The system also allows the creators to publish their test online easily. This “one-click publish” is especially a great feature for users who are not familiar with web page creation and publishing. In addition, the system allows the users to view the test results. It generates different result reports based on the parameters user selected. The results, which can be shown in plain text or graphics, can free the users from having to do much calculations and analysis of the test results.

Lastly, the test takers can access the test anytime, anywhere as long as there is Internet access. This offers great flexibility to them and at the same time permits tremendous savings on time, labor, and other resources.

REFERENCES