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On-Line Course Specification Form for the Thai Qualifications Framework

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Abstract

The Thai Qualifications Framework (TQF), which has been proposed and legislated by authorities overseeing higher education in Thailand, aims to provide some measure of quality control over university level education in the country. TQF dictates that a number of reports pertaining to an academic program be produced for an independent committee to audit for the program's quality and effectiveness. One of the reports concerns individual course information, which must be filed every semester for every course taught. TQF provides a standard form, the Course Specification Form (CSF), for this report. This paper describes the design, development, and initial evaluation of a web-based application that allows course instructors to fill out CSF on-line and save all the information to a centralized database. Initial study shows that the amount of time spent in producing the report through our on-line form is three times less than that required using a word processing software. In addition, there are other clear benefits from having the information stored in electronics database. These are, for example, reduction in physical storage space, and increase speed and accuracy for search and retrieval operations.

1. Introduction

As the Thai economy grows into a knowledge-based one, highly skilled work forces are constantly in high demand. To answer this call, in recent years, universities and other higher learning institutions in Thailand have either increased enrollment in existing programs or opened up new ones, often tailoring to specific needs of the market. The Office of the Higher Education Commission (OHEC) is concerned that this trend might exhaust the limited training resources in universities and our higher education system as a whole may face a serious quality problem. Therefore, it has set up the Thai Qualification Framework (TQF) [1], which the parliament has ratified and is now a legal framework that every legitimate higher learning institutions in the country must adopt.

TQF requires that a number of reports related to an active academic program be produced for auditing by an independent committee set up by the OHEC. The job of this committee is to evaluate those reports and determine if the program maintains its promise for quality. One of the reports concerns individual course information that must be filed by each responsible course instructor every semester the course is taught. TQF has a standard form for this report called the Course Specification Form (CSF) [2]. CSF contains 7 sections that must be completely filled out. These sections are:

1. General information
2. Purposes
3. Elements
4. Learning objectives and evaluations
5. Planning
6. Resources
7. Revision

CSF can become particularly onerous especially for large faculties. The Faculty of Engineering at Kasetsart University (KU), one of the largest engineering faculties in the nation has over 40 programs offered on its Bangkhen campus alone. This translates into roughly over 2,000 potential course reports that must be produced annually. A traditional way of creating and managing reports uses a word processing program, such as Microsoft's Word. A responsible course instructor would fill out the form, print and hand it over to his or her assistant for tracking and recording. Handling such staggering amount of reports with traditional paper-based methods is cumbersome. It takes a non-trivial amount of time for the instructor to complete the form and paper reports require storage spaces and physical bookkeeping. Thus, for a large faculty like ours, we feel that electronics-based reports for CSF would be more suitable. We have, hence, created a web-based application to allow instructors to complete CSF on-line and all the information will be

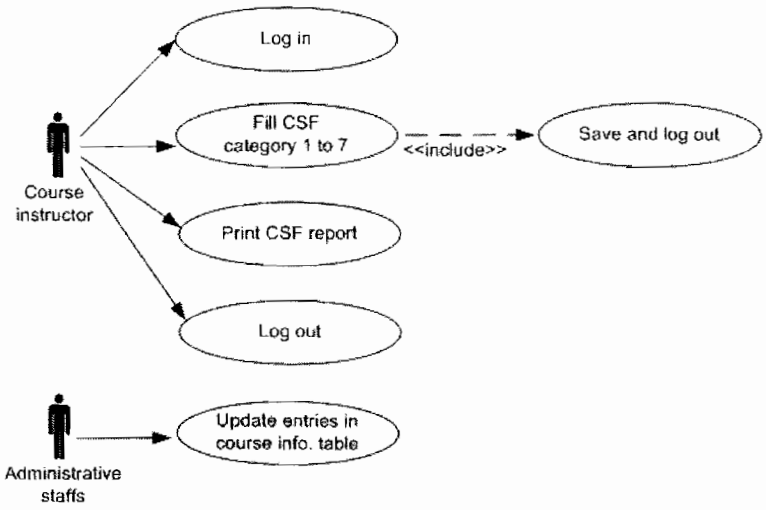

Figure 1: Use-case diagram for our on-line CSF.

stored in a centralized database. The instructors also have an option to print out the reports for his own record. The on-line CSF enables the instructors to complete CSF in considerably less time than with traditional methods using word processing software. In addition, there are clear benefits of having the information stored in electronics database. It requires less space and allows the search and retrieval operations to be performed quickly and accurately. Data analysis can also be done with relative ease. And, we save papers and the environment.

A closer look at CSF reveals the following characteristics that make it particularly suitable for electronic processing:

- Information in the first three sections can be obtained directly from the curriculum. Thus, if we make such information available in an electronics database, we can use it to pre-fill CSF in these sections.
- There are repetitive information that can be reused in later sections from earlier ones.
- Some later sections are dependent on the earlier ones and these dependences are sometimes hard to track manually.

This rest of this paper is organized as follow. Section 2 discusses the design and development of our on-line CSF system. Section 3 presents its initial evaluation. Section 4 and 5 describe related work and conclude the paper with a summary.

2. Design and Development

This section describes the design and development of an on-line CSF. We developed this web-based application using the PHP language [3] and MySQL [4] database. Our choice is based solely on familiarity and expediency. We did not use any special features that are only available in PHP or MySQL that will prevent our design from being realized in other platforms.

2.1. Basic Operations

Figure 1 shows a use-case diagram for our on-line CSF. There are two kinds of users, course instructors and administrative staffs. The former group is our main focus. A course instructor first logs in to the system and proceeds to fill out each section of CSF. If the instructor is interrupted, he or she has a choice to save the work and resume it in subsequent sessions. Once completed, the form can be printed out for the instructor's record. Currently, the final CSF printout is still in HTML format. We plan to upgrade it to PDF format at around the beginning of 2011. Another group of users is the supporting staffs. They have the responsibility to keep the course information table up-to-date. This allows CSF to be pre-filled with accurate information given a course code. The information in the course table is never static. As new courses added in and old courses revised, the table needs to be updated regularly.

2.2. Course Information Table Creation

As noted in the introduction, the first three sections of CSF deals with the general course information. They

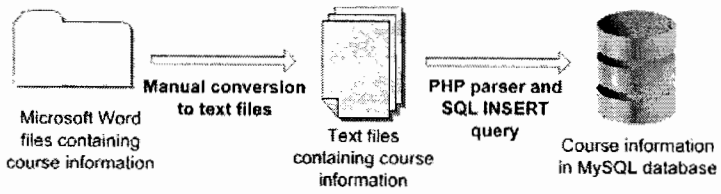

Figure 2: Generating course information table from Microsoft Word files

can mostly be pre-filled by the application in order to to save time in and increase the accuracy of filling out CSF. Once given a course code, the on-line CSF should be able to pull relevant information from the course table to fill in the relevant fields, such as those related to course description, course type, and prerequisites.

At the time prior to the development of our on-line CSF, the administrative staffs maintain information about the courses in Microsoft Word and PDF files. It is very hard for the on-line CSF to extract the information directly from those file formats. Therefore, we need to create a course information table and place it in a database that will allow the on-line CSF to readily retrieve the information from it. Figure 2 shows pictorially the process for generating the course information table. We first manually convert the existing Word files into text files. Once we have the corresponding text files, we construct a simple LL(1) [5] parser in PHP to parse those files and automatically create and modify the course information table. Initially, the parser creates an empty course table. Once a production rule for a given course code is "popped off the stack", we have already gathered all the relevant tokens such as the course name, the prerequisites, and the course description. We then insert a semantic action in the form of SQL INSERT query to modify the course table by adding a new entry into it. Theoretically, we could develop a parser to parse the PDF and Word files directly. However, this is very difficult to do in practice primarily because we do not know the exact structures of those files. These are proprietary information that the makers of Word and PDF do not normally release to the public.

The course information table is searched by two keys, primarily the course code and secondarily the year of the curriculum. The Faculty of Engineering at KU currently operates on two active curricula, a 2003 curriculum followed by senior year students and the latest 2008 curriculum followed by freshman to junior year students. Our course information table presently contains over 2,000 records to support courses for both curricula.

2.3. LDAP Authentication

The current on-line CSF system is only open to responsible course instructors of the Faculty of Engineering. Instead of creating a whole set of new user accounts with new passwords, which inconveniences users of the system, we authenticate legitimate users using their current KU ID and passwords. The authentication process goes through the central authentication server at KU's Office of Computer Services (OCS) employing the LDAP [6] protocol. We use the PHP's LDAP authentication code as recommended by the OCS, which can be obtained at: https://ldap.ku.ac.th/.

2.4. Database Design

Figure 3 shows an Entity-Relationship (ER) diagram that depicts the structure and relation of our on-line CSF database. We use the ER notation from Chen's original ER paper [7]. There are primarily four tables in the database, Account, CoureseInfo, Objectives, Plans, and Evaluations. The Account table contains authorized users of the system. There are two groups of users as described in Section 2.1, instructors and supporting staffs, each with different privileges for interacting with the database. The CourseInfo table has the relevant course information with attributes such as CoureseType and CourseDescription. Information from this table is used to pre-fill CSF form as described in Section 2.2. The Objectives, Plans, and Evaluations tables hold information for section 4 to 6 of CSF form (See the Introduction Section).

2.5. Form Design

The basic philosophy behind the form design for the on-line CSF is as follow: try minimizing the use of text boxes where users need to type some text in by replacing those with check boxes where users only have to tick on. The use of text boxes should be limited to those fields that can be pre-filled using the information from the course information table. Our

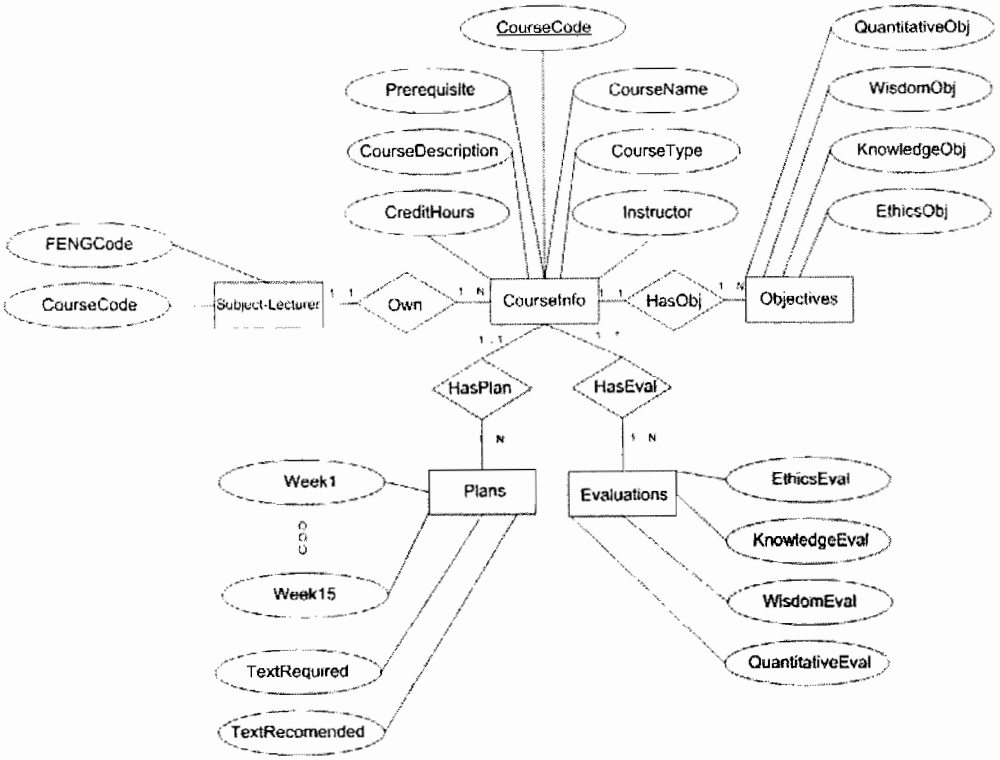

Figure 3: ER diagram for our on-line CSF.

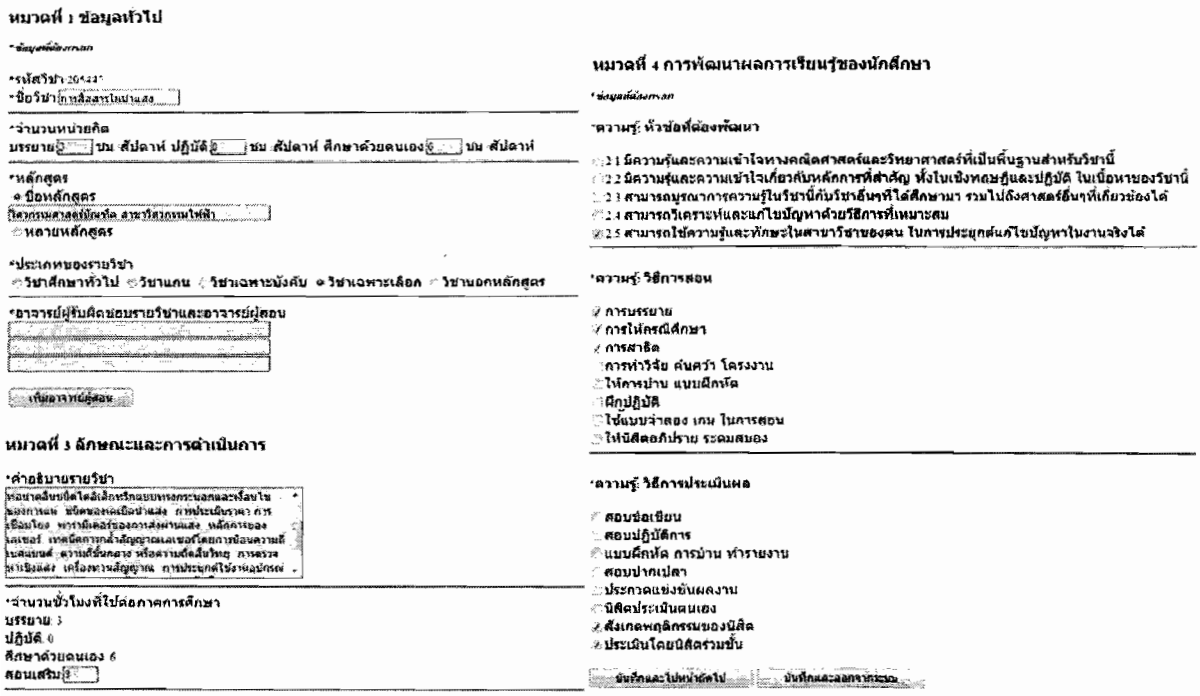

Figure 4: Pre-filled information based on course ID. In the Figure 205447 is the course ID for "Optical Devices" (left panel) and replacing rectangular text boxes in the paper CSF with check boxes in the on-line CSF (right panel).

curriculum year	subject code	subject name	on-line time	word time	speedup
2551	205311	Signals and Systems	4 min 2 sec	11 min 32 sec	2.86
2551	205314	Digital Signal Processing	2 min 35 sec	9 min 38 sec	3.73
2551	205321	Principles of Communications	2 min 44 sec	10 min 7 sec	3.70
2551	205356	High-Voltage Engineering	3 min 50 sec	10 min 48 sec	2.82
2551	205362	Linear Control Systems	2 min 22 sec	11 min 2 sec	4.66
2551	205415	Digital Image Processing	3 min 12 sec	9 min 15 sec	2.89
2551	205429	Satellite Communications	3 min 18 sec	10 min 51 sec	3.29
2551	205432	Optical Devices	2 min 24 sec	9 min 11 sec	3.83
		Average	**3 min 3 sec**	**10 min 18 sec**	**3.38**

Figure 5: Time spent filling out CSF on-line versus using Microsoft Word

focus will be on section 4 to 6 of CSF as the first three sections can mostly be automatically filled in. The left panel of Figure 4 shows a snapshot of section 1 and 3 of the on-line CSF form that have been pre-filled using the information from the course information table.

The right panel of the same figure captures part of section 4 of the on-line CSF. We can see that there are only check boxes in this part. The same part on the paper form all comprises of rectangular empty areas that users must type their responses in. In order to come up with appropriate choices in those check boxes, the Academic Committee of the Faculty gathered to compile common responses and decided on those choices. The goal was to create choices that mostly cover the anticipated responses from users and make them feel adequate with the choices. Hence, there will not be a need to type anything in extra.

In addition, our form allows dependent sections to be linked across pages. If subsequent pages depend on earlier responses of the user, he or she will be able to see them in those pages, for example, in a form of HTML's Select menu.

2.6. Basic Defenses

An on-line form processing application opens up a channel for security attacks over the network. While we have an authentication process in place, a good defense strategy is always defense in depth where there exist multiple layers of protection instead of a single one. The subject of web security is clearly beyond the scope of this paper, however. The three types of attacks that are common on web-based form processing are cross-site scripting, directory traversal, and SQL injection. Here, we outline some examples of basic defenses that we have put in to reduce the risk of these attacks.

- Use regular expression to check the expected format of inputs to particular fields.
- Use the strip_tags() function to eliminate any HTML or PHP tags from user inputs.
- Use htmlspecialchars() to disallow the interpretation of markup tags in HTML.
- Avoid the use of "dangerous" functions such as eval(),system(), and exec(), which allow the input strings to be interpreted as shell commands.

3. Evaluation

This section presents an initial evaluation of our on-line CSF.

3.1. Experimental Setup

We asked 8 users to complete both the on-line and the paper CSF for a given course. Each user first fills out the on-line CSF and then the paper CSF. The on-line CSF was completed via a web-based application whereas the paper CSF via word processing software, Microsoft's Word. We did not perform an experiment with hand-written paper CSF as we feel this mode is no longer representative of what is presently being done to produce a report. We then recorded the time each user takes to complete the form in both cases. Before we began the experiment, we had given each user an adequate training so that he or she was aware of the function of CSF and was comfortable with both the on-line and paper CSF. Each user was also given a detailed instruction on what to fill in CSF for each of the courses chosen for the experiment. The instruction was intentionally formatted to be different from CSF.

3.2. Environment

We accommodated the paper CSF on Microsoft's Word 2007. The on-line CSF was an application that runs on Microsoft Internet Explorer version 8. All our experiments were performed on an Intel 1.2 GHz Core Duo machine with 1.5 Gbytes of RAM running 32-bit

Windows Vista operating system. We used Apache web server version 2.2.14 and MySQL database server version 5.1.41 running on local host.

3.3. Result

Figure 5 shows the result of the experiment where we have chosen 8 courses taught in the Electrical Engineering Department in the first semester of 2010 to evaluate our on-line CSF. All the courses are upper-level undergraduate courses, some of which are core courses (e.g. Signals and Systems) and others are elective courses (e.g., Optical Devices). We see that on average users were able to complete the form on-line about 3.4 times faster than they do using Microsoft's Word. The absolute average time for completing the on-line and paper CSF is about 3 and 10 minutes, respectively. Provided that the running platform does not change, these numbers are expected to be higher in real situations when users are not given instructions on what to fill in. In addition, we also expect the absolute number for the on-line CSF to be a bit higher when running off local host because of network delays.

We believe that the following features in the on-line CSF contribute to the significant reduction in the time required to complete the form:

- Allow general course information to be pre-filled.
- Minimize typing into text boxes (by replacing them with tick boxes without loosing essential contents).
- Repetitive information can automatically be filled in.
- Dependent information from earlier pages can be linked and selected in subsequent pages.

4. Related Work

Our on-line CSF belongs to a class of web-based applications called multi-page form processing. These applications are common in e-commerce websites such as amazon [8] and ebay [9] where they use multi-page form to, among other things, collect member information. Another heavy use of multi-page form processing is on-line tax software [10] that allows users to fill in their tax returns on-line and the information is linked to the Internal Revenue Service (IRS) for processing.

5. Summary

This paper describes the design and development of a web-based application that allows users to fill in the Course Specification Form (CSF) on-line. CSF is part of the Thai Qualifications Framework (TQF) that must be filed every semester for every course taught. Thus, it becomes a direct burden to the responsible course instructor. Our on-line CSF was developed to help alleviate this burden. Initial study has shown that the on-line CSF can reduce the time required to produce CSF by a factor of three. In addition, having the CSF information stored in electronics form facilitates search and retrieve operations and reduces physical storage space.

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