

INTEGRATED LEARNING SYSTEM



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The present invention relates to an integrated learning system and, more particularly, to such a system suited, although not exclusively, to the development and management of e-learning
5 content and services for companies and institutions.

BACKGROUND

Traditional training programs require detailed objectives and master trainers. These processes are slow and tend not to
10 be adaptive to the specific needs and characteristics of each recipient of the training.

It is an object of the present system to address or ameliorate one or more of the above mentioned disadvantages.

15 BRIEF DESCRIPTION OF INVENTION

Accordingly, in one broad form of the invention there is provided an integrated learning system comprising at least:

- (a) A content creation subsystem
- (b) A content delivery subsystem
- 20 (c) A content consumption management subsystem

Preferably said system further includes a multi-format storage subsystem and a format converter subsystem.

In a further broad form of the invention there is provided a content builder for the above referenced integrated learning

system; said content builder adapted to derive data in different formats and from different sources; said builder further adapted to format said data into a unified format and to order said data into content in the form of learning objects.

5 In yet a further broad form of the invention there is provided a content consumption management subsystem for an integrated learning system as referenced above, said content consumption management subsystem incorporating a user usage profile store which monitors and stores data pertaining to usage
10 by a user of content made available by said integrated learning system.

BRIEF DESCRIPTION OF DRAWINGS

Embodiments of the present invention will now be described
15 with reference to the accompanying drawings wherein:

Fig. 1 is a block diagram of an integrated learning system in accordance with a first generalized embodiment of the present invention;

Fig. 2 is a block diagram of a content creation portion of
20 the system of Fig. 1;

Fig. 3 is a flow diagram for the creation of content suitable for use in accordance with the system of Fig. 1;

Fig. 4 is a block diagram of a system architecture suitable for an implementation of the content creation portion of the system of Fig. 1;

Fig. 5 outlines a table-based implementation of the system
5 of Fig. 4;

Fig. 6 is a block diagram of the functional capability of an authoring portion of an implementation of a content creation portion of the system of Fig. 1;

Fig. 7 is a block diagram of a format converter sub-system
10 suitable for use with the system of Fig. 1;

Fig. 8 is a block diagram of a system architecture suitable for implementation of the content consumption management portion of the system of Fig. 1;

Fig. 9 illustrates a role-based template for an
15 implementation of the content consumption management portion of the system of Fig. 1;

Fig. 10 illustrates a skill hierarchy applicable to the content consumption management system of Fig. 1;

Fig. 11 highlights characteristics of an implementation of
20 the content consumption management portion of the system of Fig. 1;

Fig. 12 illustrates exemplary steps in the operation of an implementation of the content consumption management portion of the system of Fig. 1;

Fig. 13 defines table structures suitable for use with an implementation of the content consumption management portion of the system of Fig. 1.

5 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With initial reference to Figs. 1, 2 and 3 there is illustrated in generalized form an integrated learning system 10 in accordance with a first preferred embodiment of the present invention.

10 Broadly, the integrated learning system 10 includes a content creation portion which, in this instance, comprises content builder 11 which is adapted to generate single-format content 12 from content initially stored in varying formats and including, in this instance, video data 13, training course data
15 14, user information tables 15 and other raw content 16.

The integrated learning system 10 further includes a content delivery system, in this instance in the form of a browser interface 17 which includes a link 18 to course content which is specific to a user for whom the particular browser interface 17
20 has been customized. In this instance exemplary user 19 is able to "click" on link 18 in his or her specific browser interface 17 so as to view sub-portions of single format content 12 which have been selected by system 10 as specific to user 19.

In this instance user 19 is part of an enterprise or institution 20 which, typically, will include administration staff 21, training staff 22 and management staff 23 as well as other users 19A of integrated learning system 10.

5 The roles of the staff 21, 22, 23, 19, 19A can be modeled within a structure template 24 forming part of a content consumption management system 25 which itself forms a further portion of integrated learning system 10 as illustrated in Fig. 1.

10 The three primary systems, namely the content creation system, the content delivery system and the content consumption management system inter-relate and co-act in a manner to be described in more detail below thereby to provide integrated learning system 10 which is adapted to provide course content
15 specific to exemplary user 19 by means of browser interface 17 or like electronic-based delivery medium having commenced with multi-format data derived from multiple sources such as data sources 13, 14, 15, 16.

20 With reference to Fig. 2 the content consumption management system 25 of Fig. 1 co-acts particularly with the content builder system 11 of Fig. 1 particularly, although not exclusively, by way of a user usage profile store 26. The store 26 tracks the usage of content 12, as illustrated in tabular form in Fig. 2, so as to build a profile of each user 19. The information derived

from the user usage profile store 26 is utilized by the content consumption management system 25 to assist in the further development of training courses and course content suited to and specifically directed at each individual user 19.

5 With further reference to Fig. 2 the single format content 12 comprises a plurality of learning objects, designated in this instance LO1, LO2 ... LO N. The learning objects are derived from a wide range of multi-format data such as data 13, 14, 15, 16 and are converted in the content builder 11 by a converter 27 into a
10 unified format suited for driving browser interface 17. In a particular preferred form the format is XML format.

With reference to Fig. 3 particular steps in the generation of course content are illustrated in block diagram form as can be implemented by content builder 11. It will be observed that the
15 building process passes through a number of phases each designated by a status, being one of "under construction", "waiting review", "waiting approval" and "released".

With reference to Figs. 4 to 13 inclusive a specific example of an implementation of an integrated learning system 10 will now
20 be described with reference to the subsystems making up the system:

CONTENT CREATION SYSTEM

1.0 Introduction

Virtual Content Factory (VCF), a sub system of Learn For Life project, is targeted to provide a web-based content
5 management system.

As project requirement states, the VCF should provide functions of reusable content management plus content builder. We use 'Factory' to simulate the idea of storing raw materials that reflects the reusable content in different format, such as
10 text, audio and video, and producing products that are the on-line training materials. As for meeting the requirement of tracing learners' progress on the learning materials, VCF should also keep the record of the users' usage of the content.

VCF is a sub system of Learn For Life project, so it has to
15 provide interfaces to its sibling systems of My Portal as well as ISDS.

Design Overview

2.1 General

20 The solution for a system of reusable content management and content builder was proposed with the following design goals:

- ❖ To provide Course Builder Wizard for generating on-line training modules from the reusable content stored in the 'Factory'.
- ❖ To simplify the reusable content management by properly categorizing the content according to the specific domain.
- ❖ To tag content with metadata compatible with IMS standard.
- ❖ To convert existing content from the form of HTML and store into the 'Factory'.

2.2 Design Goal

As per project requirements, the system is designed to support reusable content management. The vision, however, is to design a site architecture that can be easily extended to support the reusability of different domain content, it should also compatible with the Instructional Management System Global Learning Consortium (IMS) standard.

The specific design goals are:

1. **Broad reach:** The system must reach to as wide an audience as possible over the Internet medium. This means the use of ubiquitous Internet technologies such as XML, HTML, JSP and CSS.
2. **Extensibility:** The system should be designed so that features and functions can be easily plugged-in in the future.

3. **Reusability:** The system should be designed to identify and implement reusable architectural components that can be leveraged by future projects. This is a key design objective.

5 4. **User Interface:** The system should have a user interface that is intuitive and consistent. A user interface standard should also be defined to support future additions to the site.

10 5. **Scalability and Robustness:** The system should be designed to transparently scale to take advantage of additional computing power or other technological improvements the Internet may have in the future.

2.3 Design Approach

The system design approaches are follows:

15 1. **Three-tiered distributed application architecture:** The system will adopt a distributed web application architecture that consists of the three logical tiers that may physically run on different parts of the network. This ensures extensibility, scalability and robustness to handle
20 large number of users.

2. **"Object-oriented" approach to design;** component approach to implement: The system design emphasizes on the reusability and encapsulation object-oriented principles. The system will implement these principles with Java Beans.

3. **Leverage on Java, JSP, and Java Beans technologies:** The system will rely on the "write once, running every where" Java centric technologies to develop reusable software components.

5 3.0 System Architecture Overview

3.1 Terminology

1. JavaServer Pages (JSP):

2. Java Bean:

3. Microsoft SQL Server:

10 4. Video Server:

5. Borland Application Server:

3.2 Borland Application Server, Microsoft SQL Server and Video Server

15 4.0 Application Architecture

4.1 Overview

The schematic of the system architecture for VCF is show in Figure 4.

20 The architecture adopts the three-tier architecture for building distributed web-based applications. The three tiers are:

1. Presentation Tier:

2. Application Tier:

25 3. Data Tier

4.1.1 Presentation Tier

The Presentation Tier refers to the user-interface between the users (consumers) and the System. For example, users access and interact with the System through HTML-based web pages with a web browser.

4.1.2 Application Tier

The Application Tier is the middleware that encapsulates common content management processing functions required to build the reusable content factory.

It has the following logical parts:

1. Factory user admin services.
2. Content resource allocation control services.
3. Content builder services.
4. Content management services.

Factory user admin services: These refer to manage authorized content factory users by assigning proper rights. The factory users are system admin, content provider, content editor, course builder, course reviewer and course release approver.

Content resource allocation control services: These refer to assign the necessary spaces for storing result courses of XML files, or audio/video files.

Content builder services: These refer to course builder wizard to generate online courses from factory reusable content.

Content management services: These refer to core content reusable functions by provide content metadata tagging, index, sorting and searching services.

4.1.3 Data Tier

5 The Data Tier refers to front-end and back-end data-sources that the VCF System will interact with. It includes the SQL server database of user information tables, raw content unit; file systems of training courses and video data service.

4.2 Walkthrough

10 The following example gives an idea of how a course can be built, reviewed and released online by using VCF system.

Step 1: Course builder chooses to use course builder wizard or to build the course by interactive mode. In the process, the course status is 'Under Construction'.

15 Step 2.1: If the option is using Wizard after step 1, then the Wizard will guild the user, who is course builder, to generate the course materials steps by steps. The end result of the course will be in the content of XML format in the allocated file system space. And the status of the course is 'Waiting
20 Review'.

Step 2.2: If the option is using interactive mode after step 1, then the course builder need to instruct to build the course structure and import the content through the interactive mode interfaces. And the end result is also in the XML format of

files allocated on the file system. When complete, the status of the course changes to 'Waiting Review'.

Step 3: Then the course reviewer needs to go through the course materials, do comment or modify. And after complete, the
5 status changes to 'Waiting Approval'.

Step 4. The course approver then will review the course again and author the system admin to active the course status as 'Released', if the course content is considered as completed. At
this point, then the course module is available to consumer as
10 accessible online training course module.

5.0 JSP Pages

JavaServer Pages are used to implement the interactive, dynamic interface to users for doing processes on 'Factory'.

These pages are grouped into the following logical groups.
15 They are,

5.1 User Admin pages

5.2 Resource Admin pages

5.3 Content management pages

5.4 Wizards pages

20 5.5 Interactive Mode pages

6.0 Components/Beans

To try to make the software as reusable components, we adopt Java Bean technology to make business process and common process into Java Beans. These beans can be linked together into

workable process flow to meet the required jobs. And these beans functions can be expand easily if the requirement changed or new functions are introduced in future.

For convenient management, these reusable software components are grouped into the following groups:

1. Database access beans
2. HTML/XML parser beans
3. Presentation beans
4. File system operation beans

10 7.0 Database Design

The system is database centric, so the process and interface information need to be captured into the relevant tables. The tables may group into the following categories

1. User tables - For content user management
- 15 2. Content tables - For reusable content management
3. Metadata tables - For link the metadata tagging
4. Resource tables - For allocate physical space for audio/video files
5. Interface tables for My Portal - For interfaces with My
- 20 Portal requirement
6. Interface tables for ISDS - For interfaces with ISDS requirement, and content usage tracing

FORMAT CONVERTER FOR CONTENT CREATION SYSTEM

HTML Parser for VCF

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Problem

There are lots of e-learning courses on different platforms, for instance: BlackBoard, Lotus Notes, WebCT etc. We
10 need an application to convert these HTML format courses into
reusable LO, and store the LO in our Virtual Content Factory.

Solution

Fig. 7 illustrates a format converter in the form of an
15 HTML parser.

The application has these features:

- ❖ Application should be able to access the course page from some security platform, eg BlackBoard.
- ❖ Identify the content from HTML format.
- 20 ❖ Classify the content, add Meta Data, and reformat the object as VCF needed.
- ❖ Store the LO in the VCF.

Other Area

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1. Convert Microsoft Word and PowerPoint format to Learning Object.
2. Upload the local files to VCF directly.

AUTHORING SYSTEM FOR CONTENT CREATION SYSTEM

Fig. 6 illustrates the functional components of the process of authoring a course document or learning object and the tools available for doing so.

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CONTENT CONSUMPTION MANAGEMENT SYSTEM

1.0 Introduction

Skills Development System (SDS) is another sub system of the Learn For Life project. It is a web-based skills management system that maintains training plans, training reviews and detailed skill descriptions of employees. It has different roles to support different types of users, like trainer and user. It is designed so that the system could be used in many companies each having their own sets of skills

15 SDS ties closely with the Virtual Learning Center (VLC) to provide a convenient interface for on-line learning.

2.0 Design Overview

2.1 General

20 The system is to provide a framework to manage training plans, reviews and skills of employees in a company. The different roles and their functions are shown in the table below and in Fig. 9.

Roles	Functions
Administrator	Create and maintain system settings like job types, departments and users.
User	Access courses, view training reviews, training progress and skills.
Trainer	Create courses, schedules, training plan, skills, reviews and reports.
Manager	Approve plans, view reports and training plans and create reviews as well.

A two-level skill hierarchy as shown in Fig. 10 is used so that we can capture details of a company's skill needs and map it to their job functions. The relationships
5 between these levels and other components of the SDS system are also shown below.

2.2 Design Goal

The specific design goals are:

- 10 1. To create the necessary support tools for the system.
2. To have a structure to capture training information.
3. To be able to create and maintain employees' training plans and skills.

2.3 Design Approach

The system design approaches are illustrated in Fig. 11 and are as follows:

1. **Three-tiered distributed application architecture:** The
5 system will adopt a distributed web application architecture that consists of the three logical tiers that may physically run on different parts of the network. This ensures extensibility, scalability and robustness to handle large number of users.

2. **"Object-oriented" approach to design;** component approach to
10 implement: The system design emphasizes on the reusability and encapsulation object-oriented principles. The system will implement these principles with Java Beans.

3. **Leverage on Java, JSP, and Java Beans technologies:** The
15 system will rely on the "write once, running every where" Java centric technologies to develop reusable software components.

20 3.0 Application Architecture

3.1 Overview

The schematic of the system architecture for SDS is shown in Figure 8.

3.2 Walkthrough

With reference to Fig. 8 and Fig. 12 the following example gives an idea of how the SDS can be set up and used.

Step 1: The administrator sets up the system by entering basic data such as jobs, departments and sections. Then he proceeds to create users and assigning them roles of training officer, manager or user to the various departments.

Step 2: The training officer creates job functions, skills, skill elements, performance criteria, courses and schedules. Once mapping of job functions to skills is complete, he can start creating training plans for his employees.

Step 3: The manager approves the checklist and the finalized training plan will then be generated. The employee will then sit through the profiler to determine the exact courses he needs.

Step 4: Review can be created as and when needed.

A company that needs a more detailed training description can achieve this by increasing the number of skills associated with a task. On the other hand, a one to one mapping of task to skill can be used when details

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4.0 Database Design

With reference to Fig. 13, and with the exception of system settings, all other data is stored in the database. The tables may group into the following categories

1. User tables - user profiles, user skills, departments and sections.

2. Skill tables - template for the two level skill structure

3. Training tables - courses, schedules, reviews and training
5 plans.

The above describes only some embodiments of the present invention and modifications, obvious to those skilled in the art, can be made thereto without departing from the scope and spirit of the present invention.

CLAIMS

1. An integrated learning system comprising at least:

(a) A content creation subsystem

(b) A content delivery subsystem

5 (c) A content consumption management subsystem

2. The system of Claim 1 further including a multi-format storage subsystem and a format converter subsystem.

3. A content builder for the integrated learning system of Claim 1 or Claim 2, said content builder adapted to derive
10 data in different formats and from different sources; said builder further adapted to format said data into a unified format and to order said data into content in the form of learning objects.

4. A content consumption management subsystem for an
15 integrated learning system as claimed in Claim 1 or Claim 2, said content consumption management subsystem incorporating a user usage profile store which monitors and stores data pertaining to usage by a user of content made available by said integrated learning system.