

EXHIBIT 54



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(54) **UNIVERSAL FORMS ENGINE**
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(57) **ABSTRACT**

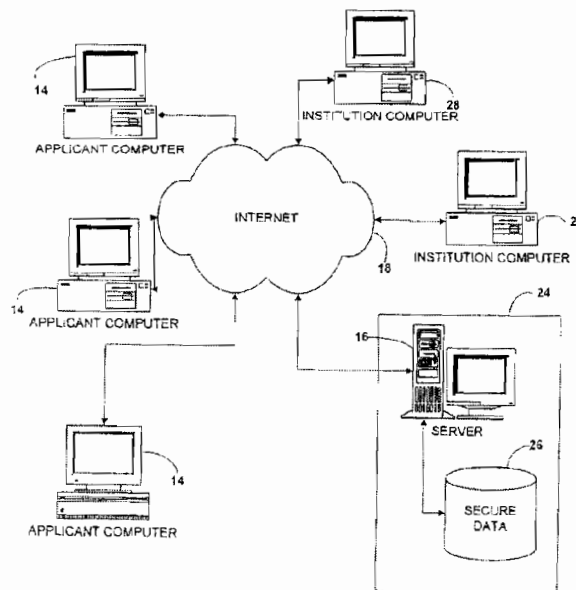
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(52) **U.S. Cl.** **707/100; 707/102; 707/104; 707/506; 707/507**
(58) **Field of Search** **707/100, 1, 10, 707/505, 506, 507, 508, 102, 104**

A forms engine allows data sharing between customizable on-line forms, such as college admissions applications. After an applicant completes an application, the data is saved in a database and automatically populates fields in subsequent application forms. Each form is branded for its institution and forms for different institutions differ in appearance and content so that the presence of the third party servicer is transparent to the applicant. The system is extensible without programming, allowing new applicant attributes to be readily incorporated into the system and allowing the content and appearance of the application to be readily changed by changing the description file. Information stored about each attribute allows the specification of data validation rules and data sharing and grouping rules, as well as dependency rules that permit application page content to depend on applicant's responses on a previous page.

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42 Claims, 32 Drawing Sheets



formatted to conform to that institutions needs. The data formats may include 1) comma separated values, 2) tab delimited values, 3) fixed length formats, 4) name/value pairs, and 5) EDI 189. For all of these methods, of course, the data is ordered as required (e.g., Social Security number first, last name second, high school name 33rd, etc.).

The format of the entire data set is done via back-end utilities that run on the server and that utilize specially formatted text files containing data formatting descriptions and additional data-manipulation rules. These utilities are triggered when the institution's contact person accesses the administrative utility on the forms engine server and chooses to upload data sets.

Another implementation of the invention uses object-oriented programming and the Extensible Markup Language (XML), which is used to create a customized mark-up language related to applications processing. In this embodiment, most of the information about each applicant is stored in an XML file corresponding to that applicant, although some basic account information about each applicant is still maintained in a data table. Information about each application is stored in an XML application description file. This implementation requires fewer files, thereby simplifying maintenance and reducing the run time overhead associated with reading and reconstructing applications from multiple files. First and second stage validation rules are maintained in the XML application description file. Unlike the previously described embodiment, initialization is only required when the web server is started, because the application persists, along with its database connections, as long as the server is operating.

An XML parser, typically written in Perl, parses the XML application description source file and invokes programs that implement by creating and saving binary objects the features specified by the XML tags. For example, the text between a <begin page> tag and an <end page> tag is used to create a page object having attributes defined by the text between the tags. Similarly, an object corresponding to an element of a page is created based upon the text between a <begin element> tag and an <end element> tag. The created objects define the application that is presented to the applicant.

FIG. 18 shows examples of binary objects created by the XML parser and the relationships between some of the objects. For example, FIG. 18 shows, that a page object 204 can include one or more element object 206, groups objects 208, and table objects 210. An element object 206, which can be instantiated for example as a question on the application, includes a pre-text element 212 and a post-text element 214 corresponding to text associated with the question, an input field element 216, and any validation rule elements 218. Groups objects 208 may also include a pre-text element 212 and a post-text element 214, as well as element objects 206, other group objects 208, and table objects 210. Table objects 210 can include table header objects 220 and row element objects 222. Skilled programmers can write many classes to customize an application and will understand that FIG. 18 is a greatly simplified example used to demonstration the principles of the embodiment.

The group object allows multiple elements to be associated with a group and eases the implementation of an adaptive application, in which the content of application pages sent to an applicant may depend upon the applicant's answers in previous pages. Whether an element or group is displayed depends upon the value of a display attribute, which can be used to specify the conditions under which the object is displayed on the screen or in printed reports. For example, a group of questions may belong to a "non-U.S. citizen" group object. Questions belonging to the non-U.S. citizen group object may request information such as visa type, alien registration number, and country of origin. If the

applicant answers that he is a U.S. citizen, elements in the "non-U.S. citizen" group are not displayed. An adaptive application would also be useful for a higher education system that includes multiple schools or campuses. A single application file could be used, with the questions presented to the applicant depending upon the particular school the applicant chooses. Using a single application greatly simplifies maintenance of the application form.

Applicant information is similarly saved in an applicant XML file. Unlike the application description XML file, the applicant file is changed as information is posted by the applicant. Thus, the applicant XML file is re-saved each time that data is posted by the applicant.

Although the present invention has been described using an embodiment that processes college admission application forms, it is not limited to that application, but is applicable to processing any form, such as employment forms and student loan forms, such as for the PLUS student loan program

While a preferred embodiment of the present invention has been shown and described, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from the invention in its broader aspects. Because the computer and computer network fields are changing rapidly, it is expected that implementation of the invention will change significantly as technology evolves. The particular programming language and the type of database can be varied depending on the preferences of the programmer. Such changes in implementation, however, do not depart from the spirit and scope of the invention. The appended claims are therefore intended to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A method of creating and processing over a computer network forms representing applications to different higher education institutions, comprising:

- creating in response to a request from an applicant for an application to a first institution a first application form customized in accordance with the preferences of the first institution, the first application form including first form data fields for entering applicant information;
- providing to the applicant over a computer network the first application form;
- entering the applicant information in the first form data fields;
- posting the applicant information entered into the first form data fields of the first application form to a server;
- storing the posted applicant information in a database having a database field structure defined by multiple database fields, the database including multiple records, each record capable of storing information corresponding to each of the database fields;
- creating in response to a request from the applicant for an application to a second institution a second application form customized in accordance with the preferences of the second institution, the second application form including second form data fields for entering applicant information, at least one of the second form data fields corresponding to applicant information not entered into the first form data fields;
- automatically inserting into some of the second form data fields applicant information from the database;
- providing to the applicant over a computer network the second application form;
- entering applicant information into the second form data fields into which information was not inserted from the

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- data storage or into which the data inserted from the data storage is to be changed;
- posting the applicant information entered into the second form data fields to the server; and
- automatically storing the applicant information entered into the second form data fields into the database by adding new records to the database, the automatic storing of the applicant information not altering the database field structure, thereby allowing new form data fields corresponding to applicant information not previously requested to be added to an application form without requiring alterations of existing application forms or of programs that access the database, whereby customized applications to different institutions share data through common, extensible data storage.
2. The method of claim 1 in which creating a first application form customized in accordance with the preferences of the first institution includes generating a first application in accordance with stored application description information and in which a modified first application can be generated by modifying the application description information without rewriting the computer program that creates the first application.
3. The method of claim 1 in which posting applicant information entered into the first form data fields of the first application includes verifying that pre-specified application information is present and meets pre-specified criteria.
4. The method of claim 1 in which posting applicant information entered into the first form data fields of the first application and posting applicant information entered into the second form data fields of the second application each includes the steps of posting data from a single page of the application and of posting data from the completed application, and in which posting a single page includes verifying that some specific information is present and meets pre-specified criteria and in which posting data from the completed application includes verifying that the information meets criteria specified by the corresponding institution.
5. The method of claim 1 in which creating an application form customized in accordance with the preferences of a first institution includes creating an application form identified with the brand of the first institution and in which creating an application form customized in accordance with the preferences of a second institution a second application includes creating an application form identified with the brand of the second institution.
6. The method of claim 1 further comprising transmitting the applicant information to the first institution in a first format specified by the first institution and transmitting the applicant information to the second institution in a second format specified by the second institution, the second format being different from the first format.
7. The method of claim 6 further comprising making applicant information from multiple applications to the first institution from different applicants available on line to the first institution for analysis after transmitting the applicant information to the first institution.
8. The method of claim 7 in which making applicant information from multiple applications available to the first institution includes making application information selectively available to various personnel at the institution.
9. The method of claim 1 in which automatically storing the applicant information is performed by a third party application server.
10. The method of claim 9 in which posting the first applicant information and posting the second applicant information include paying application fees for the first and second applications and in which the third party server processes the application fee.
11. The method of claim 1 in which storing the posted applicant information in a database having a database field

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- structure defined by multiple database fields includes parsing the applicant information within a into data elements, the data elements being separately stored and identified, thereby allowing the data elements to be separately retrieved and rearranged in subsequent applications.
12. The method of claim 11 in which automatically inserting applicant information from the database includes automatically inserting applicant information representing combined elements into a single one of the second form data fields.
13. The method of claim 1 in which:
- the first form data fields include first form data field labels;
- at least some of the second form data fields include second form data field labels different from the first form data field labels for form data fields corresponding to the same data; and
- storing the posted applicant information and automatically inserting into some of the second form data fields applicant information from the database are independent of the labels used in the first application form and the second application form,
- thereby allowing each institution to customize the appearance of its corresponding application, while still permitting information to be shared across applications.
14. The method of claim 1 in which the first form data fields and the second form data fields are formatted and in which at least some of the second form data fields are formatted differently from the corresponding first form data fields and in which storing the posted applicant information and automatically inserting applicant information from the database is independent of the data field format, thereby allowing each institution to customize the appearance of its corresponding application, while still permitting information to be shared across applications.
15. The method of claim 1 in which providing the first application form comprises providing multiple form pages and in which posting the first applicant information to a server includes posting multiple form pages to the server.
16. The method of claim 15 in which the content of a page of the first application depends upon applicant information posted in a previous page of the first application.
17. The method of claim 1 in which the database includes a relational database or XML data.
18. The method of claim 1 in which the database stores metadata describing the data.
19. The method of claim 18 in which the metadata includes validation rules for the data.
20. The method of claim 18 in which the metadata specifies the sharing between applications or the accessibility of the data.
21. A system for creating and processing customized forms for unrelated institutions using a common third party data storage over a computer network, the system including:
- a server computer operated by the third party and in data communication over a data network with a client computer for requesting a form and for entering information onto the form;
- first data storage in communication with the server computer and including form description information specifying the content and appearance of each customized form;
- second data storage in communication with the server computer and including user information posted from the client computer, the second data storage including a database having a database field structure defined by multiple database fields, the database including mul-

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multiple records, each record capable of storing information corresponding to each of the database fields; and a forms engine program operating on the server computer for generating a form from the form description information in response to a request for the form transmitted from the client computer over the computer network, the form including fields for the user to enter user information, the forms engine program automatically populating the fields for user information with user information available from the second data storage, accepting user information entered on the form by the user, and storing the newly entered information in the second data storage for automatically populating subsequent forms, the user information entered by the user including at least some information not entered on a previous form by the user, the forms engine automatically storing the entered information into the database by adding new records to the database, the automatic storing of the user information not altering the database field structure, thereby allowing new user information not previously requested to be added to a form without requiring alterations of existing forms or alterations of programs that access the database.

22. The system of claim 21 in which the forms engine program generates a form that includes branding information identifying the particular institution to which the form is directed.

23. The system of claim 21 in which the forms engine program generates customized forms that include labels for data entry fields and in which at least some of the labels are different for the same user information on different ones of the customized forms.

24. The system of claim 21 in which the same user information is requested using differently styled menus on different ones of the customized forms.

25. The system of claim 21 in which at least some of the user information is parsed into smaller elements before storage, the smaller elements being stored in the database and being individually retrievable for insertion into subsequent forms.

26. The system of claim 21 in which the user information stored in the second database is in the form of user attributes and in which at least some of the user attributes have properties that specify information about the attribute.

27. The system of claim 21 further comprising means for transmitting in a format specified by the institution information user data from a completed form to the institution associated with the form.

28. The system of claim 21 further comprising means for verifying information in a form, the verification means including verification criteria common to all forms and verification criteria for a specific institutions.

29. The system of claim 21 in which the forms engine generates a form comprising multiple pages and in which the content of at least one of the multiple pages depends upon previously supplied user information.

30. The system of claim 21 in which the first or second data storage comprises one or more XML files stored on a computer readable medium.

31. The system of claim 21 in which the first or second data storage comprises one or more relational database tables stored on a computer readable medium.

32. A method of providing customized applications to institutions, the applications sharing a common database, the method comprising:

providing at least two application information files, each describing a customized application for an institution;

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providing a database for storing applicant information entered on an application and for providing applicant information for inserting into subsequent applications, the database having a database field structure defined by multiple database fields, the database including multiple records, each record capable of storing information corresponding to each of the database fields;

generating a customized application in response to a request over a computer network from an applicant, the application form and content being specified by one of the at least two application information files, the application including multiple form data fields for entering applicant information;

populating the form data fields of the customized application using applicant information from the database; transmitting the customized application over a computer network to a requesting applicant;

completing form data fields of the application that were not populated with applicant information from the database, at least one of the form data fields corresponding to applicant information not entered into the form data fields of an application previously completed by the requesting applicant; and

automatically storing the applicant information entered into the form data fields into the database by adding new records to the database, the automatic storing of the applicant information not altering the database field structure, thereby allowing new form data fields corresponding to applicant information not previously requested to be added to an application form without requiring alterations of existing application forms or of programs that access the database.

33. The method of claim 32 which completing fields of the application that were not populated from the database includes overwriting with new values fields that were populated from the data storage, the new values being stored in the data storage in place of the existing values.

34. The method of claim 32 in which providing a database for storing information includes providing a database that is extensible without reprogramming the program for generating the customized application, thereby allowing an institution to readily request and store new information not previously stored.

35. The method of claim 34 in which generating a customized application includes generating an application that includes the logotype of the institution.

36. The method of claim 32 in which the database stores metadata describing the data.

37. The method of claim 36 in which the metadata describes permissible values for the data and further comprising comparing the applicant data in the completed form data fields with the permissible values.

38. The method of claim 36 in which the meta data describes conditions under which questions on the customized application are displayed.

39. The method of claim 32 in which the database includes a relational database.

40. The method of claim 32 in which the database includes XML data.

41. The method of claim 32 in which the customized application includes multiple pages.

42. The method of claim 41 in which the content of one of the multiple page depends the fields completed by an applicant on a previous one of the multiple pages.

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