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(54) METHOD AND APPARATUS FOR RAPIDLY PROTOTYPING STATUS DISPLAY

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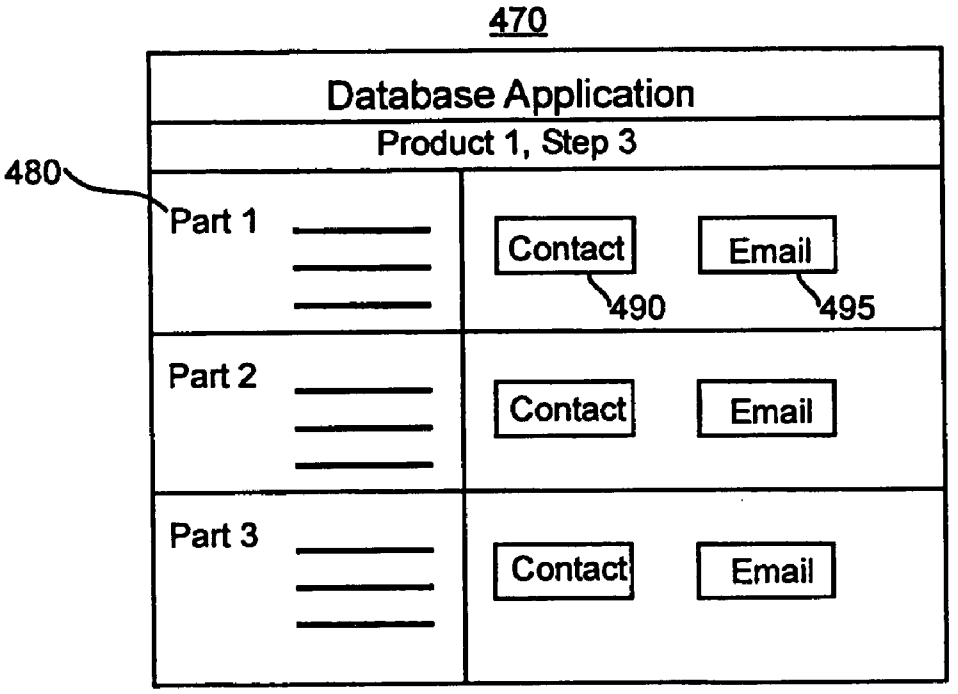
(57) ABSTRACT

A system and method for information display based on a family of display screens for displaying information derived from numerous data sources. Each display screen includes function controls as well as indicator controls. The function controls link a first level display screen to subsidiary display screens. A capacity is provided for saving defined display screen formats and for generating a custom display screen based on function controls which were previously defined in defined display screens. Also disclosed is a method of using a family of display screens for managing access to information and displaying that information.



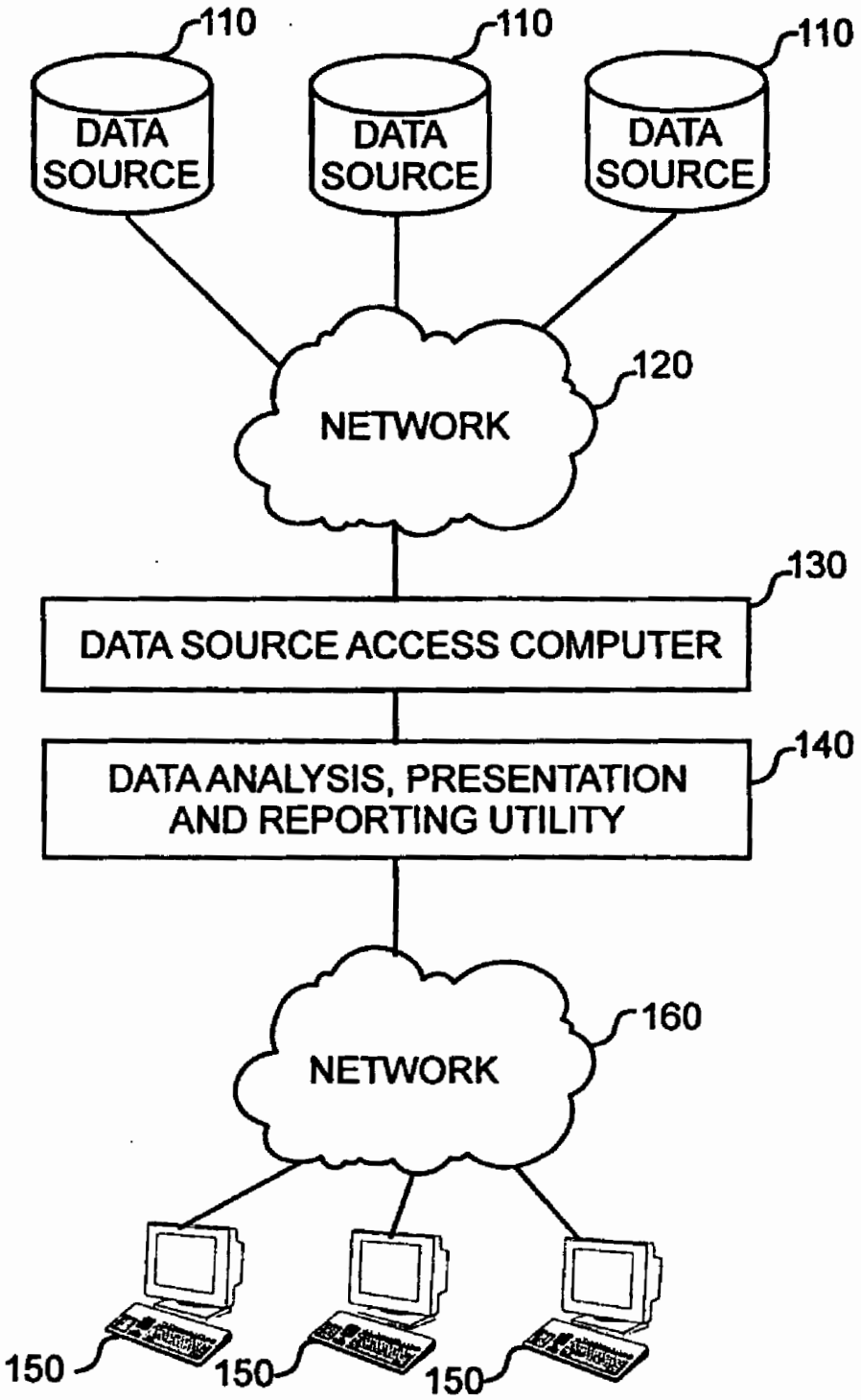

110
110
110
DATA SOURCE
DATA SOURCE
DATA SOURCE
120
NETWORK
130
DATA SOURCE ACCESS COMPUTER
140
DATA ANALYSIS, PRESENTATION AND REPORTING UTILITY
160
NETWORK
150
150
150

FIG. 1

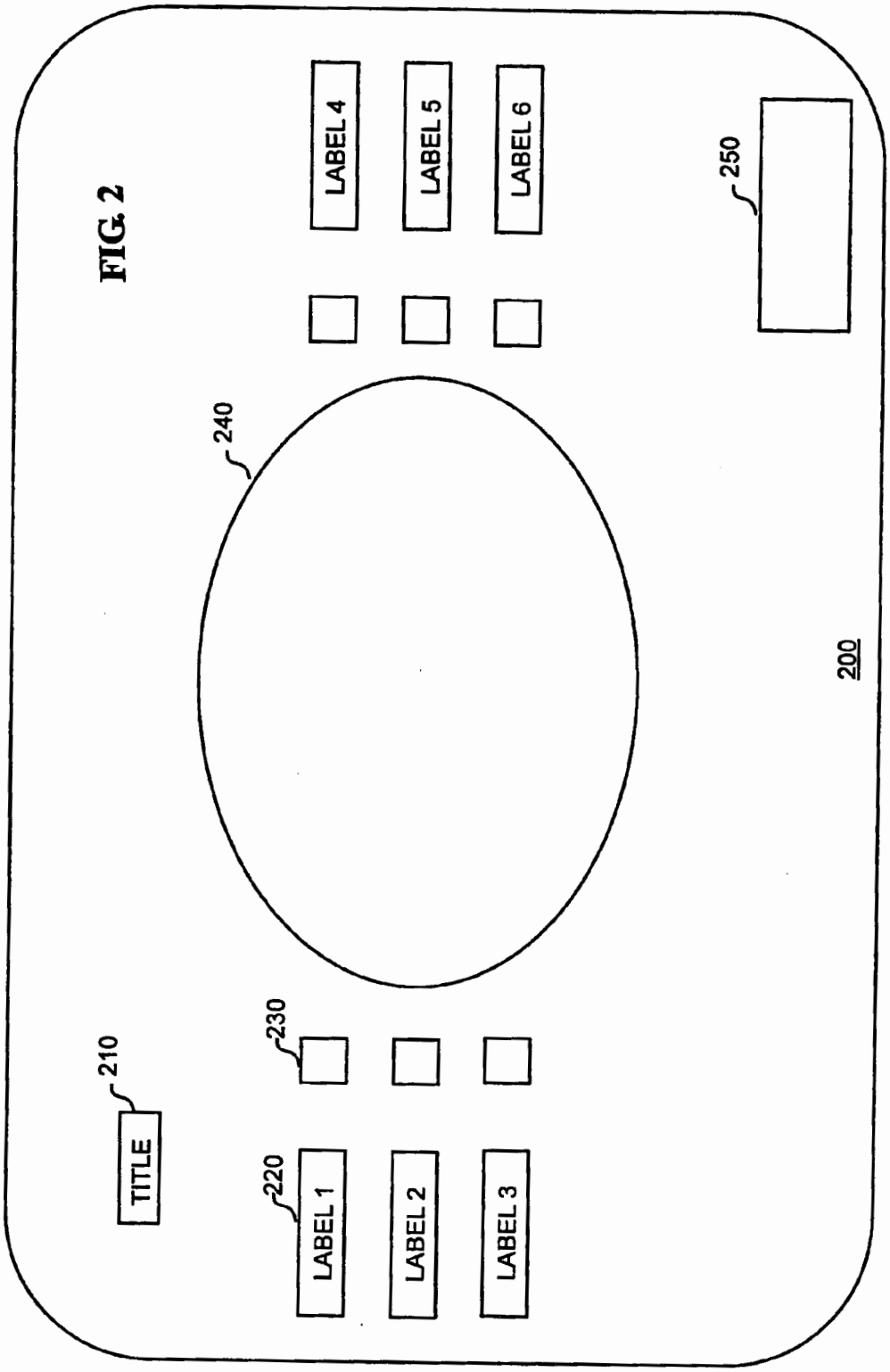

TITLE
210
LABEL 1
LABEL 2
LABEL 3
220
230
240
LABEL 4
LABEL 5
LABEL 6
250
200

FIG. 2

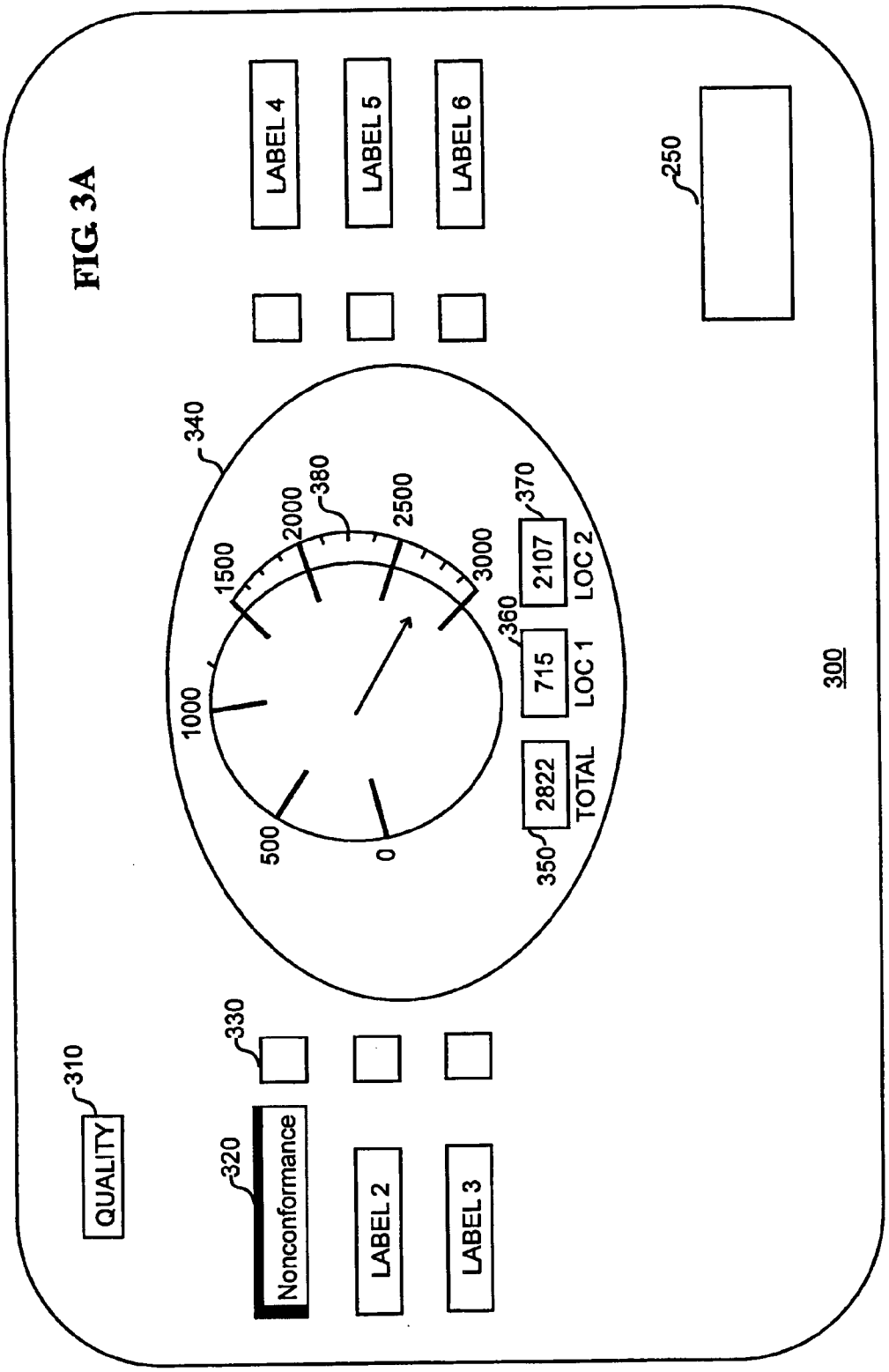

QUALITY
310
Nonconformance
320
330
LABEL 2
LABEL 3
340
0
500
1000
1500
2000
380
2500
3000
2822
TOTAL
350
715
LOC 1
360
2107
LOC 2
370
LABEL 4
LABEL 5
LABEL 6
250
300

FIG. 3A

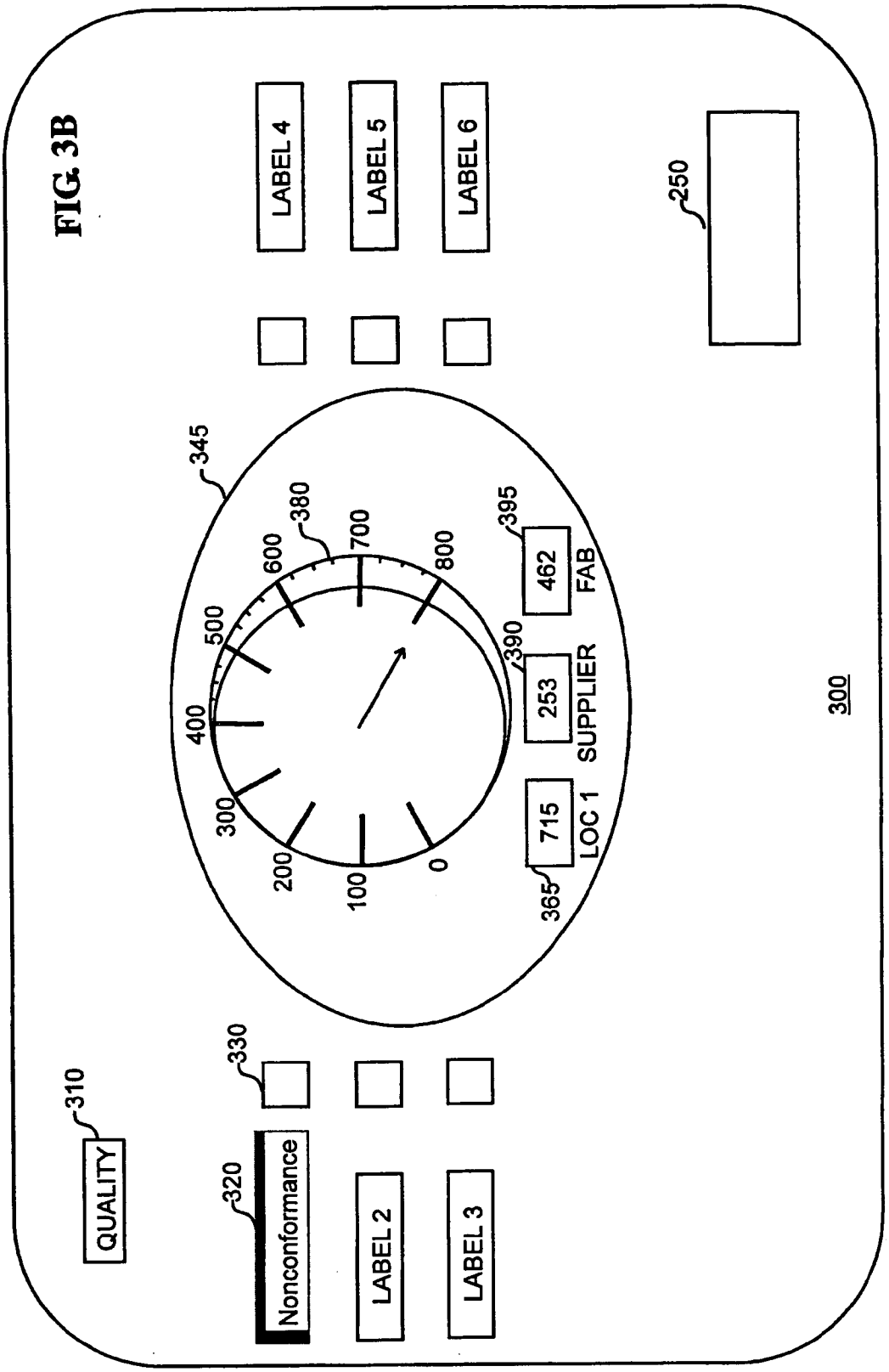

QUALITY
310
Nonconformance
320
330
LABEL 2
LABEL 3
LABEL 4
LABEL 5
LABEL 6
345
0
100
200
300
400
500
600
380
700
800
365
715
LOC 1
390
253
SUPPLIER
395
462
FAB
250
300

FIG. 3B

400

FIG. 3C

NONCONFORMANCE REPORT

Total = 715	
Location	Open
Loc 1a	221
Loc 1b	298
Loc 1c	7
Loc 1d	151
Loc 1e	38
Product	Open
Prod 1	47
Prod 2	5
Prod 3	10
Prod 4	118
Prod 5	192
Prod 6	343

410 420 430 440

FIG. 3D

450

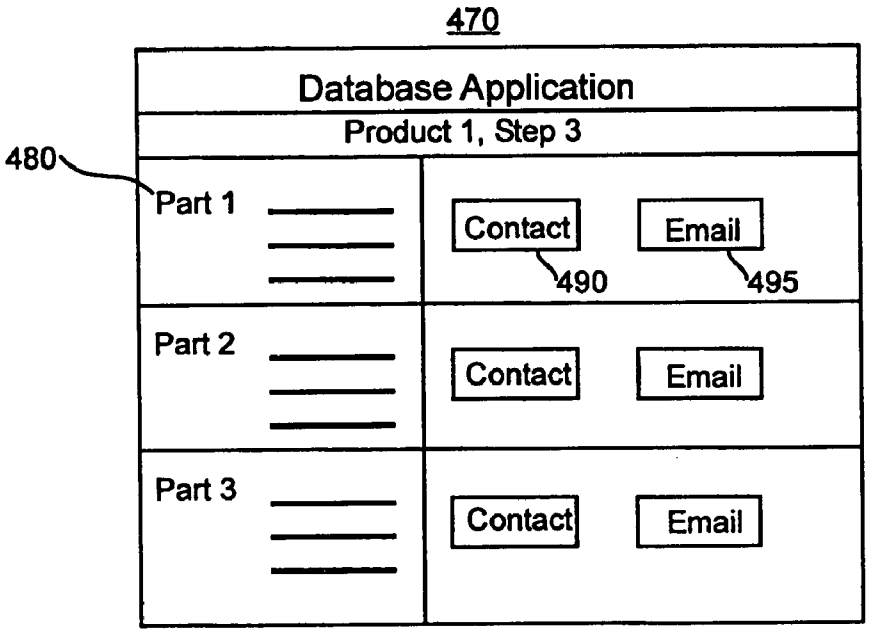
DISTRIBUTION BY PRODUCT

460

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Prod 1	—	—	—	—	—	—
Prod 2	—	—	—	—	—	—
Prod 3	—	—	—	—	—	—
Prod 4	—	—	—	—	—	—
Prod 5	—	—	—	—	—	—
Prod 6	—	—	—	—	—	—

420

FIG. 3E


470
Database Application
Product 1, Step 3
480
Part 1
Contact
Email
490
495
Part 2
Contact
Email
Part 3
Contact
Email

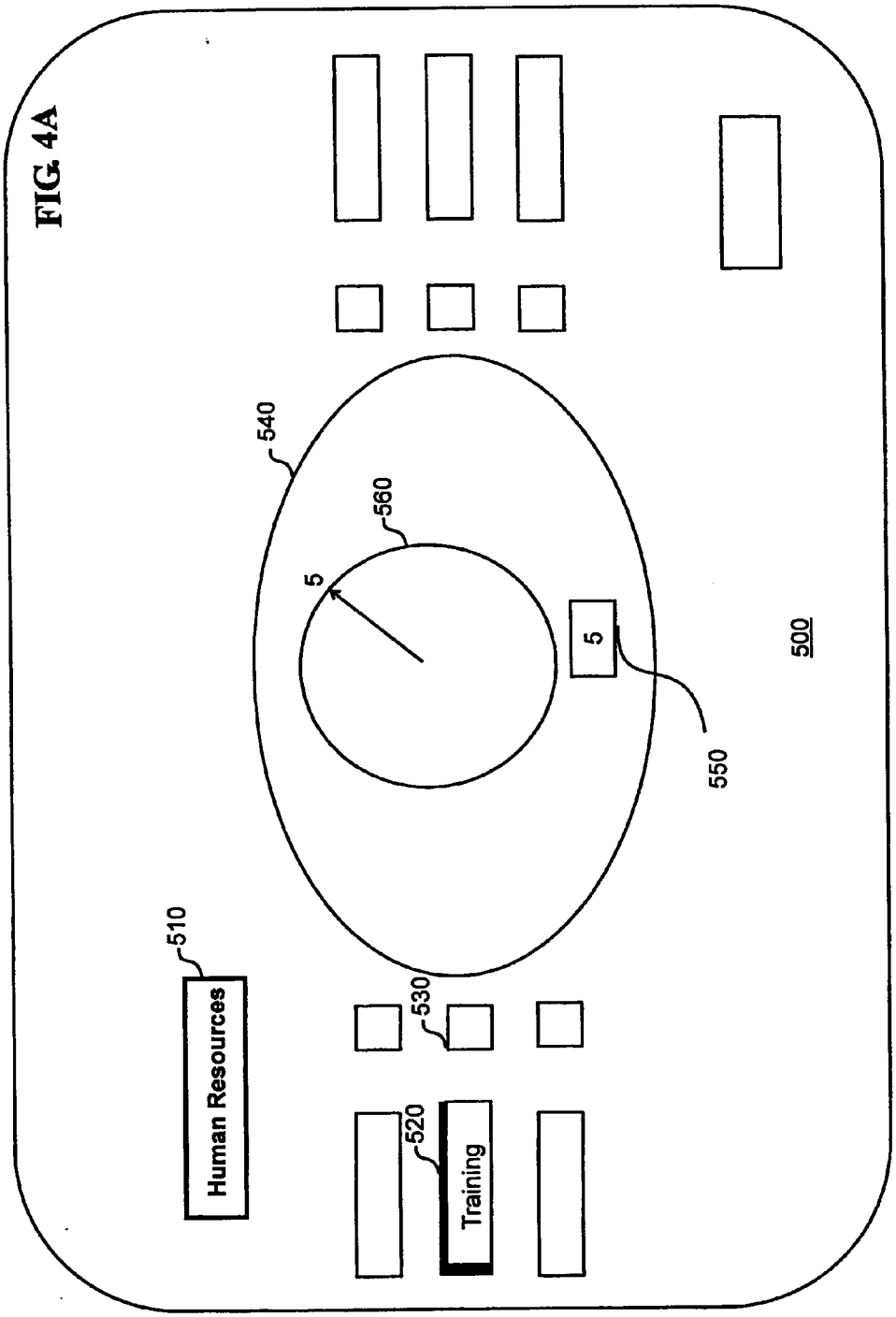


FIG. 4A

FIG. 4B

REQUIRED COURSES BY EXPIRATION DATE

570

575

Location	Expired	Expires Within 30 Days	Expires Within 60 Days
Loc 1	1	36	77
Loc 2	4	28	65
Loc 3	0	0	6

FIG. 4C

EXPIRED COURSE DETAIL

580

Expire Date

Location All ↓ Expired ↓ Sort by Name ↓

Employee No.	Employee Name	Expire Date	Course
1	Jones	07-02-04	Course 1
2	Smith	07-03-04	Course 1
3	Bush	07-09-04	Course 2
4	Young	08-01-04	Course 3
5	Allen	08-16-04	Course 4

FIG. 5

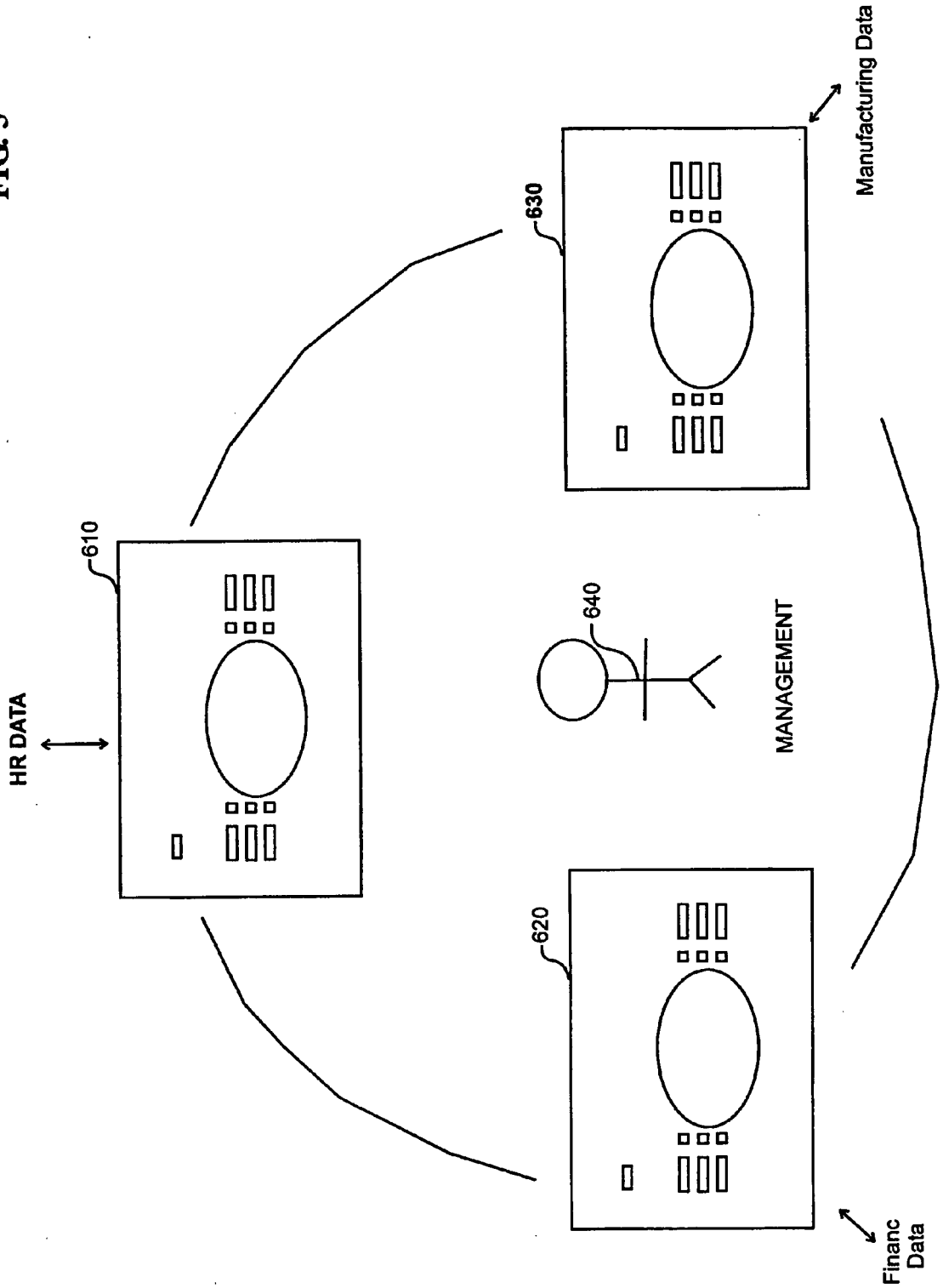

HR DATA
610
630
Manufacturing Data
640
MANAGEMENT
620
Financ
Data

FIG. 6A

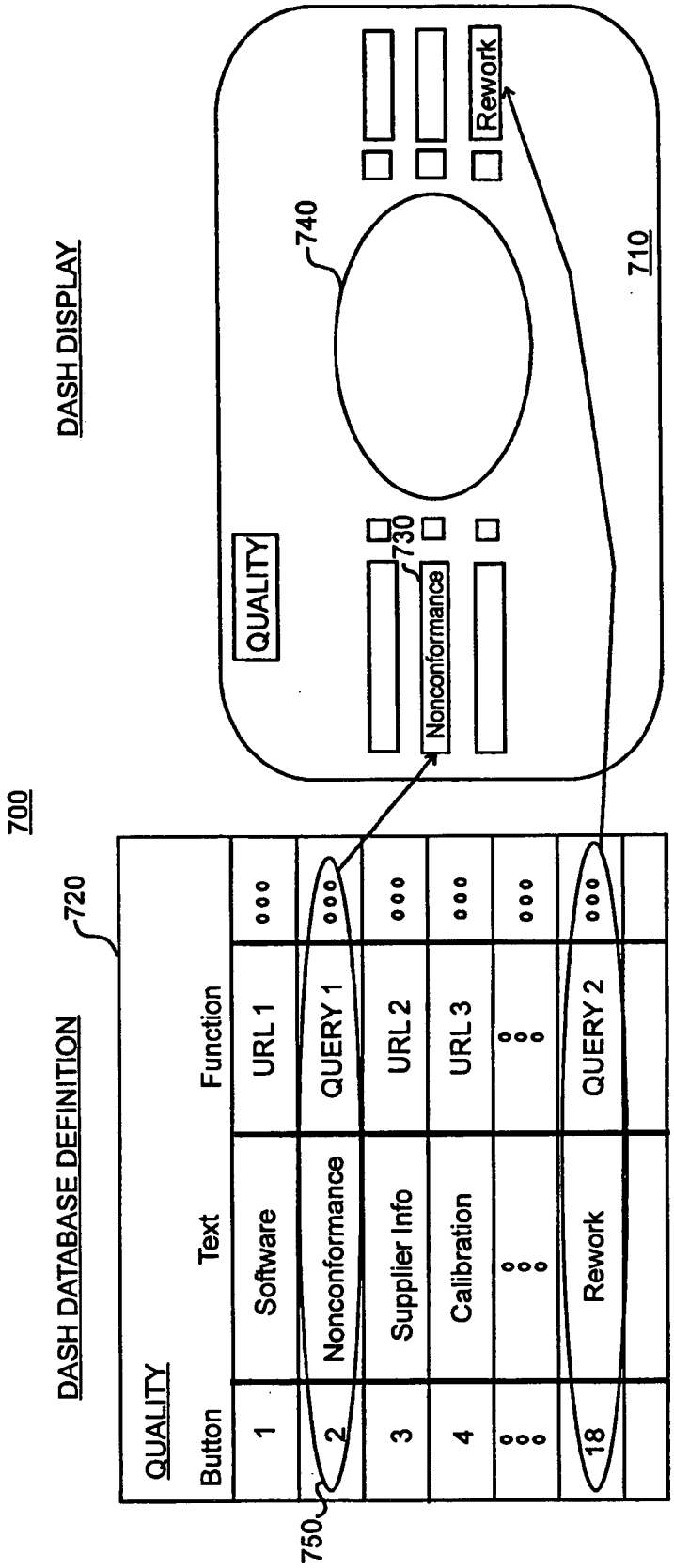
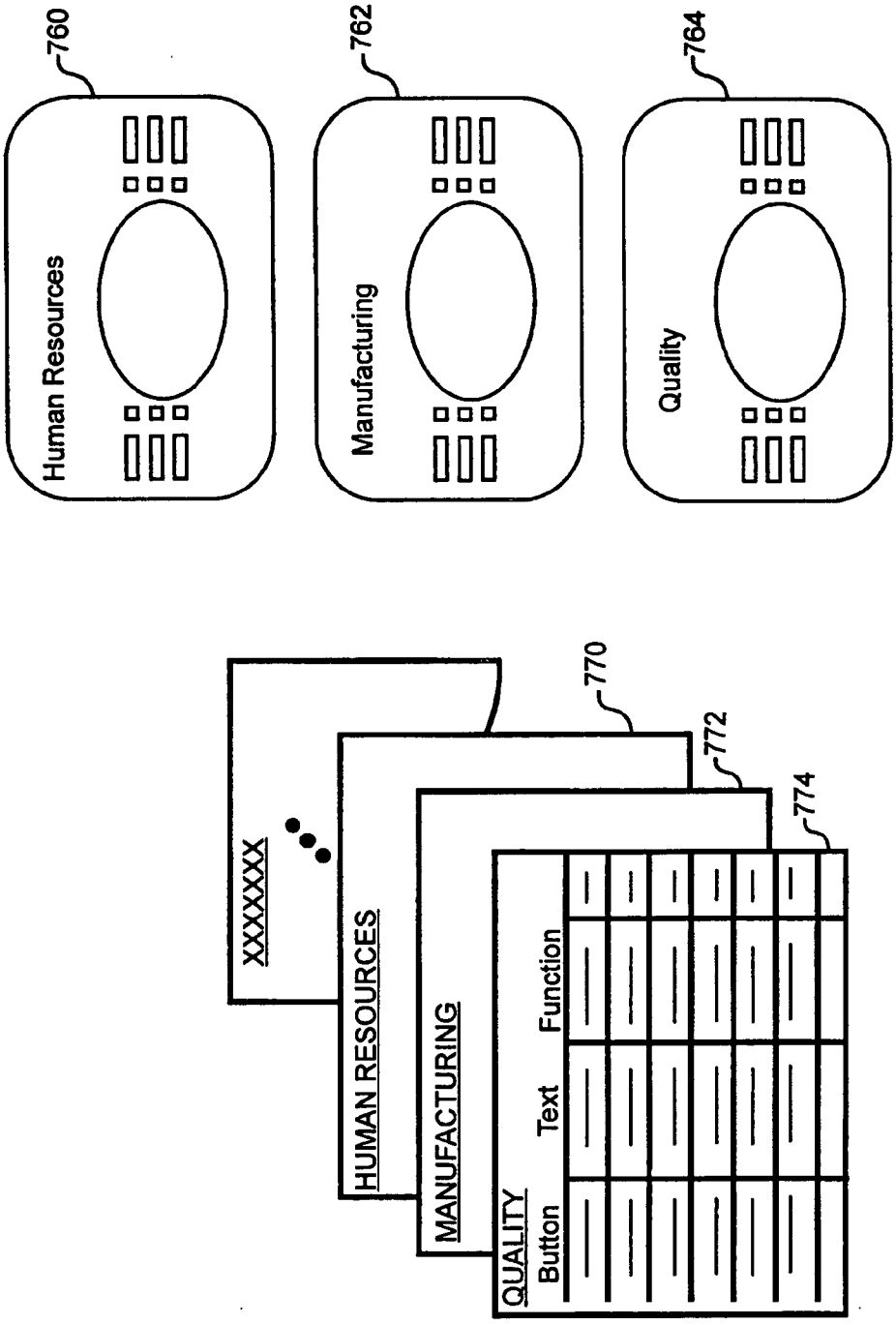

700
DASH DATABASE DEFINITION
720
QUALITY
Button
Text
Function
1
Software
URL 1
2
Nonconformance
QUERY 1
3
Supplier Info
URL 2
4
Calibration
URL 3
18
Rework
QUERY 2
750
DASH DISPLAY
QUALITY
Nonconformance
730
740
Rework
710

FIG. 6B


760
Human Resources
762
Manufacturing
764
Quality
770
772
774
XXXXXXX
HUMAN RESOURCES
MANUFACTURING
QUALITY
Button
Text
Function

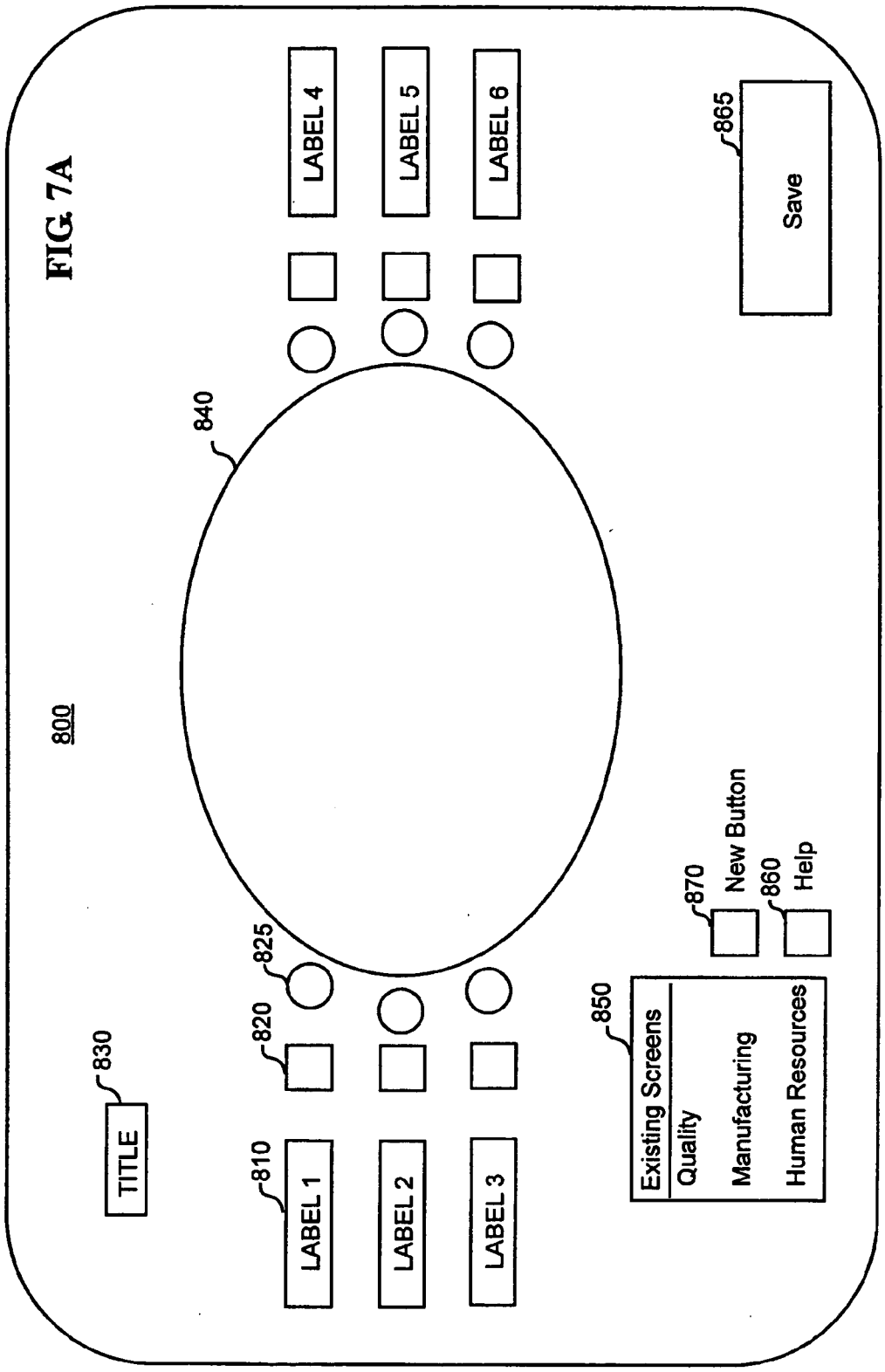

800
TITLE
830
LABEL 1
LABEL 2
LABEL 3
LABEL 4
LABEL 5
LABEL 6
810
820
825
840
Existing Screens
Quality
Manufacturing
Human Resources
850
New Button
870
Help
860
Save
865

FIG 7A

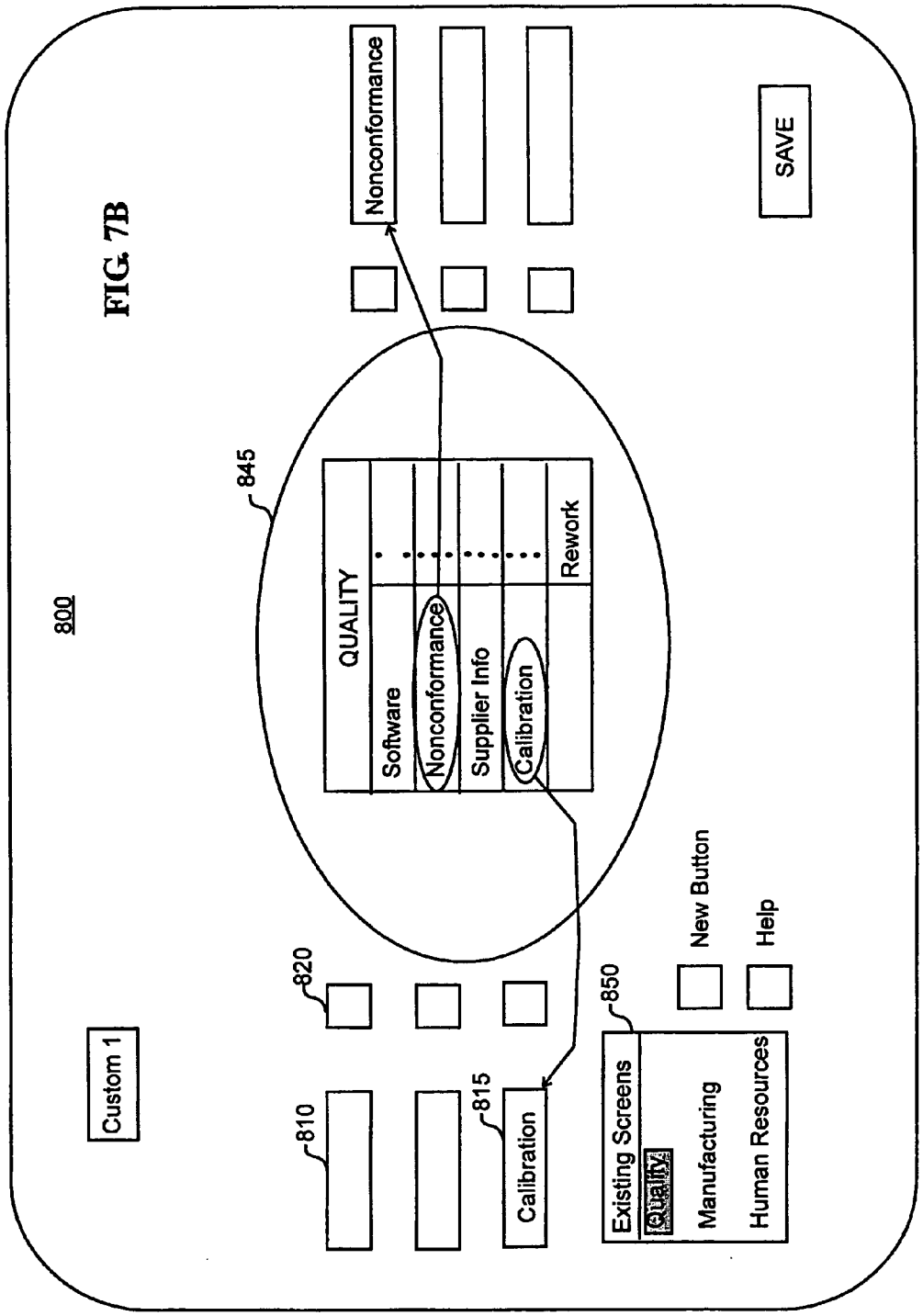

800
Custom 1
810
820
845
QUALITY
Software
Nonconformance
Supplier Info
Calibration
Rework
Nonconformance
815
Calibration
850
Existing Screens
Quality
Manufacturing
Human Resources
New Button
Help
SAVE

FIG. 7B

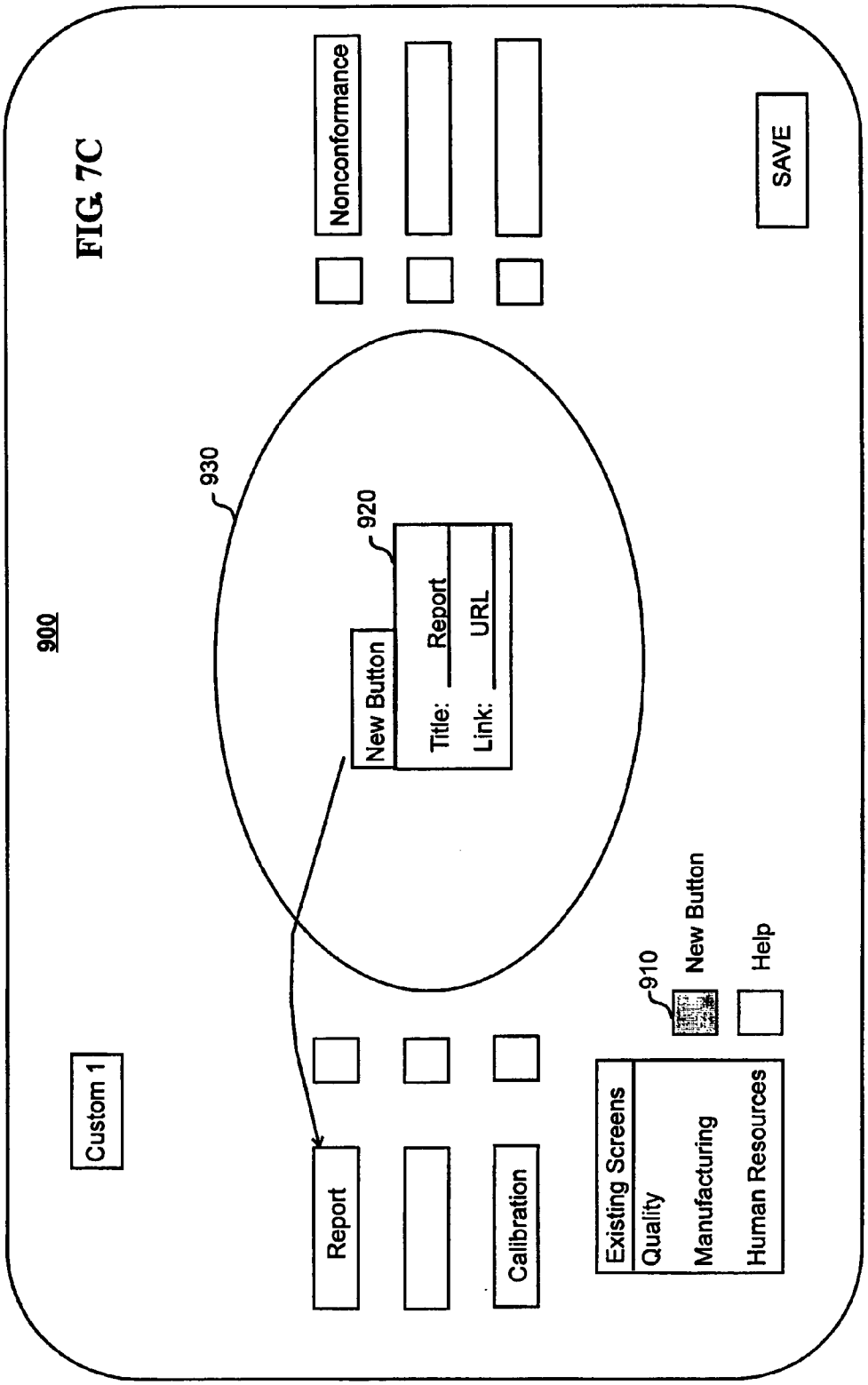

900
Custom 1
Report
Calibration
930
New Button
920
Title: Report
Link: URL
Nonconformance
910
New Button
Help
Existing Screens
Quality
Manufacturing
Human Resources
SAVE

FIG. 7C

FIG. 7D

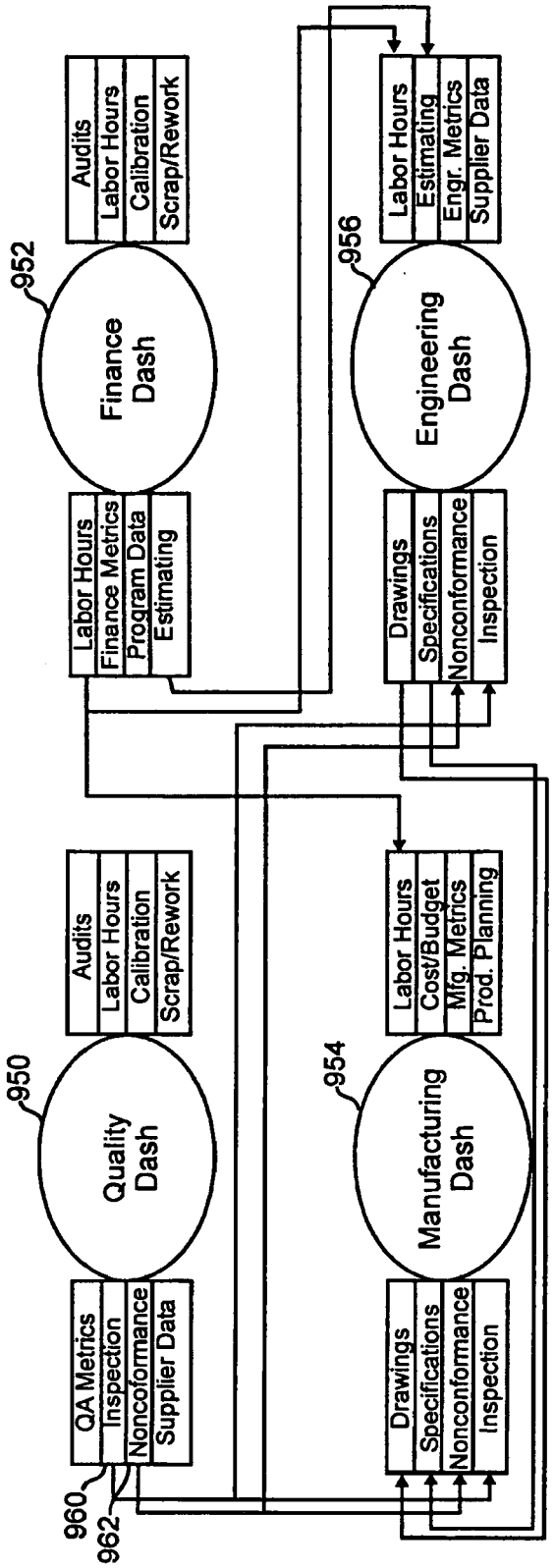
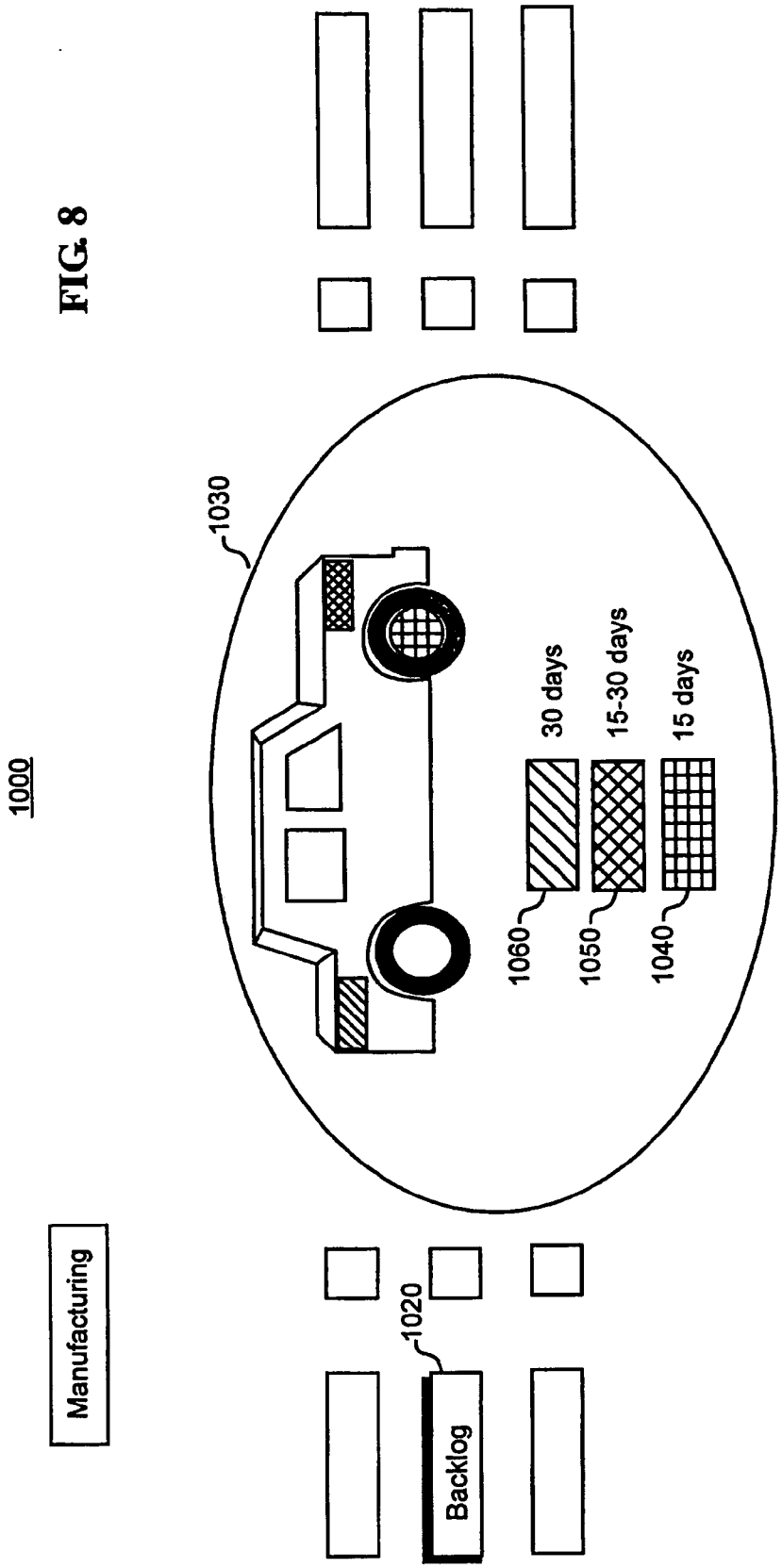

950
Quality Dash
QA Metrics
Inspection
Noncoformance
Supplier Data
Audits
Labor Hours
Calibration
Scrap/Rework
952
Finance Dash
Labor Hours
Finance Metrics
Program Data
Estimating
Audits
Labor Hours
Calibration
Scrap/Rework
954
Manufacturing Dash
Drawings
Specifications
Nonconformance
Inspection
Labor Hours
Cost/Budget
Mfg. Metrics
Prod. Planning
956
Engineering Dash
Drawings
Specifications
Nonconformance
Inspection
Labor Hours
Estimating
Engr. Metrics
Supplier Data
960
962

FIG. 8


1000
Manufacturing
Backlog
1020
1030
30 days
15-30 days
15 days
1060
1050
1040

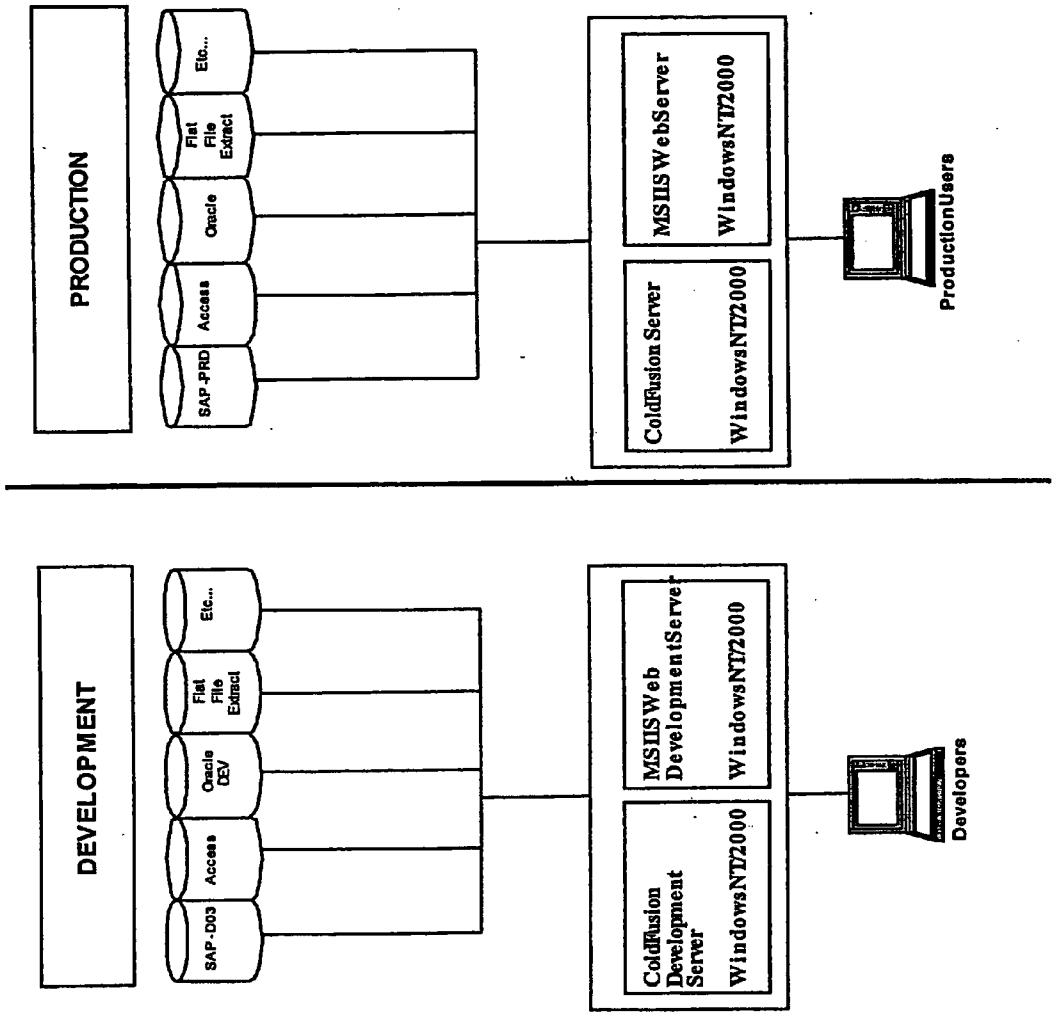

PRODUCTION
SAP-PRD
Access
Oracle
Flat File Extract
Etc...
ColdFusion Server
WindowsNT/2000
MSIIS WebServer
WindowsNT/2000
ProductionUsers
DEVELOPMENT
SAP-D03
Access
Oracle DEV
Flat File Extract
Etc...
ColdFusion Development Server
WindowsNT/2000
MSIIS Web DevelopmentServer
WindowsNT/2000
Developers

FIG. 9

METHOD AND APPARATUS FOR RAPIDLY PROTOTYPING STATUS DISPLAY

RELATED APPLICATION

[0001] The present application is related to and claims priority from provisional application serial No. 60/466,971, filed May 1, 2003, the entire contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to an apparatus for data management and a method of creating and using a data management system to access data relating to one or more tasks.

BACKGROUND OF THE INVENTION

[0003] With the advent of the wide spread use of computers, a wide variety of data sources have developed in a relatively short amount of time. Traditional legacy mainframe system are still utilized for the core processing power of many organizations. However, these data sources have now become islands of information that while they are related to other data sources the existing systems provide little or no ability to communicate with each other. Corporations today find that enterprise level solutions are burdensome for the average user and the challenge of empowering individuals with real time data for their individual responsibilities is overwhelming in both cost and magnitude based upon ever changing requirements. Moreover, these legacy systems may be physically separated by thousands of miles or practically separated based upon incompatible programming languages, which makes sharing of data difficult to accomplish.

[0004] Recently, several products such as ColdFusion, by Macromedia, have introduced advanced data access tools which provide a common means to access data across great numbers and types of data sources. These tools, while addressing the problem of accessing data across many sources, ultimately only exacerbate the data overflow problem faced by today's businesses; too much information and insufficient analysis capability to make sense of the information.

[0005] Thus, in spite of the improved computer and software tools which can access the diverse variety of data sources, there remains an unmet need for information analysis and presentation tools which allow rapid access to diverse data and which can analyze, correlate and present the data to multiple types of users in a business organization in a manner effective for each user type. There also remains an unmet need for an information analysis and presentation tool which can be easily customized by each user without knowledge of either computer programming languages or the multiple database applications on which the data is stored. There also remains an unmet need for a business intelligence system which can rapidly prototype information reporting and analysis.

SUMMARY OF THE INVENTION

[0006] The present invention addresses the aforesaid unmet needs by providing a system and method for information display based on a family of display screens for displaying information derived from numerous data sources. Throughout the following description of the present invention and of the preferred embodiments thereof, the terms "display""dash""digital dash" and "screen" may be used interchangeably in related context. As generally used, the term refers to a graphical and/or textural (e.g., alphanumeric) display screen to portray information for a user.

[0007] In one embodiment, the present invention is a web-based concept that gives end users the ability to access multiple data sources from a single location in an intuitive and easy-to-use graphical and textual format. The data is preferably presented "real time" or near real-time in a process-oriented fashion mimicking the flow of actual data and/or hardware. "Real time" may be the latest data available for the most effective analysis and reporting, whether the data is updated monthly, weekly, daily, or hourly. Drill-down capabilities give the end user the ability to view data from a top-level perspective all the way down to the fine details. Making the application web-based gives the user the ability to access the data from any location with network access either within the firewall or with special access through the firewall. In addition, the end user's credentials (e.g., NT login) optionally controls access to restricted folders and data.

[0008] One aspect of the present invention includes the ability to quickly create useful dash applications that allow the user to immediately see the power, value, and potential of their custom dash. Such rapid prototyping can serve as a catalyst in identifying better ways of visualizing, tracking, and analyzing other critical processes. Ideally, customer requirements would be clearly defined and an application developed in accordance with these requirements. The application could be built in relatively short time and thereby quickly producing valuable results for the customer. However, large organizations with competing priorities can take a significantly long time in providing specific requirements, especially when dealing with new concepts and methods such as the present idea of collecting and centralizing critical process information. In such a case the instant rapid prototyping concept becomes an important tool.

[0009] A dash built according to the instant rapid prototyping concept would be built contrary to the typical Information Technology waterfall systems design method in which substantially all customer requirements are mapped out in advance of programming. In contrast, in the absence of well-defined customer requirements, the instant rapid prototyping concept emphasizes prototyping for rapid creation of a minimally functional deliverable. The technique includes the step of making one component work as a proof of concept, such as displaying data drawn from Access databases or Excel files, etc. Once an initial capability is achieved, the customer can refine the system, critique the application, and elaborate their wants and requirements. After that, the programmer can then expand or widen the functionality based on the customers' needs.

[0010] Thereafter, once the application is running, and the customer is satisfied with the results, the data needs to be migrated from a development environment to production. For rapid prototyping efforts that may have utilized simplified data structures, such data could be migrated to a more stable data platform in a production environment. More robust database platforms, such as Oracle, and Enterprise Folders, that are in line with IT's mission statement, can be

used to migrate the system from a prototyping environment to a production environment. Additionally, this keeps the application in line with future technologies.

[0011] According to preferred embodiments of the present invention, data sources, reports, and user interfaces would be designed in such a way that the same application and data can be used by other organizations. To this end, data, data sources, application files, and associated information should be accessible to end users and developers and easily modified to meet the specific needs of a functional area or program. For example: Quality Assurance (QA) created a training report for its personnel that could also be used to build a similar report for Product Operations (Prod Ops). By structuring the data and query to allow searching for a "QA" identifier within the training database, rather than using a lengthy hard-coded list of all QA unit numbers, the QA training report could be customized for Prod Ops simply by changing a single query criteria from "QA" to "PROD OPS".

[0012] Similarly, according to preferred embodiments of the present invention, data and web pages called from one business domain should be designed such that the same data and web pages can be called from a different business domain. Public data (data that may be viewed by the general employee population) would be utilized as much as possible in order to realize the full potential of the system. However, sensitive data may be included as long as appropriate measures are taken to restrict access. Such data is preferably not expected to be available to other end users or developers.

[0013] In a preferred embodiment, a dash is a system comprising a main graphical interface and its associated files and reporting applications. In general, a preferred implementation of a dash would include an embedded collection of program links, URL links, query links as well as possibly links to other dashes. Preferably, a main graphical component would be used to give the dash a unique look and feel and provide end users with an intuitive, easy to use interface. Prototype implementations of a dash screen have been produced with Macromedia Flash. In these prototype implementations, the Flash object is then embedded within a ColdFusion file. Preferably, buttons and status indicators that appear on the dash screen are set using information contained within a database which maintains a record of the settings and other configuration information relating to the dash screen. The database can be updated to change button labels, status and hyperlinks.

[0014] Also in a preferred embodiment, the buttons on the dash can link to virtually any electronic file format (including, without limitation, MS Word file, PowerPoint presentation, Excel spreadsheet, HTML page, ColdFusion application, etc.). Moreover, the buttons on the dash can link to functions, applications, JAVA applications, scripts, etc., as well as to another dash. The business area that is utilizing the dash will determine which files or applications will be referenced by the main dash screen. Because the configuration of the dash is customizable and reconfigurable, new files or applications can be created as needed and added as new buttons to the dash.

[0015] Preferably, a series of applications and custom dashes are developed to address specific data and reporting needs of an organization. Alternatively, applications and custom dashes are developed to address specific data and reporting needs of specific functional groups within a larger organization. By implementing a system of dashes, an entire organization can be provided with timely, near real-time, at-a-glance, access to its critical business information. Each individual within an organization or segment of the business can customize their dash to represent their individual responsibilities.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] A more complete understanding of the present invention and its advantages will be readily apparent from the following Detailed Description taken in conjunction with the accompanying drawings wherein like parts are designated by like reference numbers and in which:

[0017] **FIG. 1** is a schematic illustration of a computer network environment suitable for the deployment of the present invention;

[0018] **FIG. 2** illustrates an embodiment of a user interface dash in accordance with the present invention;

[0019] **FIGS. 3A-3B** illustrate an embodiment of a dash configured to report quality information in accordance with the present invention;

[0020] **FIGS. 3C-3D** illustrate embodiments of reports accessible via a dash in accordance with the present invention;

[0021] **FIG. 3E** illustrates an embodiment of a database application screen accessible via a dash in accordance with the present invention;

[0022] **FIG. 4A** illustrates an embodiment of a dash for reporting human resources information in accordance with the present invention;

[0023] **FIGS. 4B-4C** illustrate embodiments of reports accessible via the dash;

[0024] **FIG. 5** illustrates a series of dashes that can be adapted for use by a user in accordance with the present invention;

[0025] **FIG. 6A** illustrates an embodiment of a dash and an associated database definition in accordance with the present invention;

[0026] **FIG. 6B** illustrates a series of dashes and associated database definitions in accordance with the present invention;

[0027] **FIG. 7A**-C illustrate an embodiment of a dash template for creating a custom dash in accordance with the present invention;

[0028] **FIG. 7D** illustrates a plurality of display dashes which share link or query button definitions in accordance with the present invention;

[0029] **FIG. 8** illustrates an embodiment of a dash for providing three-dimensional data in accordance with the present invention; and

[0030] **FIG. 9** illustrates an embodiment of a computer network environment suitable for creating and using a dash in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] Various embodiments of the present invention are described in detail with reference to the drawings. In the following description, numerous specific details are set forth in order to provide a more thorough description of the present invention. It will be apparent, however, to one skilled in the art, that the present invention may be practiced without these specific details. In other instances, well-known features have not been described as their capabilities are well within the knowledge of one having ordinary skill in the art.

[0032] FIG. I schematically illustrates a computer network environment suitable for the deployment of the present invention. **FIG. 1** shows a series of data sources **110** which are connected via an optional network **120** to a data source access computer **130** which provides universal data source accessibility. The data source access computer **130** is interfaced with a data analysis, presentation and reporting utility **140** which can be optionally on a same computing platform or on a different computing platform than the data source access computer **130**. Information from the data analysis, presentation and reporting utility **140** can be accessed by a plurality of user terminals **150** via optional network **160**. As will be understood by people of ordinary skill in the art, networks **120** and **160** can be separate networks or alternatively can be the same network and can be, for instance, a private or public network such as a common Ethernet, internet, intranet computer network system, wireless network or other electronic system.

[0033] Specific details of the data sources **110** is omitted from this discussion for the sake of brevity. However it is sufficient to say that all manner of data sources are contemplated as usable with the present invention including, for example, SAP databases, Oracle databases, flat file databases, SQL databases, XML databases, and Btrieve databases. Of course, any data source beyond databases may also be used without limitation, such as Computer-Aided Design (CAD), Excel, Powerpoint and TIF data sources. Moreover, data sources are not limited to file or database type sources. The data sources may also include streaming data provided, for example, by a sensor or process control system. The foregoing list is by way of illustration and not by way of limitation. One of ordinary skill will also understand that commercially available software utilities are presently available for providing cross platform and cross database access capabilities. Examples of these commercially available products include WebFocus and ColdFusion. Specific details of WebFocus and ColdFusion are omitted from this discussion for the sake of brevity.

[0034] Also referring to **FIG. 1**, it will be appreciated that the user computers **150** are employed for the purpose of presenting data taken from data sources **110** and presented directly or by way of processing through data source access computer **130** and data analysis, presentation and reporting utility **140** for display to a user. The user computers **150** can be any type of currently known or later developed user interface device including without limitation, desktop PC, notebook PC, thin client appliance, handheld device, wireless device, cell phone, PDA, etc. As a further example, on a shop floor, a projection device can be used to provide data to a plurality of users. Again the foregoing list of exemplary user computers **150** is provided by way of illustration and not by way of limitation. Similarly, one of ordinary skill will understand that data source access computer **130** and data analysis, presentation and reporting utility **140** may operate on a single computer or a cluster of computers and can be a computer for directly interfacing with a client or, alternatively, can be a server to serve the output of a process to a client computer (such as user computer **150**). Still further by way of example, data analysis, presentation and reporting utility **140** can be a web server computer which serves the output of its processing to a web client computer (such as user computer **150**). Finally, it will be appreciated that the user computers **150** can be directly connected to the data analysis, presentation and reporting utility **140**. Alternatively, the user computer **150** can be indirectly connected to the data analysis, presentation and reporting utility **140** via a private or public network, or may be wirelessly connected through all manner of known and future developed wireless access protocols.

[0035] **FIG. 2** generally illustrates a user interface dash **200**. A dash **200** is any variety of user interface screen for displaying information. A dash may be an application generated graphic image, such as would be generated by any number of programs, including C, C++, visual C++, ColdFusion, etc., or it may be a passive or interactive HTML, XML, etc., screen displayed on a browser. As shown in **FIG. 2**, dash **200** includes a field for a title **210**, a plurality of fields for labels **220** and, for each label **220**, an associated field for an indicator **230**. Dash **200** also includes a central display region **240** for the presentation of generated information to the user. Any selection device, such as a mouse, pointer, touch screen, voice recognition, etc., can be used as an interface to the dash **200**. As will be appreciated, the particular layout of the title **210**, labels **220**, indicators **230**, and central display region **240** may be varied based on a particular users' needs or subjective preferences.

[0036] As will be explained more fully below, each label **220** optionally includes the capability of a built-in function which can be invoked when the label **220** is selected. For example, when dash **200** is displayed on a user terminal (such as user computer **150**), a user may move their mouse to label **220** and activate that label (e.g., by clicking their mouse) to invoke a function associated with the label **220**. Also as explained more fully below, indicators **230** can be configured to quickly illustrate a status of information associated with the corresponding label **220**. Dash **200** additionally includes an optional function box **250** which can be used for any purpose including, for example, invocation of a so-called suggestion box function. The suggestion box **250** may be used, for example to allow a user to submit recommendations or requests for enhancements, modifications, changes, maintenance, or upgrades to, for example, the data source access computer **130**, the data analysis, presentation and reporting utility **140** or the dash **200**.

[0037] In one aspect of the invention, a user computer **150** can access the data analysis, presentation and reporting utility **140** and view the dash **200** by use of an internet or intranet. The user computer **150** can, for example, employ a web browser and access the dash **200** by using a universal resource locator (URL). Thus, the user computer **150** need not be physically located near the utility **140** or the data

sources **110**. Alternatively, the user computer **150** can access the utility **140** via other public or private communications protocols.

[**0038**] In one embodiment, the dash **200** can provide centralized access to (preferably) real-time or periodic information using a web-browser interface. By providing a centralized access point to multiple data sources, the dash can reduce or eliminate the need for multiple logins and multiple passwords (which may be required for accessing each individual data source). Of course, the need for logins and passwords may vary depending on security requirements for the data (or facility) in question.

[**0039**] Further, the dash **200** can provide a user-friendly environment where a working knowledge of vastly different computer applications and systems may be made unnecessary. The reporting utility **140** can, via the dash **200**, advantageously allow critical data, such as financial data, performance metrics, process information, technical specifications, historical documentation, etc. to be brought together for processing, monitoring, and/or analysis. Calculations, filters, sorting or other processing can be performed on the data by the data analysis, presentation and reporting utility **140**. Thus, the data can be processed in such a way as to make the data that is presented on the dash **200** easier to read and comprehend.

[**0040**] In one embodiment, the information can be tailored to the specific needs of an organization and can be organized in such a way that it can be easily accessed and analyzed. By collecting data from various data sources **110** and presenting it via the dash **200**, the amount of time an individual manager typically spends in collecting data from a variety of systems and sources can be reduced. One embodiment of the present invention advantageously provides for processes to be monitored and metrics to be analyzed in real-time or near real time. The data can then be presented in a format that is easily understood and analyzed. In such an embodiment, the critical data requirements are determined. Access to such data can be automated and the data made available to users. The users can make decisions based on the data, which is now more quickly or easily accessible. Time previously spent locating and accessing data can now be spent on other value added tasks. Thus, the company as a whole becomes more productive by the power of data.

[**0041**] In one aspect of the invention, the dash **200** can be quickly developed and implemented for an individual user. The user can thus quickly see the power, value and potential of their dash **200**. Better ways of visualizing, tracking and analyzing information and processes can be developed for the user based on their particular requirements or the requirements of their job. In one embodiment, requirements can be clearly defined and the application developed based on the requirements. In another embodiment, the development process can be an iterative process, wherein the developer can discuss the user's requirements and based thereon, quickly create a prototype dash. The user can view the prototype dash and request any modifications thereto, which can then be performed by the developer. This process advantageously provides the user the ability to comment on the dash as it is being developed, thereby increasing the user's satisfaction and ownership of the user's custom dash.

[**0042**] Indicator **230** preferably can be configured to quickly illustrate a status of information associated with the corresponding label **220**. In other words, if label **220** corresponds to a function for displaying sales volume, then indicator **230** may be programmed with an underlying function to monitor, in real-time or near real time, sales volume and compare that monitored value with a threshold (such as a budget or forecast). When the monitored value is below, equal to, or above the threshold, a visual attribute of the indicator (for example, without limitation, color, appearance, blink, blink rate, symbol, bold, etc.) is preferably changed to provide a rapidly noticeable indication of the status of the monitored information in relation to that threshold. Of course, as discussed more fully below, indicator changes can be binary or multi-level.

[**0043**] Preferably, indicator **230** can be selected from a group of possible indicators. By way of example and not by way of limitation, a green sphere icon can be used to indicate that the metric associated with the corresponding label is within a desired range. A red octagon icon can be used to indicate that the metric associated with the corresponding label exceeds a desired range. A yellow triangle icon can be used to indicate a warning, for example, that the metric associated with the corresponding label is in danger of exceeding a desired range. An icon of a white "i" on a blue background can be used to indicate that additional information is available. In a preferred embodiment, the indicators can have different shapes, in addition to different colors. Thus, the indicators will be useful to a person who is color-blind.

[**0044**] Other styles of indicators can readily be created based upon the type of information desired. For example, a single dollar sign "$" could be used to denote a task is within cost, two dollar signs "$$" could be used to denote a minor task cost overrun, while three dollar signs "$$$" could be used to denote a significant cost overrun. Alternatively, the dollar sign indicators could be used to denote sales or profitability. For example, "$" could be used to denote a low level of sales or profitability, "$$" could be used to denote a moderate level of sales or profitability, while "$$$" could be used to denote a high level of sales or profitability. By knowing which products are selling rapidly, for example, a manager can ensure that an adequate supply of the product is ordered or, alternatively, in a manufacturing setting, that all the required raw materials are ordered, so as to maximize profitability.

[**0045**] In a related embodiment, an indicator can be animated. For example, a red octagon indicator can be made to flash or rotate to draw attention. In another embodiment, an indicator can include an upward pointing arrow to denote that a task is ahead of schedule or a downward pointing arrow to denote that the task is behind schedule. An upward pointing arrow can also be used to denote an increasing trend (e.g., increasing yield over time), a downward pointing arrow can be used to denote a decreasing trend (e.g., decreasing yield over time), while a horizontal arrow can be used to denote a little to no change in the trend (e.g., the yield level is substantially stable). A combination of two indicator icons could also be used. For example, a red octagon with an upward arrow may indicate that a task is behind schedule, but improving. Each indicator could be animated to show status and whether the situation is improving, remaining the same, or becoming worse. This could be accomplished, for example, by making the red octagon

rotate in a downward direction in the event that the yield is unsatisfactory and becoming worse based upon a predetermined time frame.

[0046] In one embodiment, the selection of an indicator **230** for a particular label **220** is based on a tolerance associated with a metric corresponding to the label **220**. For example, if the label **220** is "planned cost schedule," a tolerance of ± 10% of the planned cost schedule may be selected. If, for example, the actual cost schedule varies from the planned cost schedule, an appropriate indicator can be set to display. In one embodiment, indicators for indicating a desired range (green sphere), warning (yellow triangle), and exceeding a desired range (red octagon) are all associated with a particular label (e.g., the planned cost schedule label). If, for instance, a task is within a few percent of the planned cost schedule, the green sphere indicator is active and visible. If the task is close to the 10% tolerance level, the yellow triangle indicator becomes active and visible, while the green sphere indicator becomes inactive. If the task is at or above the **10**% tolerance level, the red octagon indicator becomes active, while the yellow triangle indicator becomes inactive. In the above example, the data source access computer **130** can access the appropriate data source(s) **110** and retrieve information pertaining to the actual cost schedule and the planned cost schedule. The data reporting, presentation and reporting utility **140** can then compare a difference between the actual cost and the planned cost to the tolerance level (which can be set by selecting a parameter associated with the label **220**). Based on the relationship between the actual data and the tolerance level, the utility **140** can activate the appropriate indicator **230**.

[0047] **FIG. 3A** generally illustrates an example of a particular embodiment of a dash **300** which has been configured to report quality information. As shown in **FIG. 3A**, title field **310** shows a particular title for dash **300**. Similarly, label **320** now indicates a particular subject area, "nonconformance" for that label. Indicator **330** indicates a status corresponding to the label **320**. As will be appreciated, dash **300**, because it is for presenting quality information, may be used to track a number of parameters relating to a business' quality. Therefore, in addition to nonconformance, which is shown on label **320**, other quality related parameters may be shown on the other labels, such as product yield, scrap rates, calibration, supplier information, and software quality. The foregoing list of quality parameters is by way of example and not by way of limitation.

[0048] **FIG. 3A** also shows a particular central display **340** which is invoked when nonconformance label **320** is activated. Specifically, when a user selects or activates nonconformance label **320**, a predetermined function is invoked to generate a particular display of information associated with the subject of nonconformance. For example, as shown in **FIG. 3A**, nonconformance information may include a total amount of nonconformance **350**, a Location **1** indicator of nonconformance **360**, and a Location **2** indicator of nonconformance **370**.

[0049] Moreover, and preferably, a graphical indicator of this parameter (e.g., total nonconformance **350**) may also be shown, such as dial indicator **380**. Although dial indicator **380** is an optional aspect of the preferred embodiment, it is a desirable aspect because such graphical illustration allows a user to rapidly assess an overall level of measurement (e.g., nonconformance), and may include indicated thresholds which can quickly and visually be perceived.

[0050] As will be understood, indicators **350**,**360**, **370** and graphical indicator **380** portray information obtained from one or more data sources, which are not shown in **FIG. 3A**. For example, indicator **350** shows that a quantity of 2822 nonconforming components exists in total. Of these, a total of 715 nonconforming components are at Location **1** as shown in indicator **360**, and a total of 2107 nonconforming components are at Location **2** as shown in indicator **370**. Central display **340** with the particular nonconformance information illustrated in **FIG. 3A** is automatically generated when nonconformance label **320** is selected. The particular techniques for accessing one or more databases and for associating particular data with a particular label will be discussed later in this specification. The user or organization could choose from a list of examples of how they want the dash to appear on their visual device (user computer or display device). Another user could decide that the same data should be represented on their visual display in another format. For example, a first user might prefer the data be in the form of a bar graph, while a second user might prefer the data in the form of a pie chart.

[0051] An optional but desirable aspect of the present embodiment of the invention includes the ability to select an indicator, such as indicator **360**, and associate with that indicator a link to additional levels of details supporting an indicated value. For example, in the event that a user selects indicator **360** on **FIG. 3A**, the central display **340** would change to reflect new information. This situation is illustrated in **FIG. 3B**. Specifically, as shown in **FIG. 3B**, after indicator **360** has been selected, a new central display **345** is generated which provides a new level of information underlying the data associated with Location **1**. For example, central display **345** now shows an indicator **365** portraying the same Location **1** nonconformance information but also shows indicators **390** and **395** which provide the underlying detailed data. For example, indicator **390** may illustrate the portion of nonconformance data associated with components obtained from suppliers, while indicator **395** may show nonconformance components obtained by internal fabrication.

[0052] Just as an indicator shown on central display **340** could be selected on **FIG. 3A**, and an additional level of information be obtained (such as revised central display **345**), information presented on central display **345** may also link to additional levels of detail. As shown in **FIG. 3C**, when a user selects indicator **365** from **FIG. 3B**, a nonconformance report **400** is presented. Nonconformance report **400** can take any format which is suitable for the business organization. As shown in **FIG. 3C**, nonconformance report **400** may optionally break down the total nonconformance quantity by categories such as location or product. As shown on nonconformance report **400**, because this report was obtained by clicking on indicator **365** which is associated with Location **1**, all information on this report is associated with Location **1**. However, nonconformance report **400** may subdivide Location **1** into smaller regions or sub-locations **410** such as Location **1**A, Location **1**B, etc. To provide a more concrete example, hypothetically speaking, overall nonconformance could relate to the entire geographic U.S. Following this hypothetical, Location **1** associated with

indicator **365** could be associated with one state such as Texas. Finally, continuing with this example, individual sub-locations **410** such as shown on nonconformance report **400**, could be associated with specific cities or manufacturing sites in Texas. Along the same lines, nonconformance report **400** also illustrates nonconformance information segregated by products **420**. Finally, nonconformance report **400** may also provide further levels of detail about nonconforming items such as whether the item is still in an open status **430** and **440**.

[**0053**] Of course, what is particularly important to appreciate about **FIGS. 3A through 3C** is not the particular format of the reports, but instead that at each level of the display, summary information is portrayed and a link is provided to one or more additional levels of detail to assist the user (if necessary) in comprehending the significance or supporting factors for that information.

[**0054**] The concept of linking between levels of information is further illustrated in **FIG. 3D**. Just as a user could select indicator **365** on **FIG. 3B** and that selection would cause nonconformance report **400** to be presented (**FIG. 3C**), a user may similarly select a sub-location **410** from nonconformance report **400** and cause a distribution by product report **450** to be presented for that particular sub-location **410**. Distribution by product report **450** may show, for example, a yet additional level of data resolution supporting the previously indicated information. More concretely, distribution by product report **450** can show products **420** for a particular sub-location **410** but now additionally can show how nonconformance information is collected according to steps in a manufacturing process **460**.

[**0055**] Finally, a data item illustrated on distribution by product report **450** may be selected to link to a still further level of information. For example, selection of a particular step **460** in **FIG. 3D** may link a user directly to the native database application **470** historically used to manage data in a particular data source. Since the dash **300** ultimately links to the data in the native database application **470**, changes to the information in the native database application **470** (e.g., new manufacturing data becomes available) may result in an update to the information displayed in central displays **340**, **350**. In one embodiment, the dash **300** is continuously updating. In such an embodiment, as new information is added to the native database application **470**, the information displayed by dash **300** can be instantaneously updated. In an alternative embodiment, the dash **300** can retrieve data from the native database application **470** at a predetermined periodic interval, or can include a means for a user to refresh the data displayed with current data.

[**0056**] At the level of detail illustrated in **FIG. 3E**, detailed manufacturing data may be collected. Database application screen **470** may show individual manufacturing parts **480** and for each part a responsible party **490** may be tracked. Because the embodiments of the present invention employ cross database application capabilities, a facility such as e-mail or pager notification may be embedded in the user interface. For example, as shown in **FIG. 3E**, part **480** having responsible party **490** may include an e-mail hyperlink **495** to automatically generate an e-mail to the responsible party **490** should a question, comment or alert be desired to be manually transmitted. Additionally or alternatively, other methods of notifying the responsible party **490** can be provided, including notification via telephone, pager or other electronic means.

[**0057**] Of course, although not specifically illustrated in **FIG. 3E**, the system may be configured to monitor quantity of nonconformance levels and to automatically take action when a particular threshold level is achieved. This aspect of the present invention is discussed more completely in the following; however, in the context of e-mail notification, when a parameter reaches or exceeds a threshold it is also an aspect of the present embodiment that automatic e-mail notification or pager notification may be enabled. Other means of notifying the responsible party **490**, whether manually, by selecting a link, or automatically upon reaching a predetermined threshold, can be provided. For example, the responsible party **490** can be notified via telephone, pager or other electronic notification system.

[**0058**] **FIGS. 3A through 3E** illustrate a particular functional area in a hypothetical company. These figures discuss, among other things, so-called nonconformance data, which is manufacturing part information relating to components having a nonconforming parameter or defect. The particular reports illustrated can be adapted for any type of underlying information and for any parameter that can be tracked for an organization. The particular reports illustrated in **FIG. 3C through 3E** are exemplary and not by way of limitation.

[**0059**] Just as **FIGS. 3A through 3E** illustrate a reporting and hierarchical data sequence for nonconformance information in the context of a manufacturing organization, the present embodiment can also report non-manufacturing information. For example, as illustrated in **FIG. 4A**, dash **500** can be used to present information relating to, for example, human resources information. As seen in **FIG. 4A**, dash **500** is adapted for human resources reporting and includes a title field **510** indicating that the dash is for human resources, a plurality of labels **520** specifically labeled and enabled to provide human resources related information, indicators **530** for indicating a status of the associated information, and a central display **540** for displaying a reported metric.

[**0060**] More specifically, as shown in **FIG. 4A**, when a training label **520** is selected on dash **500**, central display **540** presents indicator **550**, which is a measurement of the number of persons having expired training obligations, and graphical indicator **560**, which provides a graphical depiction of the same information. In a manner similar to that described in the manufacturing example, when a user selects indicator **550** on dash **500**, a next level of information linked thereto is presented. Specifically, as shown in **FIG. 4B**, when indicator **550** is selected, a required courses by expiration date report **570** is presented. The particular information arrangement and format of the required courses by expiration date report **570** is not critical to the present embodiment. However, the information shown on the required courses by expiration date report **570** comprise the component data values which were employed to report the value shown on indicator **550** and graphical indicator **560**. For example, as shown on **FIG. 4A**, indicator **550** shows five persons having expired training courses. The required courses by expiration date report **570**, as shown in **FIG. 4B**, breaks down the total of five persons by location. Additionally, other information such as, for example, calendar information about the expired course(s) may be presented.

[0061] Also in a manner similar to the manufacturing example, the required courses by expiration date report **570** is linked to the data which forms the basis of that report and that data can be accessed by selecting a data item **575** on the report **570**.

[0062] For example, as illustrated in **FIG. 4C**, when a location data item **575** is selected on report **570**, an expired course detail report **580** may be presented. Again, the example illustrated in **FIGS. 4A through 4C** relating to human resources and training information provide an example of a hierarchical multilevel reporting system where each level of information can be linked to the next underlying level until the ultimate native database application can be reached.

[0063] As will be appreciated, such a hierarchical multilevel reporting system can be of significant value to a manager in an organization. For example, in a manufacturing organization, a manufacturing engineer might find the reporting capabilities and levels illustrated in **FIG. 3A through 3E** extremely valuable. Similarly, a human resources professional might find a reporting capability such as illustrated in **FIG. 4A through 4C** extremely valuable.

[0064] An important aspect of the present invention includes a series of dashes, where each dash, with its underlying data reporting hierarchy, is adapted for a particular functional purpose. As schematically illustrated in **FIG. 5**, a business manager may need access to diverse functional areas of data, including human resources data, finance data and manufacturing data. Each organization can quickly obtain appropriate data through a customized dash for their organization. For example, as illustrated in **FIG. 5**, dash **610** with its underlying data hierarchy (not shown) may provide human resources data. Similarly, dash **620** with its underlying data reporting system may provide financial data, while dash **630** with its underlying supporting data may provide manufacturing data.

[0065] Also as illustrated in **FIG. 5**, a manager who has access to human resources data dash **610**, financial data dash **620** and manufacturing data dash **630** can consult each respective one of these dashes **610**, **620**, **630** to obtain information relevant to that area. Because the dash information is presented first at a summary level and later through links to a detailed level, a manager **640** can navigate through links on the dash down to the level of information most useful to that manager. Thus, by having (1) information readily available from many data sources and (2) information summarized in a useful and comprehensible manner, the manager **640** is empowered to exercise improved judgment.

[0066] Further, by utilizing resources from throughout a company, the knowledge, skills, and experiences of the company can be leveraged and used to develop applications that are useful, efficient and robust.

[0067] The discussion will now turn toward the infrastructure supporting the dash display. For example, as illustrated in **FIG. 6A**, a particular dash display **710** is shown. Dash display **710**, like the dash display **200** illustrated in **FIG. 2**, includes a series of labels **730**, and a central display region **740**. Label **730**, as previously discussed, includes a programmed functionality that has been associated therewith. In fact, each label **730** on dash display **710** may include an associated functionality. That functionality optionally may include a title, which is shown in the label region, and may also include a function, link, query or URL which is called when the label is selected. As shown in dash database definition **720**, a preferred embodiment of the present invention includes a database which defines the functions for each label.

[0068] Dash database definition **720** illustrates a particular database suitable for a dash pertaining to quality issues. The database illustrated in dash database definition **720** comprises a series of rows or records, each one of which corresponds to a label on the dash display **710**. Each record comprises a plurality of fields which define relevant attributes for the corresponding label. For example, label number two in dash display **710** would have optionally associated therewith record number two **750** in dash database definition **720**. Record number two would define, for example, that label **730** should be entitled "nonconformance" according to the first field of that record. Similarly, record number two may define that query **1** should be invoked when label **730** is selected from dash display **710**. This can be seen from dash database definition **720** as the second field of the second record **750**. Similarly, other records in dash database definition **720** provide the definition and associated functionality for other labels on dash display **710**. Again, each record **750** comprises a plurality of fields and each field defines an attribute of the associated label.

[0069] By use of dash database definition **720**, a record can be conveniently maintained which defines the functionality for each label **730** of a given dash display **710**. The label title or functionality of each label of dash display **710** can be modified by modifying the records and/or fields in the dash database definition **720** associated with that dash **710**. Thus, as one of ordinary skill in the art will appreciate, in the situation where several dash systems are employed, each one of those dash systems would have associated therewith a database definition or a portion of a database definition. This concept is illustrated in **FIG. 6B**.

[0070] As shown in **FIG. 6B**, human resources dash **760** has associated therewith a human resources dash database definition **770**. Similarly, manufacturing dash **762** has associated therewith manufacturing dash database definition **772**. And finally, quality dash **764** has associated therewith quality dash database definition **774**. As explained with reference to **FIG. 6A**, the dash database definition for each respective dash includes records for each one of the labels on the corresponding dash. Although three individual databases are depicted in **FIG. 6B**, one of ordinary skill in the art will appreciate that three discrete sets of data each comprising records can be concatenated into a single master database so long as the association of the records pertinent to each respective dash can be separately identified.

[0071] Since each dash has a dash database definition associated therewith, a collaborative environment can be created wherein information can be exchanged throughout the company (e.g., across organizations and groups). Such an exchange of information can be mutually beneficial to all the organizations involved.

[0072] In one embodiment, the data sources, reports and user interfaces can be designed in such a way that the same application and data can be used by other organizations (e.g., within the same company). To this end, data, data sources,

application files and associated information should be accessible to both end users and developers, and should be easily modifiable to meet the specific needs of a functional area or program. In one embodiment, in order to avoid security concerns, public data (i.e, data that may be viewed by the general employee population) should be used as much as possible. Of course, sensitive data can also be included on a dash as long as appropriate security measures are taken to restrict access. Such restricted data may not be available to other end users or developers.

[**0073**] One additional feature of an embodiment of the invention is the capability to create a custom dash. One aspect of this feature relating to custom dash development is the use of a graphical interface that serves as a central access point to various files and applications to allow users to create and define their own custom dash interface. As explained more fully below, such a graphical interface preferably provides the option of choosing applications and files from existing dashes, or designating new applications and files directly. The color of the center display can also be customized. Once the buttons are defined, the dash can be saved as a demonstration (or prototype) version. A saved demonstration version can be edited by returning to the initial screen and accessing the saved demonstration dash a second time in edit mode. When a prototype custom dash is in final form, it can be saved as an official enterprise dash.

[**0074**] More specifically, **FIG. 7A** illustrates a blank dash template **800** that can be employed to create a custom dash display. Blank dash template **800** includes blank label fields **810**, blank indicator fields **820**, label remove buttons **825**, a blank title field **830**, and blank central display region **840**. Blank dash template **800** also includes a selection region **850** for selecting an existing dash as an information source. Blank dash template **800** also includes additional functional selections such as a help button **860**, a save button **865** and a new button **870**. The label remove buttons **825** can be used to delete a corresponding label **810** from the dash template **800**. The help button **860** can be used to provide instructions or other assistance. The save button **865** can be used to save the current dash. Blank dash template **800**, according to preferred aspects of the present invention, can be used as a tool to build a custom dash. Specifically, a dash may be regarded as an information layout scheme and an associated underlying functional definition. Because the dash database definition provides the functional definition, a blank dash template **800**, when associated with a dash definition database becomes a custom dash having the functionality defined by that dash database definition.

[**0075**] For example, again referring to **FIG. 7A**, label **810** on blank dash template **800** has no functional operation associated with it. While it is possible to manually populate a dash database definition with records and fields of information to define and describe the operation of this label, the present invention provides additional tools for this purpose. Specifically, as illustrated in **FIG. 7B**, the blank dash template **800** can be used to build a custom dash by building on existing previously defined dashes. Specifically, in selection region **850**, a user wishing to create a custom dash may select an existing dash as an information template.

[**0076**] For example, a quality dash which was previously designed can be selected as an information source. When the preexisting quality dash is designated as an information source, the labels associated with that quality dash are displayed in central display region **845** as shown in **FIG. 7B**. Specifically, the previously defined quality dash included labels such as software, nonconformance, supplier info, calibration, and (among other things) rework. In the event that a custom dash wishes to have the same calibration definition as employed in the quality dash, the present invention permits that calibration definition to be extracted from the quality dash and imported into the custom dash under construction.

[**0077**] In a preferred embodiment of the present invention, a graphical drag and drop interface is provided which allows a custom dash developer to merely click on a preexisting dash label shown in central display region **845** and drag that label to a label **815** on the custom dash under development. Alternatively, a preexisting dash label can be selected by using a pull-down or another type of selector. By this process, a dash database definition for the custom dash is created where the particular record associated with label **815** is replicated based on the corresponding dash database definition record from the quality dash database definition. Similarly, if a custom dash **800** under development also wishes to have a nonconformance label like that provided on the quality dash, that label too can be copied from the quality dash and imported into the custom dash. Significantly, while the examples of preexisting dash displays described thus far have single functional focuses, such as quality or manufacturing, it will be appreciated that the creation of a custom dash can rapidly cross these functional boundaries. For example, during creation of a custom display, a quality dash may be selected as a source for creating a calibration label, but then a human resources dash may be selected to define a second label on the custom dash.

[**0078**] This technique of extracting previously defined functions, attributes, labels, titles and underlying capabilities from a previously defined dash and exporting them into a custom dash vastly accelerates the development speed for custom dashes within the organization. Moreover, this technique provides a heretofore previously unachieved degree of consistency across an organization in data utilization. For example, if a quality assurance department defines the proper techniques for software performance assessment, once that software performance is programmed into a label on the quality assurance dash, that functional capability is immediately available to all other makers and users for their custom dashes. As a result, all areas of an organization can employ the same best practices and best techniques for data analysis and presentation as the functional areas most expert in dealing with that data. Thus, everybody in the organization can look at the same data in the same way without the option or ability to recast the data favorably or unfavorably.

[**0079**] The custom dash may also include newly defined labels not previously existing on other dashes. For example, as shown in **FIG. 7C**, a blank dash template **900** is illustrated where a custom button is to be created. Specifically, because no preexisting dash includes the desired capability, the specific details of the custom label must now be provided. In other words, in contrast to dragging and dropping a completely predefined function from another dash, the new button utility allows a basic record definition to be defined in the dash definition database. As shown in **FIG. 7C**, when the new button request indicator **910** is selected, a dialog box **920** is presented in central display region **930**. Dialog box

920 provides for user input fields for information such as the title of the label, a link, query, URL or other application such as Flash movie name, which is to be invoked when the label is activated, and other information necessary to populate the dash database definition record. For example, for a flash movie, the user would indicate a flash movie instead of a URL when defining a button, and input the directory path and name of the flash file.

[**0080**] In a preferred implementation, dialog box **920** is configured so that the dash buttons can link to any file or application as long as the web browser recognizes the URL.

[**0081**] Thus, by either importing previously defined buttons from other dashes or by defining individual custom buttons for the dash, or a combination of these two techniques, a new custom dash can be defined with great speed and ease. Significantly, once a new custom dash has been defined, consistent with security permissions within an organization, such new custom dash can immediately be added to the list of available dashes accessible for the creation of subsequent custom dashes.

[**0082**] **FIG. 7D** illustrates a plurality of display dashes in accordance with the present invention which share link or query button definitions. For example, quality dash **950** is configured to display data pertinent to, for example, a quality assurance employee, finance dash **952** is configured to display data pertinent to a financial employee, manufacturing dash **954** is configured to display data pertinent to a manufacturing manager, and engineering dash **956** is configured to display data pertinent to an engineering manager. Quality dash **950** may include, for example, an inspection button (i.e., label) **960** for displaying inspection data and a nonconformance button **962** for displaying nonconformance data. Further, manufacturing dash **954** may also include inspection button **960** and nonconformance button **962**. Since the nonconformance button **962** is the same for both the quality dash **950** and the manufacturing dash **954**, both the quality assurance employee and the manufacturing manager can view the same nonconformance data and view the data presented in the same way. Thus, although monitoring nonconformance information may be primarily performed by the quality assurance employee, the same criteria for viewing nonconformance information can also be employed by the manufacturing manager.

[**0083**] **FIG. 8** illustrates an embodiment of a dash **1000** which has been configured to provide three-dimensional image data. As shown in **FIG. 8**, title field **1010** shows a particular title for dash **1000** (i.e., manufacturing). Label **1020** indicates a particular subject area, backlog, for the label. Because dash **1000** is for presenting manufacturing information for, in this case, an automobile, label **1020** can be used to track the backlog associated with various components of the automobile.

[**0084**] Dash **1000** further includes a central display **1030** showing a graphical illustration of the automobile that is the subject of the dash. In one embodiment (not shown), an image of the automobile is presented. Activation of the backlog label **1020** invokes a number of backlog indicators. Specifically, backlog indicator **1040** indicates components having a backlog of 15 days or less (e.g., wheels). Backlog indicator **1050** indicates components having a backlog between 15 and 30 days (e.g., front fender). Backlog indicator **1060** indicates components having a backlog greater than 30 days (e.g., rear fender). Thus, a user can view an image of the automobile on the central display **1030** and quickly determine the types of components that are backlogged and the amount of delay in receiving the backlogged components.

[**0085**] In one embodiment, the image shown on the central display **1030** can be a three-dimensional image. A user can be given the option to rotate and view the image from a plurality of perspectives. By selecting one of the various components from the image, a more detailed image of the selected component can be displayed. Alternatively, selection of a component could lead to a textual, alphanumeric, or graphical information display for providing details about the component, such as cost, manufacturing yield, or delivery data.

[**0086**] In one embodiment, a two or three-dimensional image can be generated, for example, in real-time from stored data, such as computer aided drafting (CAD) data. In another embodiment, a two or three-dimensional image can be stored in the data source **110** and retrieved for display on a dash. The image can then be inspected visually to give the user a better understanding of the relationship between product components. For example, if a part is out of tolerance, a three-dimensional depiction of the physical relationship of the out of tolerance areas can be used to assist a user in understanding the scope of the problem. Thus, not only can a three dimensional object such as a 3D graph be displayed in the central display **1030**, but also a graphical representation of an object, a flow diagram, a manufacturing line, etc., can be shown. Moreover when an object, a flow diagram, a manufacturing line, etc. is shown, the image itself can be either annotated with data from the data source **110** or a visual or graphic attribute of the image (e.g., color, bold, blink, highlight, etc.) or a part of the image can be varied to provide a visual indication of the status between the data and the object or diagram shown.

[**0087**] **FIG. 9** illustrates an embodiment of a computer network environment suitable for creating and using a dash in accordance with the present invention. In one embodiment, development of dash applications can be performed via a Windows NT/2000 server running ColdFusion Development Server and Microsoft Internet Integration Server (IIS) Web Development Server. The ColdFusion Development Server can be used to provide access to various data sources, including: SAP, Access, Oracle, flat file extract and/or other database platforms, while the Microsoft IIS product can be used to develop and deploy web-based applications. Developers can use, for example, personal computers having the following desktop products: Internet Explorer, Macromedia ColdFusion 5.0 or MX, and Macromedia Flash 5.0 or MX.

[**0088**] End users can, for example, access the dash applications using personal computers having the following desktop products: Internet Explorer, network (LAN) access, Macromedia Flash Player, and Java Runtime Environment. The end user computers can access the dash applications via Internet Explorer, which is adapted to operate with Microsoft IIS Web Server. The ColdFusion Server provides the user computers with access to the various data sources, including: SAP, Access, Oracle, flat file extract and/or other database platforms. Of course, the end users can also use the development environment to access the dash applications.

[0089] The dash display system according to the foregoing described embodiments can also be used as a tool in a unique collaboration methodology. Specifically, for example, vendors and customers may share common sets of information and access that shared information via dash interface systems according to the described embodiments. By providing cross-platform access to data, and by providing data in a form and format which is defined by the process owner responsible for that data, vendors and customers alike may achieve a common view on data and the status of matters which the data represents.

[0090] For example, a government agency and a government contractor may set up a common set of information relating to execution of a government contract. Various dash displays may be defined relating to cost, schedule, component testing, quality assurance, data items, etc., which draw information from the native sources where this information is historically maintained. However, by collaborative use of the dash system according to the present invention, both the contractor (as well as possible subcontractors) and the government agency can achieve, for example, near real time access to program information, schedule, cost and status of deliverables. More importantly, both the contractor and the government agency would receive similar views of the information from common data sources. Thus, alerts, indicators of status and real time measurements would be (preferably or optionally) equally available to both parties.

[0091] A still further embodiment of the present invention includes user authentication and access control capabilities. For example, an organization may wish to control which users have access to certain information and/or whether certain users have read only versus update permission relating to specific types of information. In a preferred implementation of the present invention, a user's network logon information could be accessed by the dash display system thereby eliminating the need for a separate logon to the dash display system. Once user authentication and identification has been accomplished user permissions for access, update, etc., can be performed.

[0092] More specifically, in an embodiment of the present invention, a user access control table would be maintained which contains information sufficient to enumerate each relevant permission or prohibition for each user. Such user access control table could be created for a system wide implementation and would be accessed for permission information for all dash displays. Alternatively, a dash display specific user access control table could be created. In the custom dash creation system, such user access control information can also be used to control which preexisting dash labels **815** could be selected by a user to add to that user's custom dash under development. As will be understood, such user access control table can not only list each user but can also be implemented on a group or role basis where each user is identified as a member of a certain security "group" and permissions or prohibitions are established at a group level. For example, all employees in the HR department may be granted certain permissions to access HR data while employees in an engineering department may not have permission to access HR data.

[0093] Although the present invention has been fully described by way of examples with reference to the accompanying drawings, it is to be noted that various changes and modifications will be apparent to those skilled in the art. Therefore, such changes and modifications should be construed as being within the scope of the invention.

What is claimed is:

1. In a computer-based system for presenting a plurality of display screens, each display screen including at least one control, each control having at least one function associated therewith, a method for generating a custom display screen comprising the steps of:

providing a plurality of display screen function databases, each display screen function database being associated with a respective one of a plurality of display screens, each display screen function database containing at least one record of a function associated with a control for said respective one of said plurality of display screens;

providing a custom display screen template having at least one undefined control;

selecting an undefined control on said custom display screen template;

receiving a first user request for specific functionality on a custom display;

identifying a data source accessible by a computer which relates to the first user request for specific functionality;

prototyping a function which relates to the first user request for specific functionality and said data source;

associating said selected undefined control with said prototype function;

updating a display screen function database associated with said custom display screen template with a record corresponding to said prototyped function;

receiving user feedback on said prototype function;

optionally modifying said prototype function based on user feedback and updating said custom display screen function database associated with said custom display screen template with a record corresponding to said modified prototyped function; and

saving said display screen function database associated with said custom display screen template for production use.

2. A method for generating a custom display screen in accordance with claim 1 further comprising the steps of:

selecting a record of a function associated with a control for said respective one of said plurality of display screens from one of said plurality of display screen function databases;

selecting an undefined control on said custom display screen template;

associating said selected undefined control with said selected record of a function associated with a control; and

updating a display screen function database associated with said custom display screen template with a record corresponding to said selected record of a function.

3. A method for generating a custom display screen in accordance with claim 2, wherein said step of selecting a

record of a function associated with a control for said respective one of said plurality of display screens from one of said plurality of display screen function databases is performed via a drag and drop graphical user interface.

4. A method for generating a custom display screen in accordance with claim 2, wherein said step of selecting a record of a function associated with a control for said respective one of said plurality of display screens from one of said plurality of display screen function databases is performed via an on screen menu interface.

5. A method for generating a custom display screen in accordance with claim 1, further comprising the steps of:

selecting an undefined status indicator on said custom display screen template;

associating said selected undefined status indicator with an information parameter and a threshold to define a new status indicator; and

updating a display screen function database associated with said custom display screen template with a record corresponding to a definition of said new status indicator.

6. A method for generating a custom display screen in accordance with claim 1, further comprising the steps of:

optionally prototyping another function and associating said another function with another undefined control, updating said display screen function database associated with said custom display screen template with a record corresponding to said another function, receiving user feedback on said another function and optionally modifying said another prototype function based on user feedback and updating said custom display screen function database associated with said custom display screen template with a record corresponding to said modified another prototyped function.

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