

SYSTEM FOR MANAGING INFORMATION ON A REAL-TIME MONITORING SYSTEM

5 FIELD OF THE INVENTION

The present invention relates to a system and method of managing information in a real-time data in a monitoring system.

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BACKGROUND OF THE INVENTION

Electronic control systems are commonly used in a variety of industries, especially where a multitude of machinery, sensors or other control machinery have to be
15 monitored and or controlled.

In industries where there are a multitude of control devices that need to be critically monitored, it is imperative that real-time monitoring control systems are adopted.

20 Presently, industrially available dedicated electronic systems include the DCS (Distributed Control System) and the SCADA (Supervisory Control and Data Acquisition) systems, which are popular. These systems are typically used to monitor plant or industry parameters such as chemical levels or concentrations, water levels and waste matter levels or concentrations.

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The SCADA system is a software positioned on top of hardware to which it is interfaced, via Programmable Logic Controller (PLC) or other commercially available hardware modules. Figure 1 illustrates the structure commonly adopted by the SCADA or DCS system.

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The control system gathers information from the hardware modules, to a centralised database and transfers this information through the input / output driver 10, to the control network for data or information management as seen in Figure1. Data received is usually segmentized into various panels, for example, a historical data manager 20,

which stores and manages trend information, a real time data manager 30 and a message manager 40, which stores the data in memory. The data is then presented to a user through a Human Machine Interface (HMI) or a Graphical User Interface (GUI) via various panels. These panels are managed by a panel manager 50. The panel manager allows a user to access information by manipulating the GUI, to view the differing panels of information, i.e. the historical message panel 60, alarm summary panel 61, trend panel 62, graphic panel 63 and a control group panel 64. Each individual information type is displayed along a time scale as individual data points. In other words, each data-point is identifiable by at least a time-stamp indicating a time along the time scale. Although each panel has its own data or information tied to a time-stamp, each data point across the various panels are independent of each other.

In a manufacturing environment, a user will typically review the trend panel 62, to view the data points along a time scale which is usually the default display panel, on the HMI. However, to view alarms that may have occurred, the user will have to switch to the alarm summary panel 61. This panel 61 displays any alarms, which are currently unacknowledged or recovered in the SCADA / DCS system. Once acknowledged, the alarm message will be directed to the historical message panel 60, according to the present system rules of the SCADA and DCS systems.

Therefore, when a user desires to check on a particular alarm or event, he has to check on the alarm summary panel 61 first, and if the alarm message is not found there, he has to then check on the historical message panel 60. This is especially time consuming and tedious, especially when troubleshooting of particular machines are required, as a user will have to first identify all the alarms due to a particular machine, in both the alarm summary panel 61 and the historical message panel 60, and then compare with the data points on the trend panel, to see the effect of the faulty machine on the data points.

Also, when a user considers a particular data point to be of interest, he is unable to add or input any comments onto the trend graph. To do this, a user will have to copy an image of the trend graph and paste it on a document and manually add in any pertinent comments. However, as can be appreciated, these comments must be accessed independently of the panels, and will not be accessible by other users through the

system.

Figure 1 shows an example of an architectural structure of a real-time control programme of the prior art. The measurement values of the differing parameters collated from the series of programmable logic controllers (PLC) and other engineering controllers and monitors are displayed as data points in separate panels. To access each panel of information, a user will have to individually select and cause each panel to be displayed individually. For example, when in use by an operator of a manufacturing plant, the user will be likely to monitor the trend panel to control the plant and to ensure that there are no out of control (OOC) or out of specification (OOS) data points detected. However, the alarm summary panel will also have to be monitored so that any machine faults may be quickly rectified to ensure smooth operations. Therefore a user would have to constantly switch from one panel to another intermittently, which is tedious. Specifically the DCS / SCADA has an Alarm Summary panel and a 'Historical Message' panel. The 'Alarm Summary' panel shows the current acknowledged or un-recovered alarms. However, once it is acknowledged or recovered, this information will be transferred to the 'Historical Message' panel. Therefore if a user wants to check on an entire alarm history (whether or not the alarm has been acknowledged or recovered), the user will have to access and display both the 'Alarm Summary' and 'Historical Message' panels individually which is laborious and time consuming.

It is an object of the invention to ameliorate one or all of the above problems.

SUMMARY OF THE INVENTION

According to an aspect of the invention, there is provided a system for managing information for a user on a real-time control programme said system including a base layer for receiving and displaying real-time measurements of a first parameter said real-time measurement displayed as data points along a time scale, each data point tagged with at least a timestamp value of the time-scale, a subsequent layer for receiving and displaying a data or information input by a user, wherein the system

further includes a link generator to link a data value or input information to a data point of the base layer.

- 5 Preferably, the system further includes a link information generator to allow a user to create further layers for the display of further information.

10 Preferably, the further information includes media type of text based, sound based image based and other multi-media based information.

15 Preferably, the link information generator further includes an adaptor, to receive and display the further information.

Still preferably, the adaptor includes a text data adaptor, an audio adaptor, an image adaptor and any other multi-media field adaptor.

20 Preferably, the system further includes a link update generator to update the link between the data points of the base layer to the measurement data values or input information of the subsequent layer.

25 According to another aspect of the invention, there is provided a method of linking and adding subsequent layers of information on a real-time monitoring system, said system having a real-time display on a base layer including adding a subsequent layer to receive data or information, forming a link between data or information received by the subsequent layer to a base layer, configuring the subsequent layer to receive a multi-media type of data or information, adding the subsequent layer to the base layer; and
30 displaying the layers using a display means.

DESCRIPTION OF FIGURES

In order that the invention might be more fully understood, embodiments of the invention will be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows an embodiment of the prior art;

Figure 2 shows a block diagram of the features of the present invention;

Figure 3 shows the linking means is in the form of a link generator, to link a data point or an input information of a subsequent layer, to a specific data point of a base layer;

Figure 4A shows the Human Machine Interface, where the information of a subsequent layer is an image;

Figure 4B shows the base layer and the subsequent layer of the present invention;

Figure 5 shows a preferred embodiment of the software structure of the link information generator and the adaptors;

Figure 6 illustrates how a text input is linked by the link information generator;

Figure 7A shows a flow chart illustrating the method of linking and adding subsequent layers of information according to the invention;

Figure 7B shows a flow chart illustrating the process of the link information generator;

Figure 8 explains how a user can add a comment on the trend panel;

Figure 9 explains how an alarm message can be linked to the trend panel;

Figure 10 illustrates how a user can add operation history information onto the trend panel;

Figure 11 explains how to make a new piece of link information as the deviation trigger; and

Figure 12 shows the block diagram of an embodiment of the present invention.

The attached drawings are not necessarily drawn to scale.

DETAILED DESCRIPTION OF THE INVENTION

5 Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. The preferred embodiments of the invention are not intended to limit the invention in its broadest aspect to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and
10 scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the embodiments, numerous specific details are set forth in order to provide an understanding of the present embodiments.

In the foregoing paragraphs, the term "data" is used to refer to the measurement values
15 and other data tied to, and received from the engineering controls and monitors. The term "value" is used interchangeably with the term "data". The term "information" is taken to mean the information input by a user, independent of the input from engineering controls and monitors.

20 The invention builds upon a real-time control programme of the existing art. In the real-time control programme of the existing art, data is presented in independent panels, and presented to a user, in the form of a display through a Human-Machine Interface (HMI). In a real-time control programme, data is received from a multitude of engineering controls and monitors, and received by individual panels and displayed in
25 individual layer of the control programme. What this means is, each type of data received from the engineering controls and monitors, are pre-determined by an algorithm to be received by panels relevant to the data point or value. For example, data relating to the manufacturing process, is received by a trend panel and displayed in a base layer, and data relating to the machine alarms, is received by an alarm
30 summary panel and displayed on a subsequent layer. This data is usually presented to a user using a display means along a time-scale. In the present invention, the display means is in the form of a HMI. Each data point or value received from the engineering controls or monitors, are tagged with a unique time stamp, which serves as an identifier of the data point or value. The identifier may further include a pen-number, which

serves as an additional identifier for each layer. Each layer or graph on the system has its own unique identifying pen-number. Therefore, each data point obtained will be displayed on pre-determined graphs or layers, determined according to the pen-number of each data point or value. Based on the time-stamp, each data point is then displayed chronologically on the specified layer (in accordance with the pen-number), on the Human Machine Interface or HMI. Therefore, when a user views the graph displayed on the HMI, over time, the data points will also move chronologically with the graph, as each data point or value has its own time-stamp.

Figure 2 shows an embodiment of the system 100 for managing information for a user on a real time control programme. The system includes an input means 200, to allow a user to receive information from a user, or data from engineering controls or monitors. The invention also includes a layer generating means 210, to allow a user to add on a subsequent layer of data or information, to the existing real-time control display. The subsequent layer may receive data or information either by way of the engineering controls or monitors, or through a user's information input via an input means. The data or information received in each subsequent layer is then linked, using a linking means 220, to link data points from a base layer of data, to a subsequent layer of data or information. This information is then displayed, using a display means 230, and provided to a user in a HMI 240.

Each feature of the invention will be described in turn.

Input means

As explained, information may be obtained, from a user's input. As seen in Fig 3, the input means 200 is in the form of an input apparatus for example a keyboard 201 that is linked to an appropriate adaptor. For example, when a user wishes to add a particular comment to a particular layer, his input is in the form of textual information. The user inputs his text information using the keyboard 201, which is channelled to a text adaptor 202, so that the particular layer may receive and display the input text information. Similarly, when a user wishes to add on an image to a particular data point for example, an image of a faulty machine, the user inputs the image, which will be channelled to an

image adaptor 203, so that a particular layer will receive and display the graphical information on a particular data point of a particular layer.

5 An example of a panel display with an image added to a particular data point is shown in Figure 4A.

Layer Generation Means

10 The system 100 allows a user to add subsequent layers of data or information to the base layer 119 using a layer generation means as seen in Figure 4B. A user can define the media type of information to be received and displayed by each subsequent layer 120 thus formed.

15 Once subsequent layers 120 are added to the base layer 119, a user can choose the relevant adaptors necessary for the receipt of data or information of the various media types on each layer. For example, a text data adaptor, audio adaptor, an image adaptor or any other multimedia field adaptor, to receive text, sound and picture information respectively. As seen in Figure 4B, the subsequent layer 120 having text information in the form of comments, is formed on top of the base layer 119, in the form
20 of a trend chart 111.

Linking means

25 In Figure 2, the system 100 further includes a linking means 220, which enables a link to be established, between a data point of a base layer, to a data point or an input information of a subsequent layer 120 thereby linking the information. As seen in Figure 5, each data value is identifiable by at least a time-stamp 1400 or a time-stamp 1400 and pen-number 1234. The linking means links a data point or an input information of a subsequent layer 120, to a specific data point of a base layer. As seen in Figure 5, a
30 particular data point 112 from a base layer 119 in the form of a trend graph 111 is linked to a subsequent layer 120 by a time-stamp 1400 and a pen-number 1234.

This is explained subsequently and also in Figure 6.

The linking means 220 allows a user, to define the relationship between a data value of a subsequent layer 120, to a data/ information value of a base layer 119. Therefore, a user can decide on the link between a particular type of data/ information of the subsequent layer 120 to a data point of a base layer. As previously described, data values are identifiable by a time-stamp 1400 and a time-stamp 1400 or a pen-number 1234. Therefore, to link a user defined information value to a data point of the base layer, a linking means 220 in the form of a link information generator 223 reads the information and generates a link information (i.e. an identifying time-stamp or a time-stamp and pen-number), which then combines the data value from a base layer and a subsequent layer 120. In this way, data value from a subsequent layer 120 is then linked to a data value of a base layer.

The link information generator 223 allows a user to determine the media type of information, to be linked to a base layer, by defining and establishing a relationship between the points of both the base and subsequent layer 120, thereby causing a link between a data value of a base layer to a data / information value of a subsequent layer 120.

To define the relationship, a link configurator is used. The link configurator allows a user to define the relationship between data / information from a subsequent layer, to a data value of a base layer.

Referring to Figure 5, therefore, a user may configure the relationship by defining the data/ media type of information to be linked, and the particular layer, which is identified by a pen number.

The input information on the subsequent layer 120, may be viewed on the HMI once it is linked. This allows an operator to view or enter any comments onto any particular data point 112 of the trend graph 111 of Figure 5. Advantageously, when in use, a user may input comments or information directly onto a particular data point 112 of their interest. For example, a deviant data point may be related to a user's specific actions or due to certain events and a user may input their comments or other information to relate to that specific point.

Other information that may be input onto the subsequent layers 120 may be of different media types. Each media type is defined by different layers, as defined by the user.

As previously seen Figure 4A, the information that is input is an image. Other examples of multi – media information includes but is not limited to noise (sound data), video imager (video data), alarm measurer (proprietary data) and operation history data (proprietary data or text string)

Figure 6 shows a preferred embodiment of the software structure of the link information generator and the adaptors. The number of layers of information can be defined by any number according to the user. As seen in Figures 4B and 5, the user can then configure a link between the base layer 119 and the subsequent layers 120 so that the input information or data may be displayed on a single panel. The system includes a filter to allow a user to select the layers to be displayed with the base or chosen panel.

Specifically as seen in Figure 6, a user inputs text comments, by using text input apparatus such as a keyboard 201 and processing means when the user wants to link these input text comments to a trend graph. These input comments are sent to a text adaptor 202 seen in Figure 6 as residing in the link information generator 223.

A message manager 40 is constantly monitoring data in both the historical message database 510, and the memory 520. All messages are stored in a pre-existing historical message database 510 of the SCADA / DCS system. When the message manager 40 detects an abnormal state, it sends an alarm information to the historical message panel 60 and alarm summary panel 61.

At the same time, the message manager 40 asynchronously sends the alarm information to the message adaptor 204 residing in the link information generator 223.

Sound information, for example motor noise or pump noise are pre-recorded by the user. Namely, the various sound information is acquired periodically or by specific events in the sound acquisition apparatus 205. The sound information acquired in the sound acquisition apparatus 205 is sent to a sound adaptor 206 residing in the link information generator 223.

The link information generator 223 also acquires information through the link information configuration tool 221 and the link configurator 222. The link configuration information combines various data, for example, the time-stamp or time-stamp and pen-number, from the subsequent layer and the base layer. Furthermore, the link information generator reads information from the trend pen assign information 310, which assigns the identifying pen-number for each layer. The link information generator 223 then generates a link information, which combines data / information values in the subsequent layer with the data values from a base layer, thereby forming a link.

The historical data manager 240 forms the trend information by using data from the trend data 111(as seen in Figure 4B and 5) and the layer information 242.

Finally the system displays the trend data 405, which combines data values in the subsequent layer 120 with the base layer 119 being a trend graph 111.

The link configuration can also be performed automatically in response to a user-defined trigger. In other words, a user can create certain conditions or criteria for generating a link between a base layer and a subsequent layer.

For example, the link may be generated manually by a user, in response to an alarm or the occurrence of an event an operation history or a deviation. A deviation may be detected by a trend panel or a history data manager.

The invention also provides for a method to manage information on a real-time monitoring control system. Figure 7A shows a flow chart illustrating the method of the link information configuration tool according to the invention. A user is first prompted as to whether a new layer of information is to be used, and to determine whether a new layer is required. The link information configuration tool then creates a new layer when required by a user, as previously described. Next, the user then specifies a link key and a particular subsequent layer to link the information to.

The identifying information is checked to create an information, to link the data value of a base layer, to a subsequent layer. This information may be the time-stamp, or the time-stamp and pen-number.

- 5 The data value of a base layer is then connected to the subsequent layer with information obtained by the link key.

An instance type is selected based on the media type of the subsequent layer, such as text, sound or noise. A prompt is made to check if any further information needs to be added for the layer configuration, and if not, the information is saved for the subsequent layer, and the process ends.

Figure 7B shows the process flow for the link information generator. A user is first prompted as to whether a subsequent layer is to be used, and if yes, a new layer is created using the information required for a new layer, as previously explained. This information includes the identifying information in the form of the time-stamp or time-stamp and pen-number, and the media type. The media type also determines the type of adaptor to be used, when receiving the input information. When the link information generator receives new data values from adaptor, it obtains the condition.

The link info generator generates a link information according to the condition, for example timing and any other conditions for linking.

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The following paragraphs explain how the system is used in its various forms.

1. Adding comments

Figure 8 explains how an operator can add a comment on the trend panel. When an operator enters a comment on the text input apparatus 201, a comment is sent to the text data adaptor 202.

The link information generator 223 receives an input comment from a text data adaptor 202, and generates a link information and adds it onto the specific layer dynamically, according to the user defined configuration.

5 2. Linking alarm messages to a trend panel

Figure 9 explains how an alarm message can be linked to the trend panel. When the message manager 40 receives an alarm from engineering controls or monitors, a message manager 40 sends it to a message adaptor 202 asynchronously. A message handler receives an alarm message and creates a piece of link information by analyzing
10 the alarm message. This new piece of link information is added onto the subsequent layer by the link information generator 223.

3. Linking operation history information on the trend panel

Figure 10 illustrates how a user can add operation history information onto the trend
15 panel. For example, an operator starts a batch system, either manually or automatically. In both cases, automatically or manually, a programme makes an "Operation History data" and stores it on the system. The "Operation History adaptor" detects this event and gets information from the system. The "Operation History adaptor" creates a new link information and sends it to the link information generator
20 223. And the link information generator 223 will add it onto the specific layer accordingly.

4. Using a new piece of link information as a deviation trigger

Figure 11 explains how to make a new piece of link information as the deviation trigger.
25 As an example, Figure 11 shows a deviation detector commonly known in the art. The historical data server and the message manager can also take the role of a deviation trigger.

As shown in Figure 11, as an additional data, the Multi-Media files adaptor 207 gathers
30 images or sound data from the engineering controls or monitors. And its adaptor generates a new piece of link information and adds it on the specific layer through the link information generator 223.

Figure 12 shows the block diagram of an embodiment of the present invention.

In order to realize this feature, this invention proposes the way to update an action data on a layer dynamically. The "Operation data Update Apparatus" verifies whether the specified alarm is shown on the "Alarm Summary" panel. If it is shown on the "Alarm Summary" panel, this apparatus adds the action data to showing the "Alarm Summary" panel onto the layer information. If it is not shown on the "Alarm Summary" panel, it updates the layer information dynamically to replace the action data to showing the "Historical Message" panel.

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The embodiments have been advanced by way of example only, and modifications are possible within the scope of the invention as defined by the appended claims.

CLAIMS

1. A system for managing information for a user on a real-time control programme
5 said system including a base layer for receiving and displaying real-time measurements of a first parameter said real-time measurement displayed as data points along a time scale, each data point tagged with at least a timestamp value of the time-scale;
a subsequent layer for receiving and displaying a data or information input by a
10 user;
wherein the system further includes a link generator to link a data value or input information to a data point of the base layer.
- 15 2. A system according to claim 1, wherein the system further includes a link information generator to allow a user to create further layers for the display of further information.
3. A system according to claim 2, wherein further information includes media type
20 of text based, sound based image based and other multi-media based information.
4. A system according to any one of claims 2 or 3; wherein the link information generator further includes an adaptor, to receive and display the further information.
- 25 5. A system according to claim 4, wherein the adaptor includes a text data adaptor, an audio adaptor, an image adaptor and only other multi-media fields adaptor.
6. A system according to any of the proceeding claims, wherein the system further includes a link update generator to update the link between the data points of the base
30 layer to the measurement data values or input information of the subsequent layer.
7. A method of linking and adding subsequent layers of information on a real-time monitoring system, said system having a real-time display on a base layer including adding a subsequent layer to receive data or information;

forming a link between data or information received by the subsequent layer to a base layer;

configuring the subsequent layer to receive a multi-media type of data or information;

- 5 adding the subsequent layer to the base layer; and
displaying the layers using a display means.