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(56) Documents Cited:
EP 1277936 A1
EP 1168121 A2
US 6343251 B1
US 6298308 B1
US 20030014219 A1
US 20020177978 A1

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UK CL (Edition W) G1N
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(54) Abstract Title: **Real-time viewing of turbine monitoring system data**

(57) A method of viewing data of a monitoring system (12) for rotary machines such as steam and gas turbines from a remote location (30) is provided. The turbine monitoring system includes a programmable logic controller (14) having an interface rack (16). The method includes supplying an on-site monitoring computer (18), installing at least one communications gateway card (20, 22) eg an Ethernet card in the interface rack, connecting the on-site monitoring computer to the at least one gateway card by a local area network (24), and connecting the on-site monitoring computer also to a wide area network (32).

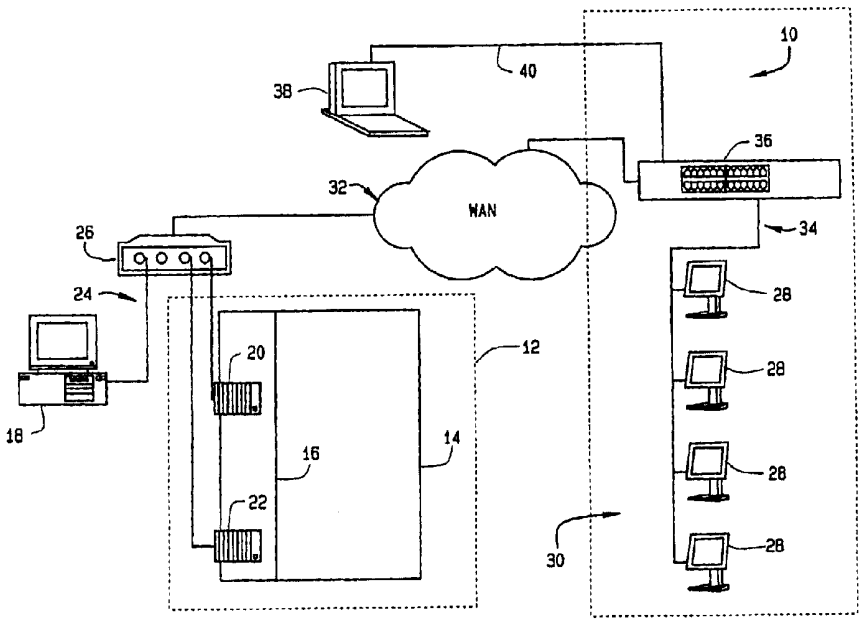

FIG. 1

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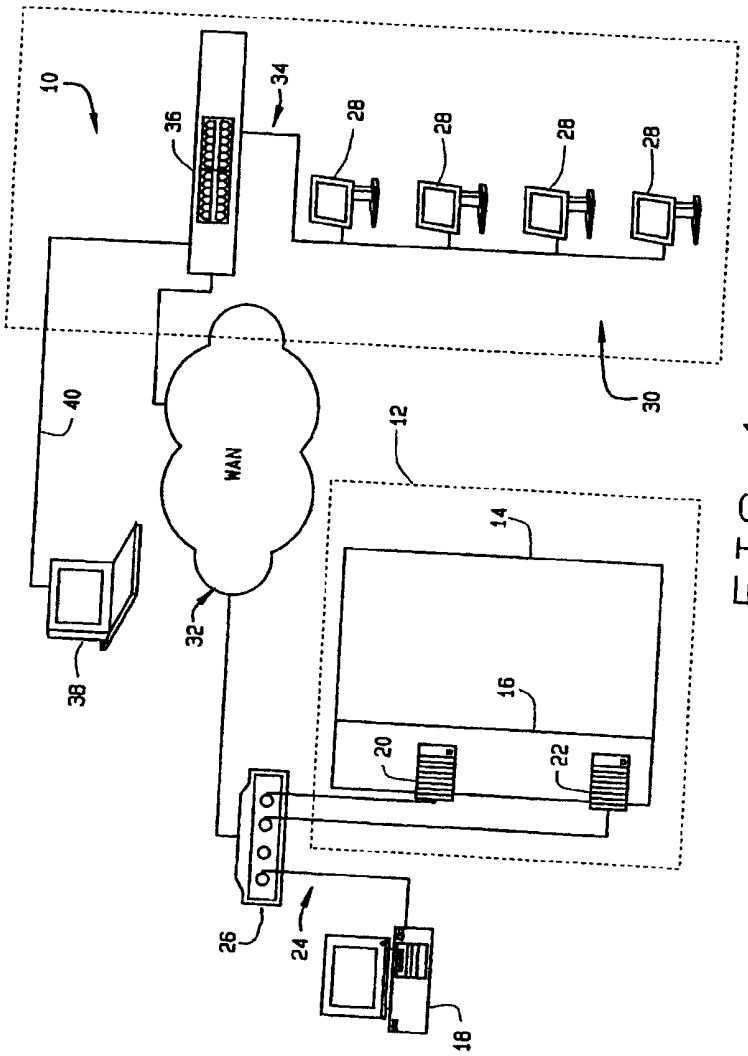

FIG. 1

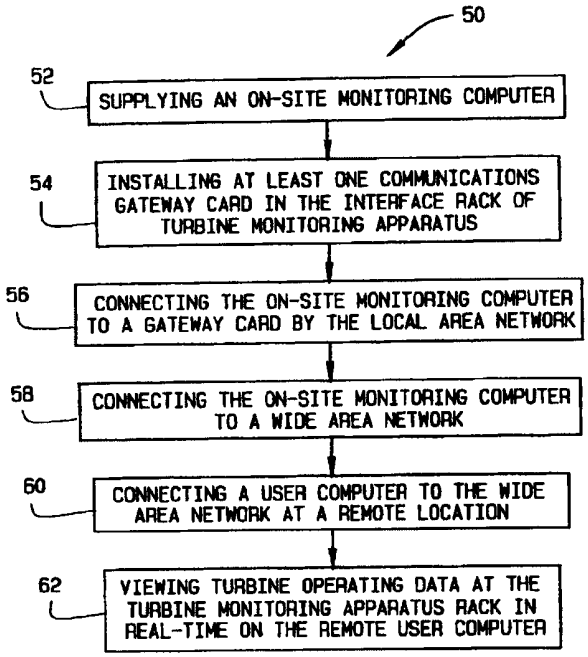
50
52
SUPPLYING AN ON-SITE MONITORING COMPUTER
54
INSTALLING AT LEAST ONE COMMUNICATIONS GATEWAY CARD IN THE INTERFACE RACK OF TURBINE MONITORING APPARATUS
56
CONNECTING THE ON-SITE MONITORING COMPUTER TO A GATEWAY CARD BY THE LOCAL AREA NETWORK
58
CONNECTING THE ON-SITE MONITORING COMPUTER TO A WIDE AREA NETWORK
60
CONNECTING A USER COMPUTER TO THE WIDE AREA NETWORK AT A REMOTE LOCATION
62
VIEWING TURBINE OPERATING DATA AT THE TURBINE MONITORING APPARATUS RACK IN REAL-TIME ON THE REMOTE USER COMPUTER

FIG. 2

SYSTEM AND METHOD FOR REAL-TIME VIEWING OF MONITORING SYSTEM DATA

This invention relates generally to systems for monitoring rotary machines such as steam and gas turbines, and more particularly, to systems and methods for real-time viewing of monitoring system data.

As power generation demands have increased, there also has been an increased need for assessing operating conditions of power generation turbine plants. Accurately assessing operating conditions facilitates accurate prediction of potential problems, troubleshooting existing problems, and predicting future power generation shortfalls.

Gas and steam turbines used for power generation include a plurality of sensors which monitor key turbine parameters and associated components, for example, vibrational data, operating temperatures, operating speeds, operating pressures, valve and actuator settings, fuel demand, power generation, operational setting percentages, alarms, and operating states and conditions. The signals generated by the sensors are typically transmitted to a monitoring system within the plant at preset time intervals. At least some known monitoring systems are coupled to local intranets which enable users within the plant to view the data collected. However, the data collected cannot be viewed by remote user computers in real time.

In one aspect of the invention, a method of viewing data of a turbine monitoring system from a remote location is provided. The turbine monitoring system includes a programmable logic controller having an interface rack. The method includes supplying an on-site monitoring computer, installing at least one communications gateway card in the interface rack, connecting the on-site monitoring computer to the at least one gateway card by a local area network, and connecting the on-site monitoring computer also to a wide area network.

In another aspect, a method of viewing data of a turbine monitoring system from a remote location is provided. The turbine monitoring system includes a programmable logic controller having an interface rack. The method includes

creating turbine operating data by the turbine monitoring system, transmitting the operating data to an on-site monitoring computer in real-time via a local area network that connects the on-site monitoring computer to the interface rack of the turbine monitoring system, transmitting the operating data to a remote computer by the on-site monitoring system in real-time via a wide area network that connects the on-site monitoring computer to the remote computer, and viewing the transmitted data at the remote computer.

In another aspect, a system that facilitates viewing data of a turbine monitoring apparatus from a remote location is provided. The turbine monitoring apparatus includes a programmable logic controller having an interface rack. The system includes an on-site monitoring computer, a remote computer, at least one communications gateway card configured to communicate with the turbine monitoring apparatus, a local area network connecting the on-site monitoring computer to the at least one gateway card, and a wide area network connecting the on-site monitoring computer to the remote computer.

The invention will now be described in greater detail, by way of example, with reference to the drawings, in which:-

Figure 1 is schematic representation of a monitoring system in accordance with an embodiment of the present invention.

Figure 2 is a flow chart of a method of viewing data of a turbine monitoring system in real-time from a remote location.

Exemplary embodiments of methods and systems that facilitate viewing turbine monitoring system data from a remote location are described in detail below. The methods and systems facilitate, for example, a user at a remote location from a turbine to view real time data generated by a turbine monitoring system. Also, the remote user can view the configuration and settings of the monitoring system from the remote location. Further, if there are problems with the turbine or the monitoring system, the remote user can perform diagnostic evaluations from the remote location without the need of on-site personnel involvement, thereby reducing maintenance costs and

times.

Referring to the drawings, Figure 1 is schematic representation of a monitoring system 10 in accordance with an exemplary embodiment of the present invention. System 10 facilitates monitoring a turbine (not shown) located, for example, at a power plant. System 10 includes a turbine monitoring apparatus 12 that is controlled by a programmable logic controller 14 that includes an interface rack 16. Turbine monitoring apparatus 12 can be any type of turbine monitoring apparatus that is configured to monitor a plurality of turbine parameters from equipment including, but not limited to, vibrational data, operating temperatures, operating speeds, operating pressures, valve and actuator settings, fuel demand, power generation, operational setting percentages, alarms, and operating states and conditions.

An on-site monitoring computer 18 is operatively connected to interface rack 16 through communications gateway cards 20 and/or 22 by a local area network 24 that includes a hub 26. On-site monitoring computer 18 is physically located at the same location as the turbine that is being monitored and is useful for facilitating the examination and analysis of data produced by turbine monitoring apparatus 12. Communication gateway cards 20 and 22 can be any suitable communications card, for example Ethernet/485 communication gateway cards. Also, Communication gateway cards 20 and 22 can be configured to interface with a T1 line an/or a T2 line.

To enable workers/users 28 at a location 30 remote from the turbine location to view the data produced by monitoring apparatus 12, on-site monitoring computer 18 is operatively connected to a wide area network 32 through hub 26. Remote user computers 28 are networked together by a local area network 34 which is operatively connected to wide area network 32 by a router 36. Also, a user computer 38 that is remote from local area network 34 can access local area network 34 by a virtual private network 40 operatively connected to router 36.

The communications topology described above permits remote users 28 and 38 to view turbine data at interface rack 16 in real time. This communications topology also permits users 28 and 30, with the appropriate authorization, to

make configuration changes to interface rack 16 from an off site location.

Figure 2 is a flow chart of a method 50 of viewing data of turbine monitoring apparatus 12 in real-time from remote location 30. Method 50 includes supplying 52 an on-site monitoring computer 18, installing 54 at least one communications gateway card 20 in interface rack 16 of turbine monitoring apparatus 12, connecting 56 on-site monitoring computer 18 to gateway card 20 by local area network 24. and connecting 58 on-site monitoring computer 18 also to wide area network 32.

Method 50 also includes connecting 60 a user computer 28 to wide area network 34 at a location 30 remote from turbine monitoring apparatus 12, and viewing 62 turbine operating data, captured by turbine monitoring apparatus 12, at turbine monitoring apparatus rack 16 in real-time, on user computer 28.

CLAIMS:

1. A method (50) of viewing data of a turbine monitoring system (12) from a remote location (30), the turbine monitoring system comprising a programmable logic controller (14) having an interface rack (16), said method comprising:

supplying (52) an on-site monitoring computer (18);

installing (54) at least one communications gateway card (20, 22) in the interface rack;

connecting (56) the on-site monitoring computer to the at least one gateway card by a local area network (24); and

connecting (56) the on-site monitoring computer also to a wide area network (32).

2. A method (50) in accordance with Claim 1 further comprising:

connecting (60) a user computer (28) to the wide area network (32) at a location (30) remote from the turbine monitoring system (12); and

viewing (62) turbine operating data, captured by the turbine monitoring system, at the turbine monitoring system rack (16) in real-time, on the user computer.

3. A method (50) in accordance with Claim 1 wherein connecting (56) the on-site monitoring computer (18) to the at least one gateway card (20, 22) comprises:

connecting the on-site monitoring computer to a hub (26); and

connecting the hub to the at least one gateway card.

4. A method (50) in accordance with Claim 3 wherein connecting (56) the on-site monitoring computer (18) also to a wide area network (32) comprises connecting the hub (26) to the wide area network.

5. A method (50) in accordance with Claim 1 wherein installing (54) at least one communications gateway card (20, 22) in the interface rack (16) comprises installing a first and a second communications gateway card in the interface rack, the first gateway card configured to communicate with a T1 line and the second gateway card configured to communicate with a T2 line.

6. A system (10) that facilitates viewing data of a turbine monitoring apparatus (12) from a remote location (30), the turbine monitoring apparatus comprising a programmable logic controller (14) having an interface rack (160, said system comprising:

an on-site monitoring computer (18);

a remote computer (28);

at least one communications gateway card (20, 22) configured to communicate with the turbine monitoring apparatus;

a local area network (24) connecting the on-site monitoring computer to the at least one gateway card; and

a wide area network (32) connecting the on-site monitoring computer to the remote computer.

7. A system (10) in accordance with Claim 6 further comprising a hub (26) connecting said on-site monitoring computer (18) to said local area network (24) and said wide area network (32).

8. A system (10) in accordance with Claim 6 wherein said at least one communications gateway card (20, 22) comprises a first and a second communications gateway card, the first gateway card configured to communicate with a T1 line and the second gateway card configured to communicate with a T2 line.

9. A method of viewing data of a turbine monitoring system from a remote location substantially as described herein with reference to the drawings.

10. A system that facilitates viewing data of a turbine monitoring apparatus from a remote location substantially as described herein with reference to the drawings.

Application No:	GB 0329477.4	**Examiner:**	Dr Susan Dewar
Claims searched:	1-10	**Date of search:**	31 March 2004

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X,P	1-10	US 20030014219 A1	(SHIMIZU et al) See figure 3 and related text
X	1-10	EP 1168121 A2	(GENERAL ELECTRIC COMPANY) Whole document relevant
X,P	1-10	EP 1277936 A1	(GENERAL ELECTRIC COMPANY) Whole document relevant
X	1-10	US 20020177978 A1	(OBENHOFF et al) Whole document relevant
X	1-10	US 6343251 B1	(HERRON et al) See figure 1 and related text
X	1-10	US 6298308 B1	(REID et al) See in particular column 13 lines 42 - 54

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[W]:

G1N

Worldwide search of patent documents classified in the following areas of the IPC[7]:

F02C, G01M, G05B

The following online and other databases have been used in the preparation of this search report:

EPODOC, JAPIO,WPI