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PLC-Based SCADA System For Oil Tank Area And Application

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Abstract: **In the process of petroleum storage and transportation, temperature, pressure and flow, controlled by varieties of electric valves and pumps, are the main monitoring parameters. The changes of temperature and pressure will lead to the change of the petroleum storage and transportation. In order to achieving the most effective petroleum storage and transportation under different environments, temperature, pressure and flow, petroleum storage and transportation database is established. The database provides the basis for petroleum storage and transportation to adopt different ways and methods in different temperature, pressure and flow In the paper, configuration software and PLC are applied to construct SCADA System of the petroleum transportation In additional of this theme, here embedded technology is added. This technology is nothing but zigbee wireless communications.**

Keywords: ***PLC,SCADA, petroleum, storage, configuration software, transportation database***

I. INTRODUCTION

With the increasing competition of the oil market oil depots are playing a more and more important role, and it has become a long-term important job to supervise and control the operation state of oil depots. This paper designs a supervisory and control system for a oil depot in Shandong Province. This oil depot collected tank information and controlled valves manually before. There were some shortcomings in it such as slow supervisory, great error and low reliability. So it is necessary to establish a better supervisory and control system that is Programmable logic controllers PLCs have been widely used in the industrial control feilds because of its merits such as simple structure, flexible functions, high reliability and strong ability in communication. Computers have advantages in the data display and storage, as well as in human-computer communications This paper designs a supervisory and control system for oil tanks area based on PLC and computer. PLC is the control centre and it completes all the details of the control task. It connects with digital and analog signals of field devices through general I/O interfaces, collects and processes field datas accurately and quickly, and completes the logic, timing, counting and mathematical operations easily. Computers provide human-machine interface, display the feid working stste dynamically, and makes the operation easy. The system combines the advantages of PLC and computer, provides a remote real-time monitoring for the tanks area, ensures safety and reliability and improves the work efficiency. Considering oil depot's high requirements on reliability and continuity, redundancy scheme is designed to improve the reliability further

II. REQUIREMENT ANALYSIS

At present, a number of small petroleum indoor test loops have been set up in the world. The experimental data and experience to each kind of crude oil transmission have been obtained, but their differences still exist in long pipeline applications. So test data can't be fully applied into practice, it only plays a vague guiding significance. In addition, the actual pipeline can not perform Shutdown and Restart reliably, and can not effectively monitor the characteristics of the external environment such as the geothermal field. In order to get more real data of petroleum storage and transportation under different environments, and to provide reliable and accurate test results for the storage and transportation stations, and to store petroleum scientific, and to reduce maintenance in storage, it is necessary to build a large-diameter,multi-function , high-automation dual-pipe test loop. So breakthrough of a crude test loop from indoor to outdoor is achieved.

In order to simulate the actual long-distance pipeline operation accurately, soil temperature field around the ring road, which is applied to monitor the soil temperature impact of petroleum storage and transportation, is established with 30 intelligent temperature detectors. Then crude oil stored in the tank will be transmitted to the experiment ring road through experiment pump, and various experiments will be completed. Data acquisition and equipment control are achieved by SCADA system. The test content for Ring.

Road include: crude oil rheology test; Shutdown and Restart test; crude oil wax deposition test. The test can be extended to vibration test and leak detection test.

1. The data for the above experiment content are monitored and set by automatic monitoring system.
2. The main functions are as follow:
3. To test the operation state and breakdown of various implementing agencies.
4. To dynamic show technology flow chart, real-time curves and historical curves of experiment ring road.
5. To provide interactive window, instrumentation and equipment range, and control parameters setting.
6. To show all kinds of experimental parameters, processing and other relevant parameters.
7. To instruct alarm by sound.

PLC Programming

The first PLCs were programmed with a technique that was based on relay logic wiring schematic .this eliminates the need to
teach the electricians, engineers and technicians how to program a computer. But this method has stuck and is the most common
used technique for programming PLCs today

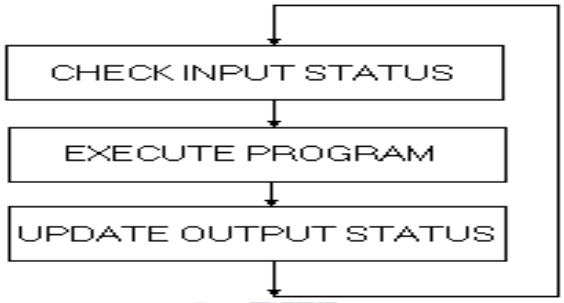


Figure 1. PLC PROGRAMMING

III. SYSTEM CHARACTERISTIC AND FUNCTION MONITOR SOFTWARE CHARACTERISTICS:

Today the Oil & Gas industry faces many tough challenges such as:

1. Industry consolidation
2. An exodus of industry expertise
3. Aging oil and gas fields

Wonder ware software recognizes the challenges with which your operation is faced: the need to make changes that cost-effectively accomplish your goals as you continue to provide reliable service to your customers and improve profitability for your investors. You need a software provider that knows your business and offers solutions to address these challenges.

A. Easy-To-Use Report Generation

Wonderware software also makes it extremely easy to create the reports needed for regulatory agencies. Hourly, daily, weekly and monthly reports that contain minimums, maximums and averages over various time spans can quickly and easily be created, printed and saved
.

B. Superior Operator Visualization

Wonder ware's world-famous, award-winning software for visualization and process control automation offers outstanding ease of use and simple-to configure graphics. Powerful wizards and the new Wonder ware Smart Symbols enable users to quickly create and deploy customized displays that connect and deliver real-time information. Applications can be viewed from a single monitor or multiple screens.

C. Monitor and Control from Anywhere

Users can monitor and acknowledge alarms, change set points, hear exact values of variables and operate equipment via telephone. Messages can be sent to pagers, telephones, personal communication systems via e-mail, making the acquisition of real-time information convenient and easy

D. Mobile Information Management

In an Oil & Gas SCADA system, maintenance personnel are often deployed to the field to gather data or troubleshoot problems. A mobile HMI tablet can increase operator productivity by facilitating mobile visualization and control without being tied to a station or a location. Durable and reliable, the Wonder ware Industrial Tablet comes pre-integrated with Wonder ware's industry-leading software that has been enhanced for mobile communications

IV. SCADA SYSTEM PRINCIPLE

In order to automate an oil refinery and minimize human intervention, there is a need to develop a SCADA system that monitors the plant and helps to reduce the errors caused by humans. While the SCADA monitors the system, PLC is used for the internal storage of instructions for implementing functions such as logic, sequencing, timing, counting and arithmetic to control various types of machine processes through digital and analog input/ output modules. SCADA refers to the combination of telemetry and data acquisition. It includes collecting information via a Remote Terminal Unit (RTU), PLCs and Intelligent Electronic Devices (IED) and transferring it back to the central site to

carry out any necessary analysis and control and then displaying that information on a number of operator screens. Three of the most important parts of a SCADA system are Master Station, remote terminals (RTU, PLC, and IED) and the communication between them

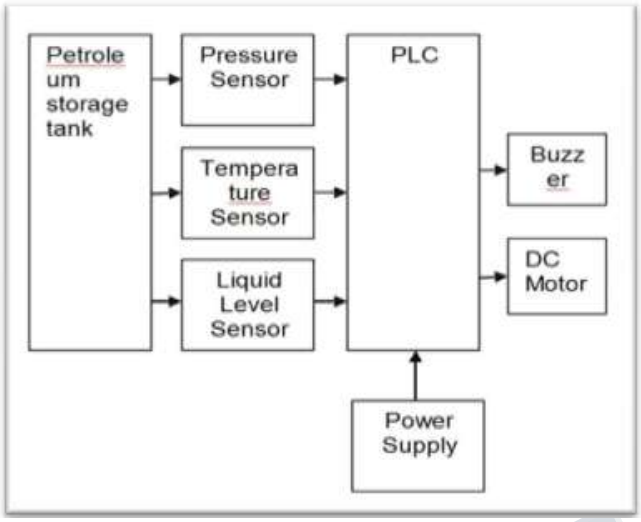


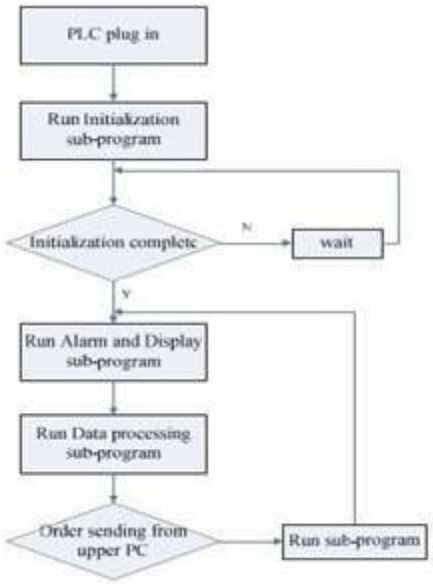
Fig2.block diagram of plc based scada system

V. DESIGN OF SYSTEM SOFTWARE

PLC software is designed with RSLogix5000 of ROCKWELL companies. It mainly consists of main program, initialization, reset, alarm and display, data processing and nine experimental processes. There are 42 sub-programs, and flow charts of sub-programs are omitted. Flow chart of main procedures is shown in Fig.3. The programs of operator station are written by configuration software Citect. More than 50 configuration screens are completed. The Excel database used to store all kinds of storage and transportation data is created, so various experiment databases in oil storage and transportation are created.

VI. CONCLUSION

After being run in field, SCADA system is fit to the design requirements, and can collect various parameters of crude oil storage and transportation, and can control field equipment, and create databases to petroleum storage and transportation running in different technology, and calculate the best conditions for crude oil transmission by relevant software, and simulate the operation of the real pipeline. To increase the effective communication system, the whole operation controlled and monitored by wireless manner by using Zigbee,



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