Establishment of Offshore Marine Observation Equipment Sensor Monitoring System

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Abstract. Arctic system is an important part of the Earth as a whole system, monitoring and research polar marine environment, to reveal the rapidly changing Arctic marine environment and its significance in response to the feedback effect of changes in the Earth. However, due to the harsh weather conditions of the Arctic, ocean observation buoy long-term work in harsh environments (deep sea, far from the sea, high pressure seawater corrosion, etc.), strict conditions (weight, volume) and so on, its reliability has put forward higher requirements [1]. Based on the full understanding of the status quo at home and abroad ocean observations and ocean observation equipment, based on the analysis of ocean observation buoys often malfunction of the sensor, the use of LabVIEW software to build a comprehensive ocean observation buoy sensor monitoring system, to achieve the lower computer system acquisition the data is sent to the host computer via the serial port, and thus the sensor data buoys equipped with real-time monitoring. After testing, the system results in line with expectations, you can solve the ocean observing system for the analysis of failure under extreme conditions buoys reference.

Introduction

Arctic system is part of the whole Earth system, its global-scale atmospheric circulation, ocean circulation and climate variability have a direct impact. Country located in the northern hemisphere, climate and environmental change in the Arctic also affects the country's natural environment and social development. According to the existing research can be seen in the Arctic Ocean and sea ice is an important factor affecting the process of China's climate can significantly affect the East Asian monsoon climate and our country, there is an urgent need to strengthen the Arctic climate change and its impact on China and the environment assessment and predictability research on sustainable economic and social development to provide a scientific basis[2].

The main research topics

We can know from the previous analysis, the sensor for the observation buoy work is essential, so the monitoring of the state of the sensor can substantially affect the overall fault buoy prediction[3-4]. In this paper, based on the above conclusions, the Arctic Ocean Observing created buoy sensor monitoring system based on LabVIEW, the system is mainly the following functions:

1)serial communication functions, the use of single chip temperature sensor serial communication with the PC, and can in a timely manner and the temperature data to a PC, and the PC interface is intuitive to show temperature trends;

2) temperature conversion function, you can achieve Fahrenheit and Celsius temperature detection and conversion;

3) limit alarm function, set the lower limit of the data, when the temperature exceeds the upper limit alarm and is accompanied by a beep;

4) data display function, the display data changes in the trend, the value in the data table is displayed in the waveform diagram;

5) temperature, pressure, flow rate, while display;

6) Test results of the data storage function, the user can save part or all of the collected data down, easy access and printing.

According to the Arctic Ocean Observing buoy sensor monitoring system, you can easily view the sensor to monitor the temperature, pressure, flow rate values, provide a reference for the analysis of the meteorological parameters in the Arctic, and can detect the corresponding fault alarm according to the system, root cause failure analysis, problem-solving.

This paper is based on the design and development of sensors LabVIEW2012 monitoring system, according to the design principles from the general to the local, through analysis of system functions, the whole system is decomposed into several different functional modules, and then were designed for each module. In order to achieve the specific sensor functions (temperature, pressure, flow rate) detection system proposed, the entire system can be decomposed into the host computer and the next crew of two parts: the PC is equipped with a PC LabVIEW2012 software, the next crew to SCM and its peripheral circuit of small systems. Two parts are communicating via the PC's USB port. Where some of the major PC to complete the hardware drivers, data display, processing and preservation, limit alarm and generate human-computer interaction interface; lower machine part to complete the acquisition and the output temperature of the data.The overall design of the system block diagram shown in Figure1:

Fig.1 Overall system design diagram

Data acquisition hardware system used in this paper include:

1) DALLAS temperature sensor DS18B20. Working principle is put into the sea buoy and connected to the circuit after the sensor begins sensing different temperatures, the temperature across the diode inside have different voltage, this voltage is the analog to A / D conversion to obtain digital temperature, then send it out via the serial transmission[5];

2) STC produced by a low-power, high-performance single-chip STC89C52 model.

3) Prolific Introduces RS232 to USB (or USB to RS232) interface converter chip PL2303HX.

In addition, the software is used herein technology platform LabVIEW NI (national instrument) for the development of computer virtual instruments (Laboratory virtual Instrument Engineering workbench), namely Laboratory Virtual Instrumentation integrated environment. It is currently the most widely used one, the most powerful and fastest-growing graphical software development environment, a powerful, flexible programming, friendly interface features in measurement techniques and instrumentation engineering sciences has been very wide range of applications[6].

PC - Arctic Ocean Observing buoy sensor monitoring platform

Due to the limitations of existing conditions and time, and cannot fault mechanism Arctic fieldwork analysis buoy on the important parameters to measure the polar extreme environments buoy under working conditions (temperature, pressure, flow rate - these three factors are important parameters ocean observations, At the same time easy to measure) and so established a comprehensive Arctic marine observation buoy sensor systems to achieve specific functions shown in Figure 2, the use of LabVIEW software for data transmission lower computer data processing, enabling data display, processing and storage, overrun alarm functions, for the future of polar marine research in the field to monitor the temperature and other meteorological parameters, analyze and solve ocean observation buoy failure under extreme conditions as a reference.

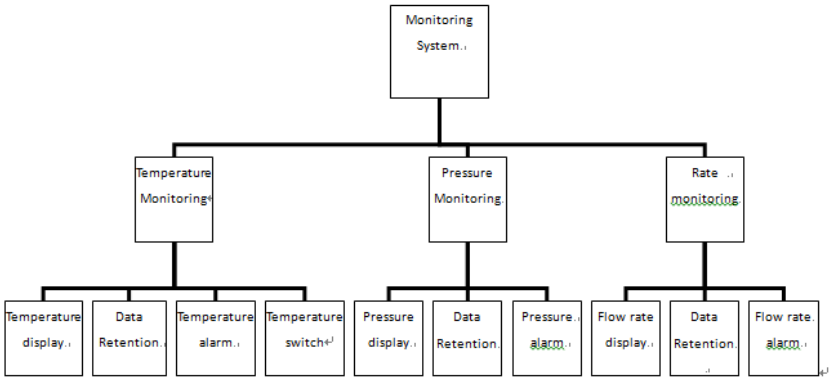

Fig.2 ocean observation buoy sensor monitoring system function block diagram

The main advantage of this system LabVIEW2012 simulation analysis for the various sensors onboard the Arctic ocean observing buoys (temperature, pressure, flow rate) parameters, and data display and recording, and data can be saved, and also defines the parameter values via the front panel, when the parameter value exceeds the limit, the system will send an alarm signal.

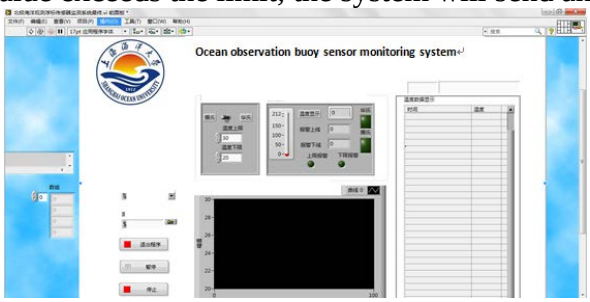

Fig.3 Temperature Sensor Interface

PC system temperature sensor on the front panel shown in Figure 3, the main added value of the input I / O (input / output interface) VISA resource name control, numerical controls, display controls, thermometers controls; Boolean control button controls, indicating light controls, horizontal rocker switch; string input string path, display controls, file path input control; there is a waveform chart control, EXPRESS form controls, and tab control, and so on. Click "Run", the program started, temperature interface consists of the following components:

1) Temperature Configurator: You can achieve the lower limit on the Celsius and Fahrenheit temperature switch and set the temperature;

2) Temperature Display: You can display the current temperature thermometer, and when the current temperature is higher than the upper temperature limit or below the lower limit temperature alarm, the system beeps;

3) Temperature waveform chart: shows the lower the temperature from the serial port on the temperature data and sent to the user-defined;

4) The temperature data is displayed: the temperature of the incoming serial data and displays the time when the data collection;

5) VISA resource name: refresh the display specified by the control serial communication device;

6) Save path: Select path to save the time and temperature can be collected temperature data stored in it;

7) to exit the program: Click this button to exit the system;

8) Pause: Click this button to suspend the operation of the system;

9) Stop: Click this button to stop the running system.

Pressure sensors and flow sensor interface shows the tank controls use controls and instrumentation controls to achieve the same functionality with a temperature sensor, not repeat them here. Pressure sensor interface shown in Figure 4.

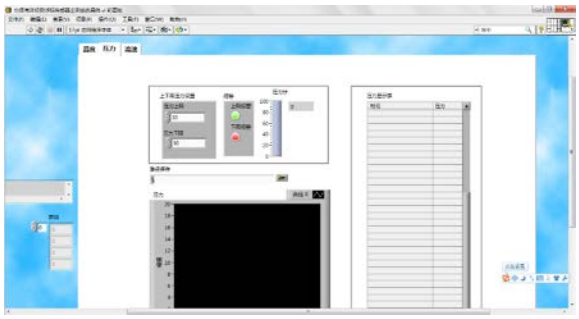

Fig.4 Pressure Sensor Interface

Main program introduce

LabVIEW The program is divided into three parts: the temperature sensors, pressure sensors and flow sensor part. Temperature sensor, for example, is divided into four parts to complete the function buttons corresponding treatment: read data, temperature switch, data display and data storage. The first part of the entire program is contained in a sequential structure, the box represents the first implementation of the program, and then perform the following procedures. By event-driven mechanism (click on the different buttons) can implement different functions, program structure as shown in Figure 5.

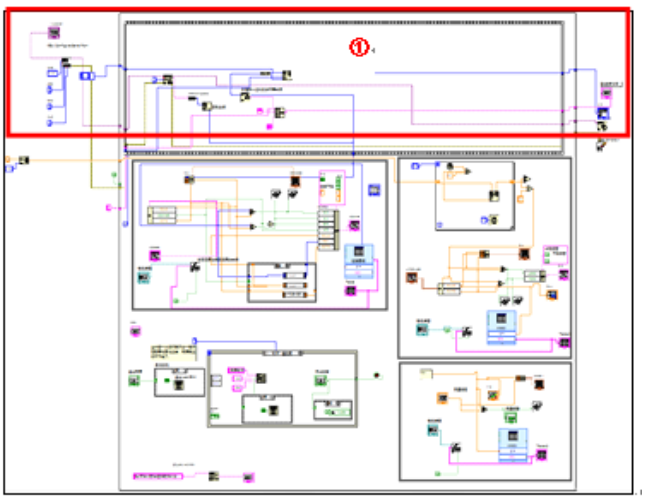

Fig.5 Overall block diagram PC

Read data. arrow shown in Figure 5 for the serial port configuration section block diagram. Designated by VISA resource name inserted USB device (herein as the device number for ASRL2 :: INSTR), then all the data on the USB device is initialized, so that the device is ready to accept commands sent by the host computer LabVIEW; VISA write control data is written to the write buffer VISA resource name specified interface; VISA read control from the VISA resource name specified USB interface reads a specified number of bytes, and the data is returned to the read buffer, and finally VISA Close control to close the VISA resource name specified device handle session object or event, completed a data collection process. By triggering continuous operation button, you can achieve a continuous data collection, and displays the corresponding chart.

Temperature switch.

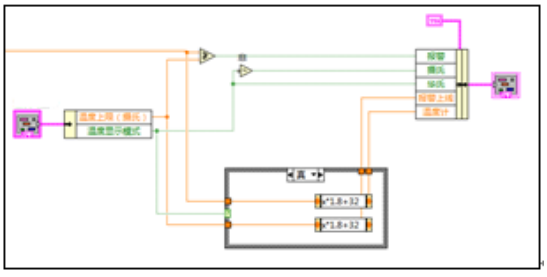

Fig.6 Fahrenheit and Celsius temperature switch block diagram

As shown in Figure 6,temperature switch is mainly used to determine the condition of the structure, the default is Celsius temperature data, the structure when the condition is true, the numerical temperature data conversion, that Fahrenheit = Celsius * 1.8 + 32; When the condition is false structure, temperature data values unchanged, temperature sensors spread display.

Numeric Display.

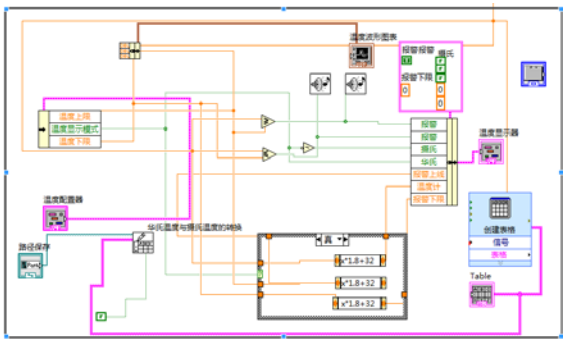

Fig.7 Temperature Sensor Block Diagram

Arrow shown in Figure 7, the program mainly by temperature waveform chart, temperature display and EXPRESS table shows changes in temperature.

Temperature switch.

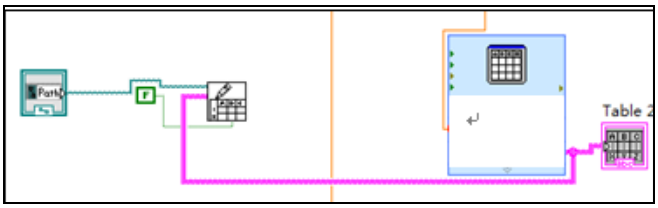

Fig.8 Data stored on the block diagram

As shown in figure 8,this program can be recorded in the table EXPRESS time and data storage by specifying a path in the corresponding file, initially, without specifying the file path and name dialog box will pop up when the program is running, the user chooses to save the file the path and name, you can also save excel table except for a different format, the program runs every time, run the appropriate documentation will be recorded during the data acquisition time and all collected according to different needs.

Next crew Overview

The next crew of the Arctic Ocean Observing buoy sensor system consists of a sensor DS18B20, STC89C52 microcontroller and PL2303HX conversion chips. DS18B20 digital temperature signal from the temperature sensor as measured by the SCM system is composed of a small temperature signal acquisition and processing, and then through the PC's USB port to transfer data to the host computer[7] . It works shown in Figure 9:

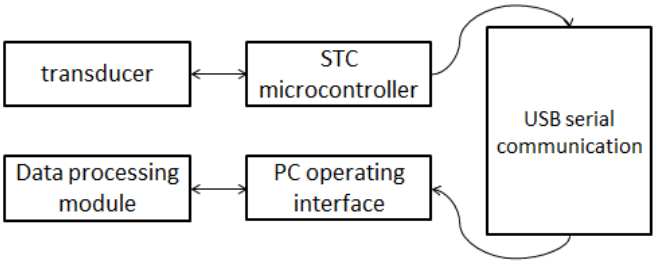

Fig.9 Ocean observing buoy sensor system works next crew

Conclusions

By understanding the status of the Arctic ocean observations and buoys often malfunction, an important parameter to measure the buoys work for the state to establish a comprehensive monitoring system for ocean observation buoy sensors: lower STC89C52RC microprocessor

controlled mainly by the temperature sensor DS18B20 temperature via USB serial port to the PC, the PC is mainly done by LabVIEW data acquisition software programming design. The practical test, the system does work on the development of the Arctic Ocean Observing some reference value.

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