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Monitoring system of sewage index cloud platform

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ABSTRACT

With rapid development of agriculture and industry today, water pollution happens everywhere. The discharge of sewage is more and more concerned by the people and the government, because it is closely related to the people's vital interests. This paper proposed a design of a sewage index cloud platform monitoring system, through the sensor real-time collection of sewage turbidity, temperature, conductivity and dissolved oxygen concentration. And the use of micro-processor data processing algorithm, set the alarm value when the data exceeds the limit of the timely alarm, data were uploaded to the cloud platform for real-time, remote multi-terminal view. This paper introduced the overall design of the system, and the software and hardware design of the system analysis. Testing results showed that the system could realize the monitoring of the corresponding index of sewage environment, and can be widely used in the sewage monitoring system.

Keywords: Sewage; Cloud platform; Monitoring

1. Introduction

Water is the source of life and plays a vital role in the survival and development of mankind. With the rapid development of factories, one of the important measures to realize the protection and management of water environment is to monitor and evaluate the water environment effectively [1]. Traditional sewage monitoring is usually done by means of artificial sampling and laboratory analysis. These methods waste a lot of manpower and financial resources, to a great extent, influenced by human factors, low efficiency and no real time [2]. Through the investigation of some sewage treatment units, the monitoring of sewage parameters is still scattered sampling, separate inspection, many data collection points, complex construction, high equipment allocation cost, more staffing, more difficult data processing, and more sewage parameters detection for sewage treatment enterprises to ensure the discharge of sewage. The water quality of the water treatment plant is safe [3]. The water quality of sewage treatment plant in sewage treatment plant is not regulated at present. The charge of discharge charge is charged according to the flow rate, which makes the pollutant discharge units do not pay attention to the water quality of the sewage and discharge at will. This not only has a large amount of sewage discharge but also poses a challenge to the sewage treatment process of the sewage treatment plant [4]. Many sewage pollution problems cannot be solved through a single channel or the efforts of environmental personnel [5]. The treatment of sewage is closely related to the health of the human body [6]. However, the factory design phase is difficult to determine the actual discharge of sewage, resulting in sewage treatment effect and design requirements are inconsistent, and then to the surrounding water environment caused by different pollution [7] and the factory sewage treatment facility to the operation management request is high, the actual operating environment has not provided the efficient management environment for it, namely the existence lacks the sewage management specialized personnel and the

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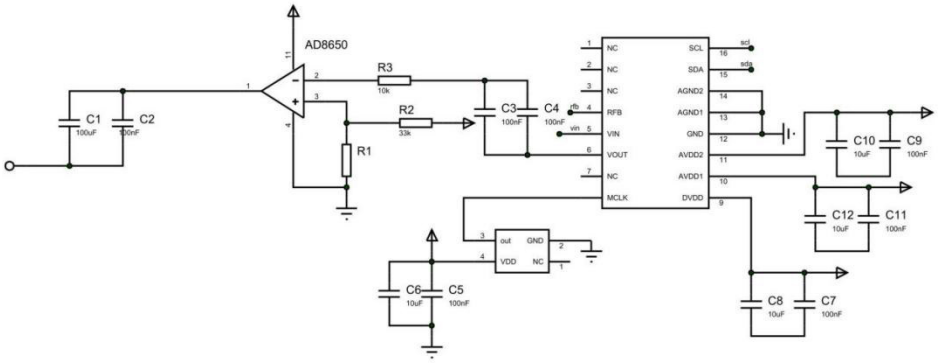

Fig. 1. AD5933 Hardware Connection diagram.

maintenance personnel, causes the sewage treatment effect is not good, then has seriously affected the factory periphery environment [8].

The traditional monitoring device mainly has two disadvantages, one is that the sensor is an analog sensor. In order to satisfy the CPU needs, a complex digital signal conditioning circuit and modulus conversion circuit must be designed, also, calibration, process, and trial are needed of the analog sensor [9]. The other is that the detecting way is mostly cable detection, and wiring complexity and monitoring are not easy to move at the same time, most of the measuring data can only be stored on the local observation, waste a great deal of manpower material resources [10].

Aiming at this problem, this paper designs a monitoring system of sewage index cloud platform, which mainly accomplishes the following functions: (1) Sensor collects turbidity of sewage [11], temperature, conductivity and dissolved oxygen concentration. (2) The microprocessor collects data to carry on the data processing. (3) Upload the cloud platform for data sharing. (4) Real-time data monitoring site and remote alarm.

2. Methodology

2.1. Hardware design

First, we introduce the design of electrical conductivity test circuit, conductivity is an important parameter of water quality, the physical meaning is the size of conductance in the 1 cm cubic solution, which can be used to characterize the conductivity of aqueous solution. The content of metal ions in sewage is high, the conductivity is strong and the conductivity is large. Therefore, conductivity is an important index to detect water quality. The sine excitation required by the conductivity measuring instrument is realized by the chip AD5933 as shown in Fig. 1. The amplitude and frequency of the sinusoidal signal can be adjusted by the chip [12]. When the external access load is AD5933, the real part R and imaginary part I of the load impedance after Fourier transform can be computed and stored in the internal registers by AD5933. The amplitude of Fourier transform can be computed. In order to improve the accuracy of the AD5933 output signal, the active crystal oscillator chip is used to provide the external clock, and the frequency of the chip is 16.384 MHz. AD5933 internal ADC sampling frequency is the external clock mclk 1/16, so the final access to the internal

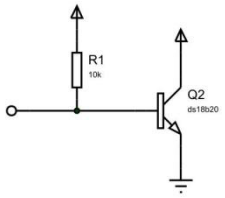

Fig. 2. Temperature monitoring module.

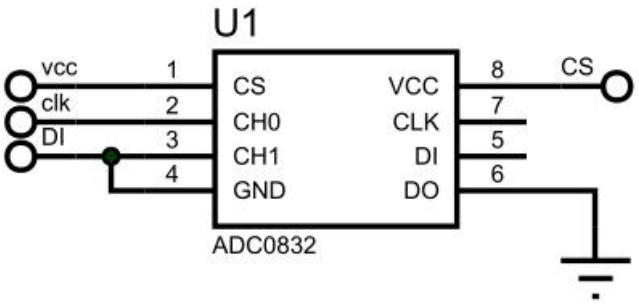

Fig. 3. Interface circuit of ADC0832 and MCU.

ADC frequency is 16.384/16 = 1.204 MHz, resulting in the chip resolution of 1.024 MHz/1,024 = 1 kHz, to ensure that the scanning frequency is 1,000 integer times, so as to prevent the DfT calculation when the spectrum leakage, to ensure the correctness of the results after the transformation. Finally, after the DfT transform, the real and imaginary parts of the impedance are saved to the AD5933 registers, and the MCU can read the results of the registers through the AD5933 SCL pins and the SDA pins by bus. The sine wave of the AD5933 output is isolated by the DC component in parallel with two 100 μf and 100 nF capacitance, and the same measure is taken to isolate the DC component of the output signal to the output end of the operational amplifier AD8605. Because the AD5933 of the same phase input of the internal Op-drop has a 1/2vdd forward bias voltage, a 1/2vdd forward bias voltage is added to the same phase input of the AD8605 to ensure that the sine signal is not distorted when the peak 3V is reached.

Then, we introduce the design of temperature monitoring module circuit in order to obtain sufficient current supply for the sensor Q2 in the precise temperature conversion, we adopt an improved parasitic power supply mode. Temperature monitoring as shown in Fig. 2 below, the main

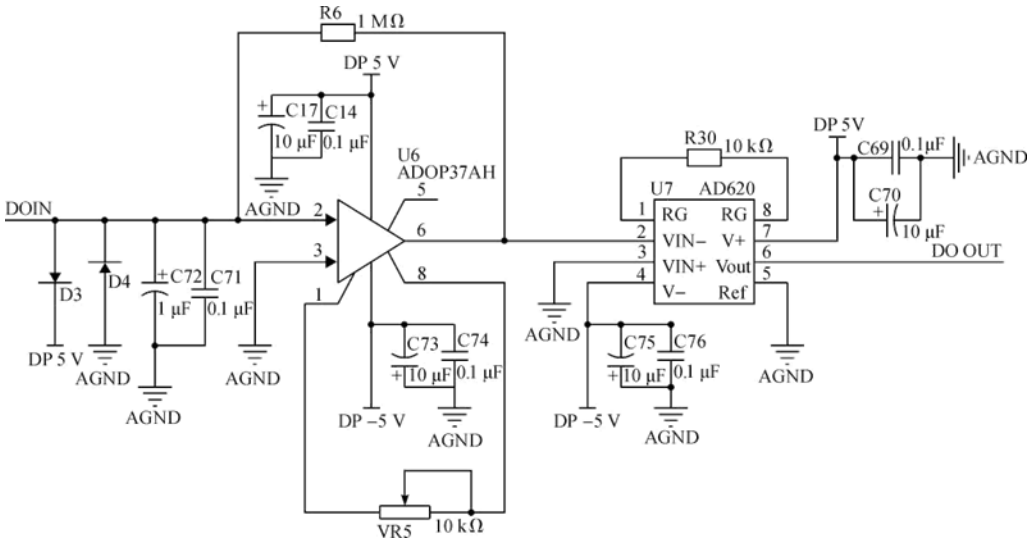

Fig. 4. Measuring circuit of dissolved oxygen.

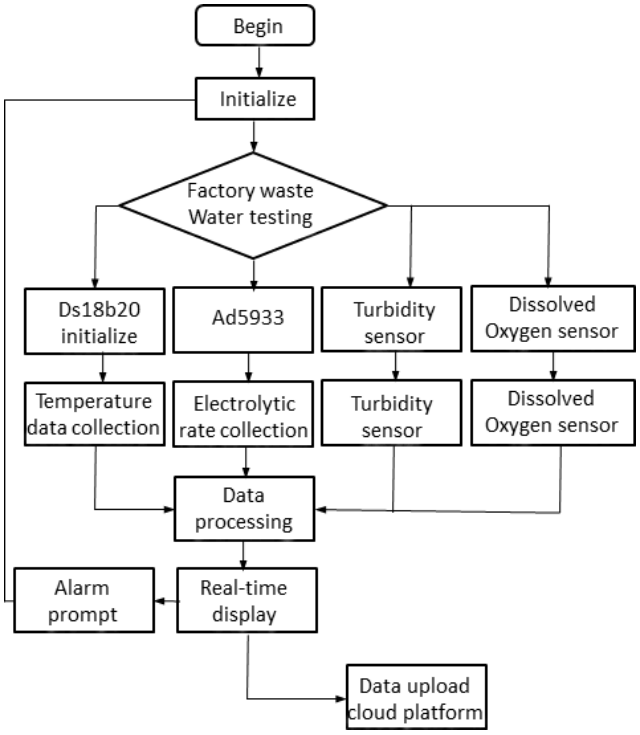

Fig. 5. Overall flowchart.

line of the sensor Q2 to the microcontroller, in this thread with a 10K resistor R1 and to the parasitic power supply. To avoid the lack of current supply, the temperature error caused by the problem is enormous.

Then we introduce the design of turbidity detection. The turbidity of water is caused by suspended substances such as silt, clay, microscopic organic matter and inorganic, plankton and other microorganisms. These impurity particles can become the carrier and package of bacteria and viruses, reducing the chlorine ions, UV or ozone disinfection of water sterilization, may cause disease transmission. Therefore, on-line detection of turbidity of sewage is of great practical significance. When the turbidity of liquid increases, the light emitted by the diode is greatly weakened when it reaches resistance, and the resistance of resistance is improved [13]. When the turbidity of the liquid drops, the light emitted by the diode will reach resistance smoothly. When the intensity of the light signal emitted by the diode is certain, the turbidity of the measured substance changes and the resistance of the resistance changes, so the resistance resistance can reflect the change of the turbidity of the measured object. The ADC0832 can digitally handle the electrical signals that are read in the turbidity sensor as shown in Fig. 3.

Finally, we introduce the design of dissolved oxygen monitoring module circuit as shown in Fig. 4. Dissolved oxygen is the oxygen dissolved in the molecular state of water, that is, oxygen in the water. Dissolved oxygen is an indispensable condition for the survival of aquatic organisms. Dissolved oxygen varies with temperature, pressure, and salinity, generally speaking, the higher the temperature, the greater the dissolved salts, the lower the dissolved oxygen in the water, the higher the pressure, the higher the dissolved oxygen in the water. Dissolved oxygen is usually consumed by reductive substances such as sulfide, nitrite and ferrous ions in water. Therefore, dissolved oxygen can be used as an important index to detect water quality.

2.2. Software design

First of all, overall process is introduced, the equipment initialization configuration, the factory's sewage detection, and then the sewage turbidity, temperature, conductivity and dissolved oxygen data collection, collected value sent to the micro-processing controller and data processing. The LCD12864 real-time displays the water turbidity, temperature, conductivity and dissolved oxygen values. Make appropriate adjustments according to the corresponding situation, and upload the data to the cloud platform in real time.

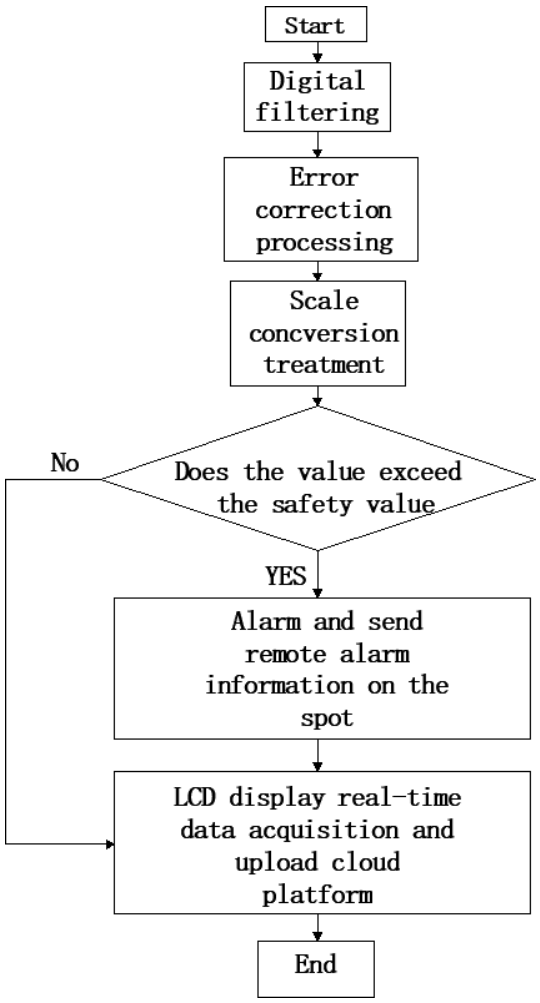

Fig. 6. Flowchart of key detection program.

Then, press key detection program is introduced, After the sensor online detection program is executed, the implementation of the key detection program, first check whether the key press, if there is a key press, then determine whether the alarm value set button press, if you press the selection needs to set the sensor and set the alarm value.

The user presses the confirmation key after the exit and sends changes before and after the value to the cloud platform as shown in Figs. 5 and 6.

3. Results and discussion

According to the above hardware and software design scheme, the system is designed and loaded into the microprocessor. The following test environment is established: test environment as workshop, test data are as follows: special instrument and system test control. From the test data, the system for dissolved oxygen, conductivity, temperature, opacity and other data multiple measurement errors are within the scope of safety, in line with practical requirements.

At present, China's sewage treatment plant almost all over the country [14]. The capacity of sewage treatment is also increasing, but there are still many problems. According to the data provided by the Ministry of Environmental Protection, as of 2011, 3,028 sewage treatment plants have been built in the country only 1/3 of normal operation, low load operation of about 1/3, and 1/3 of the open and shut down, and even do not run. The normal operation of sewage treatment plant is directly related to the final result of water pollution treatment. The sewage index cloud platform monitoring system can upload the wastewater treatment index to the cloud platform in real time. Therefore, we should mainly improve the sewage treatment plant from two aspects: (1) actively promote the work of the sewage treatment plant, follow the laws and regulations, standardize the drainage of sewage. (2) Joint Water Index cloud platform monitoring system, let sewage treatment plant low energy consumption, efficient operation.

4. Conclusion

Although China has a more detailed standard for wastewater discharge by enterprises, the phenomenon of sewage disposal by enterprises is very serious. The reason is mainly due to the lack of supervision by regulators and effective monitoring of wastewater discharge by enterprises, which provides an opportunity for enterprises to steal sewage. Sewage discharge regulatory authorities, due to its lack of complete information management tools, collecting emissions data for enterprises more difficult. At the same time as a large number of enterprises, types of complex. Lack of effective monitoring and management of enterprise wastewater discharge information, making the monitoring and management of sewage discharge there is a big loophole, this paper designed a sewage monitoring system online, given the system software design and hardware design, the following conclusions can be tested given that the whole system is effective and the measurement is very accurate, the system will surely get a wide range of applications.

Acknowledgements

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