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DESIGN AND IMPLEMENTATION OF THE TURBIDITY REMOTE MONITORING SYSTEM BASED ON STM32F407 MICROCONTROLLER

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Summary. *Facing the developing trend of remote monitoring and real-time early warning of the monitoring system, based on FX -11A optical fiber sensor and the STM32F407 microcontroller, a turbidity remote monitoring system design is completed to monitor turbidity with high precision. According to Lambert-Beer Law and theoretical derivation, the relationship between the reference voltage and the measured voltage under the measuring facility was obtained. Based on this, two sets of experiments were designed by using a mixture of water and soil and 0-4000NTU Formazin solution to achieve the purpose of high-precision measurement of turbidity. Processing the experimental data with MATLAB software, the results shows that the system can monitor the turbidity, the correlation coefficient is as high as 0.9955, and the turbidity range of 400-1500 NTU can be monitored with an error of 3.5%. Take the STM32F407 microcontroller as the core controller in the system, and it is connected to Internet to realize the function of web server with Light Weight IP (LWIP) communication protocol. The value of turbidity can be transmitted to web server in real time with Server Side Include (SSI) instruction, and any device connected to Wi-Fi can realize the remote monitoring function through the router. The system function can realize the remote monitoring and real-time warning function of turbidity, which is in line with the developing trend of the monitoring system.*

Keywords: *remote monitoring, STM32F407, turbidity, high-precision, optical fiber sensor*

Outline

Research Background: During the sedimentation process of alumina smelting, when the various liquid layers of the sedimentation tank are unbalanced, there will be phenomena such as overflow and turbidity, which will affect the alumina production. Therefore, it is necessary to monitor the height of each liquid layer, which is monitoring the turbidity. The current measurement schemes are mostly for experienced workers to observe from small holes, or to perform real-time monitoring through probes and monitoring stations. This puts forward requirements on the workers' experience and restricts it in space. The development of a remote monitoring system will play a role in liberating labor. Due to the excellent physical properties of the optical fiber sensor, it can adapt to the high temperature and alkaline smelting environment.

Research Objectives: Based on the research background, the team put forward research objectives, which are to achieve high-precision measurement of turbidity and the design and implementation of a remote monitoring system.

Turbidity Measurement [1]: Take FX-11A fiber optic sensor, which has a Beam-emitting end, a Beam-receiving end and an analog voltage output end, as the turbidity monitoring sensor. The light emitting end will send infrared light, which can be absorbed and transmitted by the determinand. The transmitted light will be received by the receiving end and output in the form of

1-5 V analog voltage. Since the ADC of STM32F407 Microcontroller can only detect the voltage of the upper limit of 3.3V, a resistor divider module is added to complete the realization of the turbidity measurement facility. According to Lambert-Beer Law of the transmission method, the transmitted light intensity has a negative exponential relationship with the incident light intensity. When the distance between the two end is fixed, the light intensity is only related with turbidity. According to this experimental facility, the facility can convert the incident light intensity and transmitted light intensity into voltage . In order to facilitate the fitting analysis, the change is the exponential relationship between the ratio of the reference voltage to the measured voltage and the turbidity.

Firstly, a feasibility experiment was carried out using the mixture of water and soil after standing as the test object. The experimental device can clearly distinguish the water layer and the mud layer, indicating that the device can measure turbidity. Based on this, the reference voltage value is the intensity of the incident light through 0 NTU. The 0-4000 NTU gradient concentration of Formazin solution was used as the test substance, and the measurement results are recorded. After fitting analysis, the experimental results conform to Lambert-Beer Law, and the facility can accurately measure the interval of 400-1500 NTU, the correlation coefficient is as high as 0.9955, and the error is within 3.5%.

System Implementation [2]**:** The design and implementation of the remote monitoring system is the core point. The system can realize three functions of data collection, remote monitoring and real-time early warning, and the architecture diagram of the system is shown in figure 1.

Fig.1 system architecture diagram

Based on the LWIP protocol through the RMII interface, LAN8270A, an external physical layer chip acts as the physical layer; the MAC of STM32F407 acts as the data link layer, while the LWIP protocol serves as the network layer and transport layer. The application layer uses the above-mentioned turbidity measurement device, it also uses the RTC to obtain the real-time time. The early warning function is realized through the buzzer and LED and the preset threshold value. Any devices that connect to the router can access the system. In addition, a display module can be added to display locally. Because STM32F407 has abundant resources, it can also be used to monitor multiple indicators. The final web page monitoring interface is shown in figure 2.

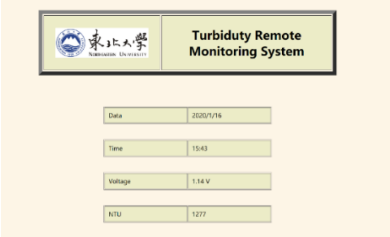

Fig.2 observing results of 1250 NTU from web page

Summary and Prospect: The monitoring system designed by the project conforms to the developing trend of real-time early warning, remote monitoring and multi-point distributed monitoring of the monitoring system, and has compatibility, which can be extended to other fields.

The transmission method based on Lambert-Beer Law can monitor high turbidity with high precision, and the whole range of turbidity can be monitored by combining with scattering method.

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MATTHEW EFFECT IN B2C AND ITS COUNTERMEASURES - EXPLORATION OF NEW C2B MODE

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Summary. *This paper studies the Matthew effect in the field of B2C, through the search theory of consumers and the scale effect of businesses, the disadvantages of the current B2C model are obtained. Combined with the exploration of C2B under the background of industry 4.0 and some new transaction modes in the game, we propose a reverse transaction mode in the field of B2C to improve the disadvantages of the current B2C mode, and as a transition to the future C2B mode, and demonstrate its feasibility through the search cost theory and Pareto improvement.*

Keywords. *B2C;C2B; Matthew effect; Search theory; Customization effort; Pareto improvement*

Any individual, group or region that has achieved success and progress in a certain area will have an accumulated advantage and will have more opportunities to achieve greater success and progress. This is the Matthew effect. The phenomenon that the stronger the stronger and the weaker the weaker, is more obvious in the e-commerce industry. The higher the transaction volume, the more resources accumulated, the easier it is to develop; the lower the transaction volume or the new business is difficult to obtain the advantage resources quickly, the competitiveness is becoming weaker and weaker, and finally faces the doom of being eliminated.

From the perspective of consumers, according to the search theory, people's search for information has costs. With the increase of search times, the marginal revenue from search always decreases. When the expected marginal revenue equals the marginal cost, the search activity will stop. Consumers want to buy high-quality and low-cost products. When consumers search for goods on the B2C platform, the order of the product interface is just listed from top to bottom and from front to back based on the factors such as price, quality and sales volume. Naturally, consumers search and filter from top to bottom and from front to back. Because of time cost and other factors, consumers tend to browse the first few stores We will place an order to buy the goods, instead of spending more time browsing the next products at the sequence back. We can also find that the top sellers or manufacturers of commodities are generally the official flagship stores or authorized stores of famous enterprises. They have the advantages of good quality and low price by virtue of the scale effect. However, the unknown merchants who later joined the B2C platform are not only difficult to beat other well-known businesses who have entered the B2C platform first in terms of product quality and price, but also It is very difficult to attract consumers to pay attention to and