A Design of Negative Pressure Fish Tank Control System

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Keywords: Negative pressure fish tank; Control system; single chip micyoco; Timer; Constant temperature control

Abstract: The negative pressure fish tank increases the height of the fish tank under the condition of operation restriction.it solves the international problem that the traditional fish tank (aquarium) can't grow long. The design takes the AT89C52 SCM produced by ATMEL company as the core control element. Combine sensor technology, designing a water tank intelligent control system which is suitable for all kinds of aquariums with water level and water temperature as the main control object, and realizes the aquarium power saving mode, cold and hot constant temperature. LED indicator display. It's easy to operate, beautiful and has the characteristics of humanization.

1. Introduction

With the progressive elevation of modern people's living standards and the emergence of various entertainment intelligent electrical appliances, people pay more attention to the home life taste. Embodied in the economic form is related to leisure, and the resulting new style of home decoration [1-3]. The city man who work and live in the "reinforced concrete jungle" bear all kinds of pressure. They are eager to return to the ecological harmony in their hearts. However, a fish and grass aquarium, which is full of green and dynamic, more than bringing us the visual comfort and beauty. In addition to ,making the living and working environment lively and warm. It makes people feel the gift of nature when they stay at home. Leisure aquarium industry is also born under the demand of human beings, and has made considerable progress this year, gradually to large-scale, intelligent development [4-8].

Previously, the aquarium control system in the market of aquarium equipment basically did not have a simple switch. Intelligent type is inadequate, such as fish tanks need to be equipped with equipment for water exchange and supplementary oxygen applied to water pumps and air pumps to clean water and supplement oxygen. But the work of these devices will be caused by the number of fish, season, the volume of the fish tank, and the convenience of people for many times. The continuous work is not timely targeted control, and is not conducive to energy conservation. At present, various kinds of craft products such as fish tanks are gradually entering the public places such as the general residents' families. Most of the existing ornamental fish tanks are container type products, that is, the top openings are naturally placed. Its water temperature, liquid level, water circulation, etc. either do not exist, or the operation needs manual control, which brings great inconvenience to people [5-6]. The negative pressure fish tank, which cleverly utilizes the atmospheric principle and connectivity principle, utilizes the technical means to solve the basic problem that the traditional positive pressure fish tank can not surpass: that is, when the operation limit is increased, the height of the fish tank is increased while the real-time operation of the tank body is convenient, and more importantly, the intellectualized ecology of the fish tank is completed. System construction. For this reason, a multi-functional negative pressure fish tank control system is designed.

  DOI: 10.25236/isrme.2019.011

2. Overall Scheme Design

This design chooses microcontroller as the core device, through the temperature detection circuit, water level detection circuit, control system, the alarm circuit, display circuit, such as automatic lighting system made of a system, the system can detect the temperature of the tank, water level, the date, time, week, temperature display on the LCD display LCD1602, then compared with upper and lower limit set if more than the set range to the police, also can be adjusted through the key date, week, time.

Ornamental fishes are tender and fragile, and need to be taken care of [9-11]. The daily care is important and frequent. At present, the depth of the household aquarium is about 60cm, and it is advisable to touch the bottom of the bowl with the palm of the human hand. Since 1800, the aquarium is only a box container with a top opening. The height of the aquarium is gradually standardized, and it is divided into several specifications according to its length. Therefore, the fish tanks (or aquariums) commonly used in the market are determined by length, such as 1.2m, 1.5m, 2m fish tanks, etc. In order to increase the height of household aquarium, people invented negative pressure aquarium. Negative pressure tank is a fish tank with closed top and open bottom, which uses atmospheric pressure to raise water level. Under atmospheric pressure, a certain negative pressure is formed in the cylinder body, making the water level of the hydrophilic mouth lower than the high water level in the cylinder body. The fish in the cylinder can swim to the water inlet, which can feed the fish through the water inlet, and the water in the fish tank does not gush from the water inlet, which is different from the unique display effect of the general aquarium.

However, the current negative pressure fish tank control system has complex structure and is generally used in large areas such as Ocean Park and underwater world. There is a negative pressure fish tank control system which is close to the actual life application. It can not only monitor and control the temperature and water level of the fish tank in real time, but also automatically feed the fish and solve the problem. The problem of feeding the fish on a business trip or tour.

In view of the shortcomings of the above existing technologies, a negative pressure fish tank control system is provided, which has simple structure and reasonable design, solves the problem that the traditional fish tank can not grow long enough, and can monitor and control the temperature and water level of the fish tank in real time, and can automatically feed the fish, and has convenient operation and strong practicability. It has good use effect and is convenient for popularization and use.

This design can real-time monitor and control the temperature and water level in the tank. If it exceeds the set range, it will give an alarm. This design takes the AT89C52 microcontroller produced by ATMEL company as the core control element. Combined with sensor technology, it designs a water tank intelligent control system which is suitable for all kinds of aquariums with water level and water temperature as the main control object. According to the design requirements, the system plan is designed, and the overall structure design and hardware design are completed. The design of the meter and software is to realize the mode of saving electricity and constant temperature of the aquarium. The man-machine interface is displayed by LCD and LED. It is easy to operate, beautiful and has the characteristics of humanization.

The principle block diagram of the control system is shown in Figure 1.

As shown in Fig. 1, the system includes a microcontroller, a vacuum pump for pumping the fish tank and an oxygenating pump for pumping the fish tank. The input end of the microcontroller is connected with a timing control circuit, a temperature sensor for detecting the water temperature in the fish tank, and a water level transmission system for detecting the water level in the fish tank. The output terminal of the microcontroller is connected with a feeding mechanism, a heating mechanism, a display mechanism, an alarm mechanism, a first driving mechanism for driving the vacuum pump, and a second driving mechanism for driving the oxygenating pump.

The timing control circuit starts from time to feeding time, and the timing control circuit sends out control information to the microcontroller. The micro controller completes a feeding through the feeding mechanism according to the set feed quantity, and solves the problem of feeding the fish

when people go on business or on leave. The temperature sensor and the water level sensor real-time detect the water temperature and water level information in the fish tank and send it to the microcontroller. When the water temperature is below the set value, the microcontroller sends out the control signal, and the heating mechanism starts to heat the water in the fish tank until the predetermined value is reached. When the water level is below or above the predetermined value, the alarm mechanism is provided. Start the alarm, remind the staff to come to see. When the pressure difference in the differential sensor changes forward, the microcontroller sends out the control signal. The first driving mechanism drives the vacuum pump to start pumping until the output value of the differential sensor is zero, and the first driving mechanism stops driving; when the pressure difference of the differential sensor changes negatively, the microcontroller sends out the control signal, and the second drive mechanism drives. The dynamic oxygen pump starts to pump until the output value of the differential pressure sensor is zero and the second drive mechanism stops driving. At the same time, the microcontroller can display the feeding time, pressure difference information, water level information and temperature information on the display mechanism, which is convenient for staff to view.

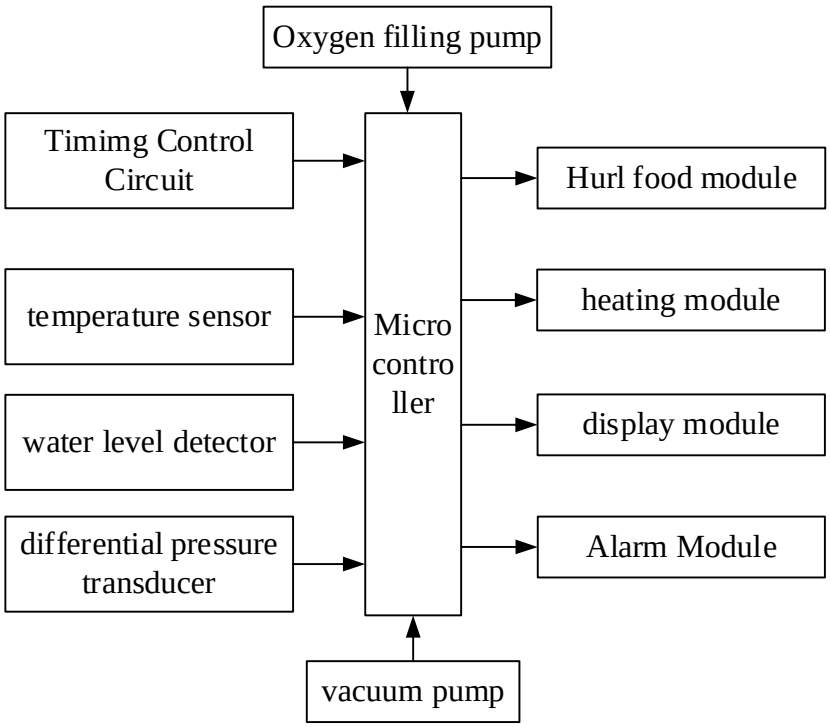

Figure. 1 Block diagram of negative pressure fish tank control system

3. Hardware Circuit Design

The system hardware circuit is shown in Figure 2.The timing control circuit in Figure 2 includes timer DS1302, the VCC1 pin and the VCC2 pin of the timer DS1302 are connected to the 5V power supply, the X1 legs of the timer DS1302 are divided into two paths, one is grounded by capacitor C1, the other is connected to one end of the crystal Y1, the DS1302 leg of the timer is divided into two paths, one is grounded by capacitance, the other is with the crystal oscillator. The SCLK pin, I O pin and RST pin of chip DS1302 are connected with the PI.5 pin, P1.6 pin and PI.7 pin of chip AT89C52 respectively.

As shown in Figure 2, the temperature sensor is the chip DS18B20, and the DQ pin of the chip DS18B20 is connected to the P2.0 pin of the chip AT89C52.The water level sensor includes a water level sensor of BF-KT4 type. The differential pressure sensor is Siemens gas differential pressure sensor QBE64-DP4.

This design uses digital temperature chip DS18B20 to measure the actual temperature, and the output signal is digitized. It is easy to process and control and saves many peripheral circuits of

traditional measurement methods. One of the biggest features of DS18B20 is the single bus data transmission, digital thermometer DS18B20 and the temperature measuring device for controller AT89C52. In this way, the structure of temperature measurement system is relatively simple, and the volume is not large.

The temperature acquisition circuit adopts DS18B20, a mainstream digital temperature sensor produced by DALLAS, USA. Because the chip has a unique single-wire interface mode, only one line is needed to realize the two-way communication connection between the microprocessor and DS18B20, and it can be directly connected to the single chip. DS18B20 has three pin t0-92 small volume packaging forms. Temperature measurement range of -55 -- +125 degrees Celsius, programmable A/D conversion precision of 9-12 bits, temperature resolution of 0.0625 degrees Celsius, and serial output temperature of 16-bit digital quantity. The working power can be generated by parasitic power source or introduced at the remote end. GND and VDD are both grounded when working in the family planning power mode, which is particularly useful in situations requiring remote temperature detection and space limitation, but the parasitic power mode requires a strong pull-up circuit, and the software control is relatively complex. Therefore, if possible, external power supply should be adopted.

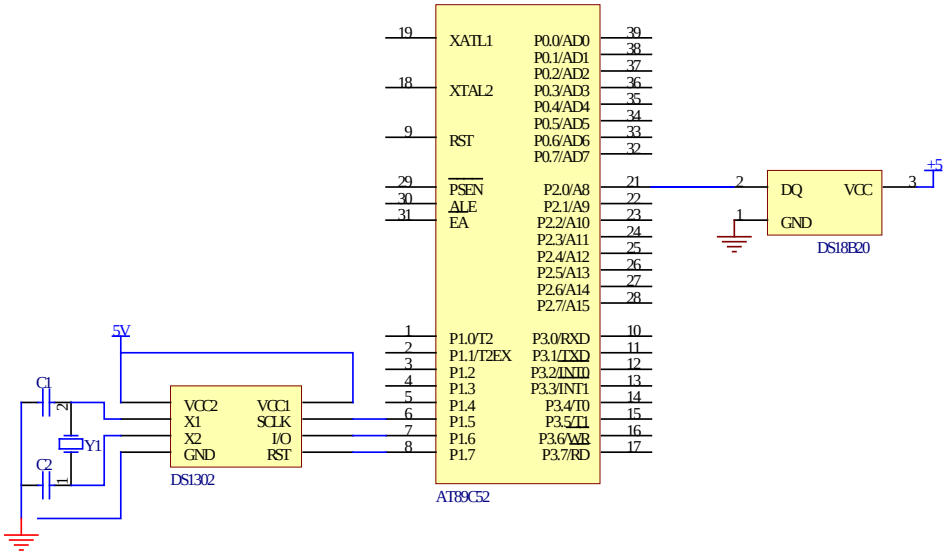

Figure. 2 System hardware circuit diagram

When the temperature and water level in the fish tank exceed the upper and lower limit, in addition to the starting temperature and the regulator of water level and height, an alarm shall be given. The buzzer can be divided into the active buzzer and the source buzzer. The active buzzer can be driven by the dc voltage due to the internal integration of the oscillation source. The passive buzzer has no internal oscillating source, so 2k-5k square waves are generally used to drive it. Buzzer is a kind of electronic device with body structure, which is powered by dc voltage. It is widely used in computers, alarms, photocopiers, electronic toys, telephones, automobile electronic equipment, timers and other electronic products. This design uses an active buzzer, which can be made to sing by applying a dc voltage of 5V at both ends.

4. Simulation Design

The system simulation interface is shown in Figure 3.The working process of the system is divided into several parts, and the set temperature and water level height limit value will be set. When the set temperature and water level height value are different from the detection value, an alarm signal will be sent. This procedure process includes five parts, the first part is the main program, which describes the overall structure; The second part is the subprogram of LCD1602 display. LCD1602 is initialized and the date, week, time and temperature are displayed. The third part is the reading, writing and initialization of DS1302 clock. The fourth part is the keyboard

scanning program, used to modify the date, week, time, temperature upper and lower limit; The fifth part is the temperature acquisition procedure of DS18B20.

The process of reading the clock from DS1302 is to read year, month, day, hour, and minute from the corresponding storage location of DS1302 in turn, and these values are read in the form of BCD code, which must be converted when other programs call.

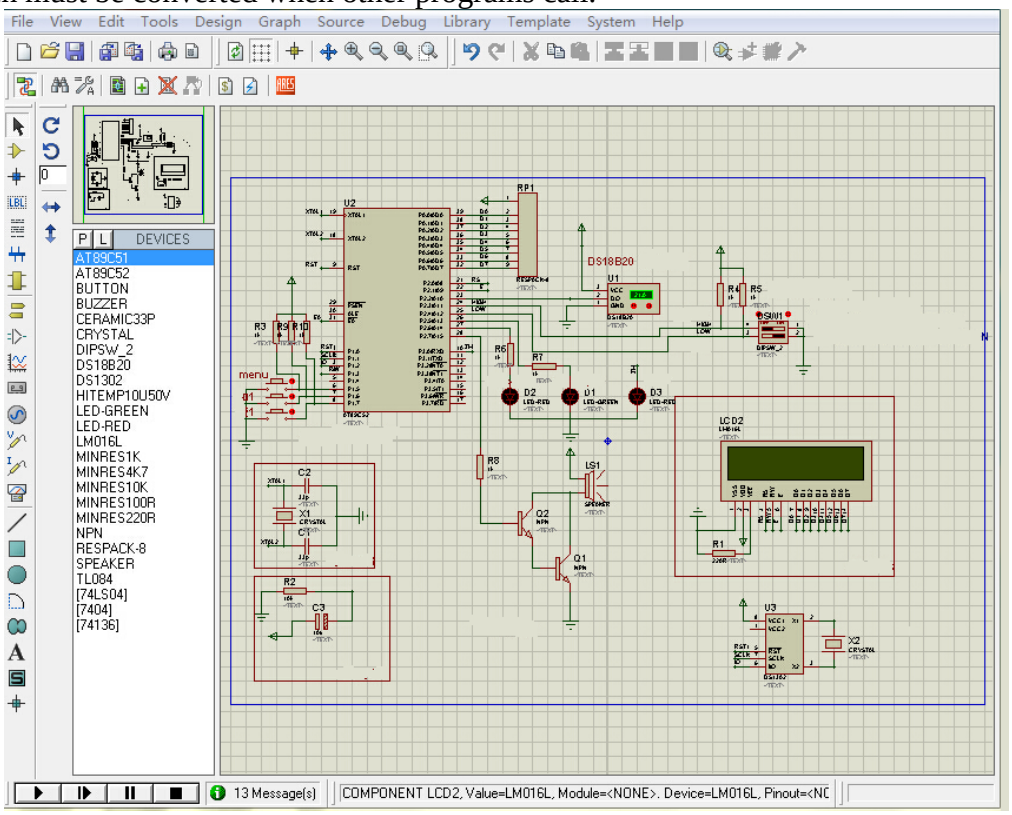

Figure. 3 System simulation interface

5. Conclusion

The design has simple structure, reasonable design, easy implementation and operation.

According to the principle of atmospheric pressure, the design realizes the design of negative pressure fish tank according to the principle of atmospheric pressure, and solves the problem that the traditional fish tank cannot grow long enough, and has strong practicability.

The design can monitor and control the temperature and water level of the fish tank in real time, and automatically feed the fish through the timing control circuit and the feeding mechanism. It solves the problem of fish feeding when people travel or travel outside, and the effect is good.

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