

# A multi-functional fish tank remote monitoring system based on STM32

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**Abstract:** In today's society, fish keeping is no longer just the exclusive favorite of a few breeding enthusiasts, but is increasingly seen as a work of art to decorate the home. But for the novice fish keeper, fish keeping is not an easy task, the survival period of the ornamental fish put in is short and the survival rate is low. Especially when there is a relatively long time to go out, the aquarium is not easy to carry numerous problems. In such a context, a multifunctional aquarium intelligent assistant that can be viewed and controlled remotely is designed based on the principle of STM32 microcontroller.

**Keywords:** Internet of things, wireless communication, motor drive, remote video surveillance

## 1. The introduction

Design a smart assistant for families who are new to fish farming, safer, more practical and cheaper than ordinary smart fish tanks, reducing the cost of farming while improving the efficiency of farming. Home multi-functional smart fish tank system includes 13 sub-systems, with the Jiji cloud Internet of Things, not only has the market smart fish tank often available functions, but also add a camera, real-time view of fish tank conditions.

## 2. The hardware design

### 2.1. System hardware composition

The hardware design of this system includes STM32 core controller core circuit, DBS18B20 digital temperature sensor module, SG90 servo driver module, ESP8266 wireless module, JQ8900-16P 8400 voice module, OLED module, XKC-Y25-PNP non-contact liquid level sensor, infrared sensor module, pH sensor module, TS-300B turbidity sensor [1] and monitoring camera.

### 2.2. Design each module of the system

#### 2.2.1. Master Control Module

The main control module is the minimum STM 32F 103C 8T6 system, which is responsible for connecting and controlling the wireless communication module, OLED display module and engine driver module. mp3 playback module, infrared detection module, water quality detection module, etc. The STM 32F 103C 8T6 Minimum system divides the power supply circuit into power supply circuit and drop circuit, oscillation crystal, reset circuit, unit capacity, charging circuit and other peripheral circuit debugging. Embedded system core is small and the system is simple. The embedded system is not a general computer system, the system software and application software are unified. By simplifying the functional design and saving cost, the security of the system is increased, and the embedded system has the requirement of reliability and fast running speed, and the program is burned into the memory of the embedded system [2].

#### 2.2.2. Digital Temperature Sensor

The DS18B20 temperature and humidity sensor displays temperature and humidity on an OLED display. In addition to the smart cloud IoT compatible with cell phones. Even without an app. It is assumed that the DS18B20 has no temperature limits. Utility mode can be efficient and can be used at any state of it when checking the digital control, the detected temperature is very accurate [3].

### 2.2.3. ESP8266 wireless communication module

The ESP8266 wireless communication module is used in this design, networking to transmit temperature, water quality, MP3 playback, motor control and other information to or receive information from the Internet of Things. ESP8266 size 5x5 mm, ESP8266 module has the accessories: resistor capacitor inductor 10, passive crystal oscillator 1, etc. The normal operating temperature range is approximately in at: -40~125 °C. The ESP8266 module was chosen because WiFi network solutions with completely independent systems can operate independently and install other host operations. Save development cost and improve system stability. As shown in Figure 1 below.

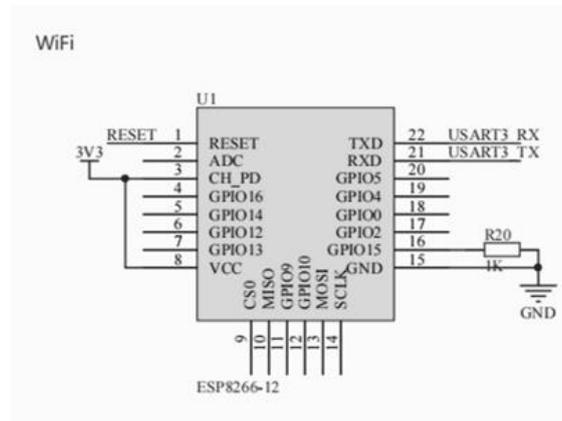


Figure 1: Wifi module wiring diagram

### 2.2.4. JQ8900-16P 8400 MP3 voice module chip

With the mini mp3 player playback module, the feeding habit training of ornamental fish can be realized in the feeding operation by playing from the remote end.

### 2.2.5. TS-300B Turbidity Sensor

General long-term non-flowing water will produce suspended and colloidal state of particles, resulting in the original pure water turbidity phenomenon, the turbidity of water containing colloidal particles is called water turbidity. The unit of turbidity is expressed in degrees, 1L of water contains 1mg of SiO (or non-curved mg of white clay, diatomaceous earth), turbidity units for JTU, 1FTU = 1JTU. turbidity is the use of optical effects, when the light penetrates the water layer by the degree of penetration obstruction size response to the water layer for the ability of light scattering and absorption, that can be expressed in turbidity value.

### 2.2.6. Camera secondary development process

This design uses a camera that can be developed twice, different from ordinary home fish tank, we use the camera comes with the camera API data package written to the cloud SDK, the Jizhi cloud and the background monitoring APP to create a connection to combine the two into one. Users can view the ecological situation of the fish tank directly from the client through the cloud, and make reasonable adjustments to the ecological control of the fish tank according to the situation [4].

## 3. Software Design

### 3.1. Main programming

The software part is modularly programmed according to the system functions. Two different program parts, the main program and the interrupt service program, make up the system software. The interrupt service program is mainly for data acquisition from the sensors. The main program is to package and send the data collected by the interrupt service program as well as to receive the data and to drive the corresponding module to perform the corresponding actions. As shown in Figure 2 below.

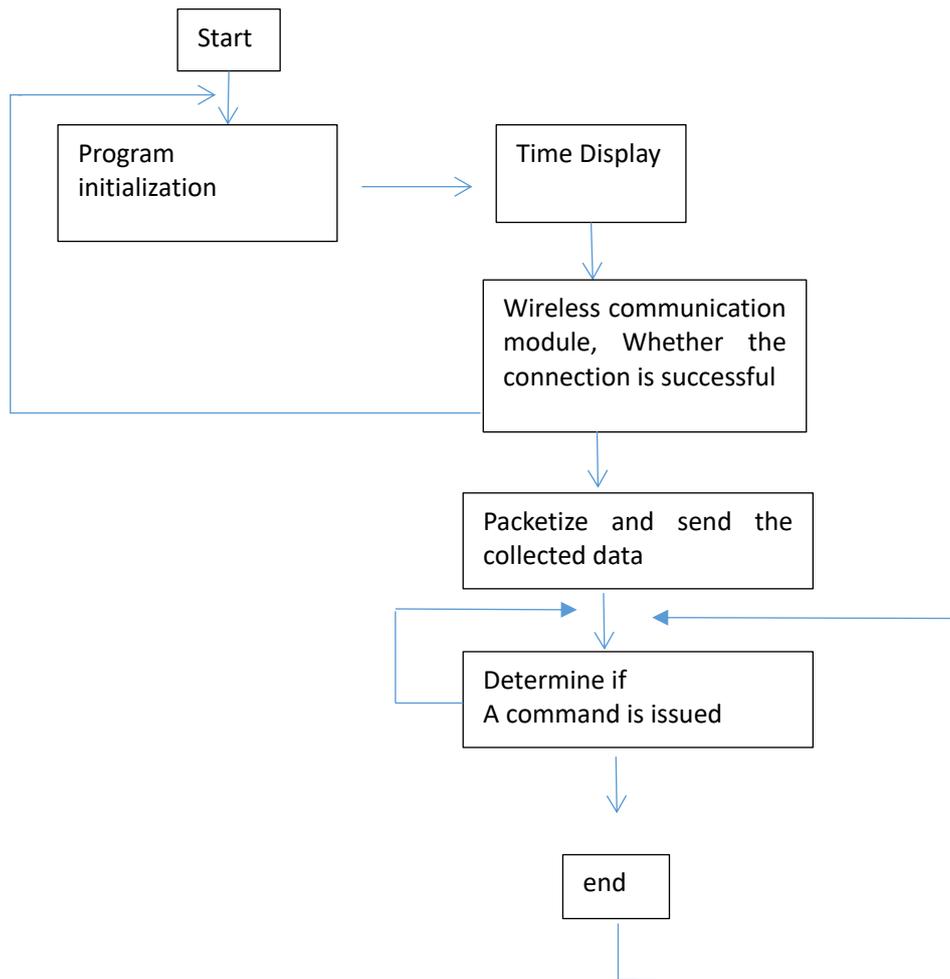


Figure 2: Software execution steps design diagram

#### 4. Conclusion and Analysis

This design is based on the research and implementation of the remote intelligent assistant system of home fish tank in JiZhi cloud, using the more advanced and professional JiZhi cloud IoT development platform, which reduces the complexity of IoT solutions, and reduces the time and cost of developers in designing terminal nodes, data transmission, data monitoring interfaces and functional systems compared to traditional IoT solutions.

#### References

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