Intelligent Display Bracket Based on Ali Cloud IoT Platform

Chengbang Lu[1,a,*], Xiaohua Li[2,b]

[1,2]School of Electronic Information Engineering, Foshan University, Foshan, 528000, China

[a]2298716995@qq.com, [b]380125779@qq.com

*Chengbang Lu

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Abstract: This work proposes a display stand based on the Ali cloud IoT platform, combined with esp8266 master control chip control, utilizing the Ali cloud IoT platform as an MQTT server, using Wi-Fi, hardware for data transmission, by publishing and subscribing to mobile terminals, to accomplish wireless control of fixed display stand, solve the user to keep a fixed posture facing the screen for a long time, manually adjust the display problem, and enhance efficiency. Following testing, the system may steadily adjust the location of the mobile monitor as required. Control the gadget with a WeChat applet for some degree of practicality, ease, and promising application.

1. Introduction

People hold a fixed posture facing the computer for extended periods when working or studying as a result of the growing popularity of electronic offices and PC use, dramatically increasing the likelihood of cervical spine illnesses. The major goal of this research is to utilize a WeChat applet to manage the monitor screen daily. By eliminating the need for manual screen adjustments, this approach avoids having to hold a fixed posture for extended periods when working or studying and lowers the danger of developing spinal disorders.

2. The total design of the system

The system consists of a network layer and application layer, the core master control is the ESP8266 Node MCU module, the network layer is networked by the home router and uses MQTT protocol communication; the application layer uses the IoT Ali cloud platform as the server of the whole system[1]. WeChat applets are used on the mobile side. The ESP8266 Node MCU module and the WeChat applet communicate using an MQTT server, and the mobile site uses the server to send control commands to the control node to implement MG996R servo angle control. Figure 1 displays the overall design structure.

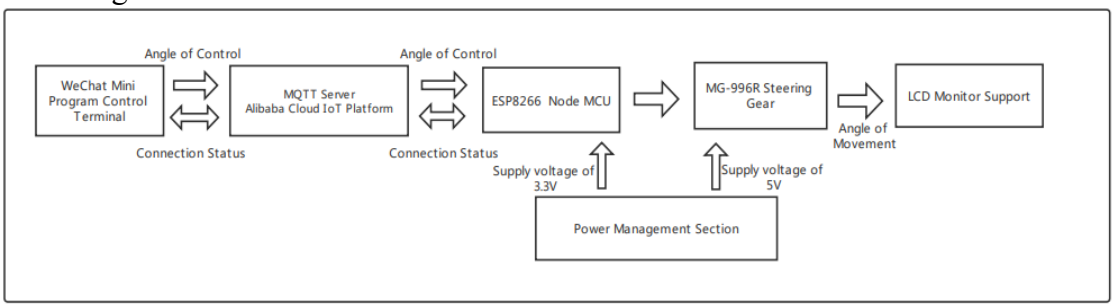

Figure 1 Overall System design structure.

3. Hardware design of the system

The ESP8266 Node MCU development board, MG-996 servo (multiple), input and output interfaces, and an adjustable power supply module make up the main control node of the system hardware design. Figure 2 displays its circuit schematic.

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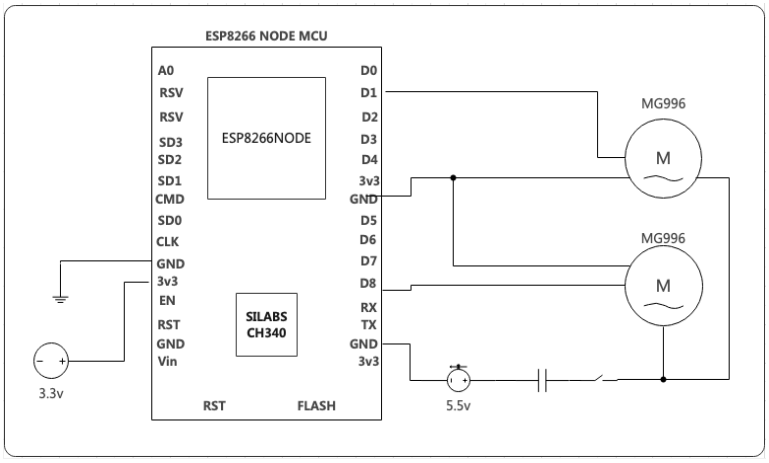

Figure 2 Circuit schematic.

3.1 WI-FI communication module

The ESP8266WIFI wireless communication module serves as the Node MCU firmware platform's hardware carrier. It is an ultra-low power UART-WIFI transceiver module with rich hardware interfaces, supporting UART, IIC, PWM, GPIO, and ADC interfaces, and primarily implementing serial transceiver, PWM regulation, and GPIO control functions, among others. Furthermore, the ESP8266 module STA/AP/STA+AP communication modes can be used with the ESP8266 module[2]. This prototype model includes an ESP8266 Wi-Fi module, a USB to TTL chip, a 5V to 3.3V LDO, an automatic download circuit, etc. It is simple to implement Wi-Fi connection and data transfer, avoiding networking techniques like ZIGBEE, LORA, Bluetooth, etc., and enhancing data transmission rate.

3.2 WI-FI transport with MQTT transport protocol

IBM created the transport protocol known as MQTT, or Message Queuing Telemetry Transport, for IoT connectivity. It is a communications protocol created for distant devices with subpar hardware and in cases of unstable networks[3]. The system's hardware side is linked to the router, and the hardware side, together with the mobile side, uses the subscribe/publish function (following code block), which enables the system to receive and deliver data remotely.

```
client1.publish('/gt9tlAMIzCS/0U828u6SnTyf7VKfLyIy/user/update',
"\{\"method\":\"thing.service.property.set\",\"id\":\"437804760\",\"params\":\{\"PowerSwi
tch01\":" + dvl01 + ",PowerSwitch02\:" + dvl02 + "},\"version\":\"1.0.0\"}\}");
```

4. Software design of the system

The ESP8266 Node MCU and the WeChat applet were both designed and developed as part of the system's software component. The former contains the fundamental Wi-Fi configuration, communication, and control data functions; the latter has the WeChat applet's front-end design, MQTT server connectivity, and control angle logic processing operations. Figure 3 depicts the mobile terminal's software flowchart. There is no need to address the complex back-end development because the software side of this system simply needs to fulfill the transmission function of control data.

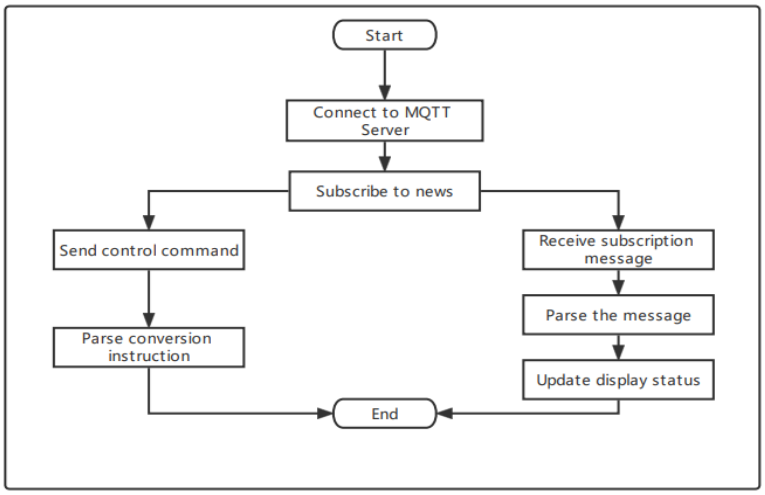

Figure 3 Mobile software communication process.

4.1 MQTT server communication

The creation of web servers frequently uses the HTTP protocol. However, while analyzing the IoT server's system architecture, reaction time, throughput, decreased battery consumption, and bandwidth utilization become the key performance indicators of the system, and the MQTT protocol is more effective in addressing such issues[4,5,6]. As a result, the MQTT server is used in this system's communication design. Three roles—message publisher, message broker, and message subscriber—make up the MQTT protocol communication paradigm[7]. Figure 4 depicts the communication principle.

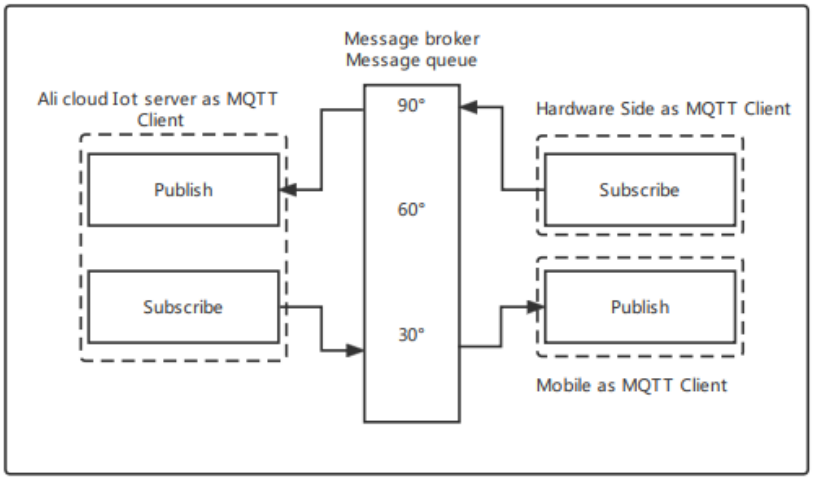

Figure 4 MQTT server communication principle.

WeChat applets for mobile devices connect to the MQTT server using WebSocket. The onLoad function, which is triggered by the page logic function once the user enters the WeChat applet, initializes the triplet (productKey, deviceName, and devicesecret) and checks to see if the connection is successful. If it is, the mobile side communicates by subscribing to the subject of the IoT platform, and data transfer may be carried out after a successful subscription to actualize the communication between the mobile side and The communication connection of the server. Figure 5 depicts the communication process.

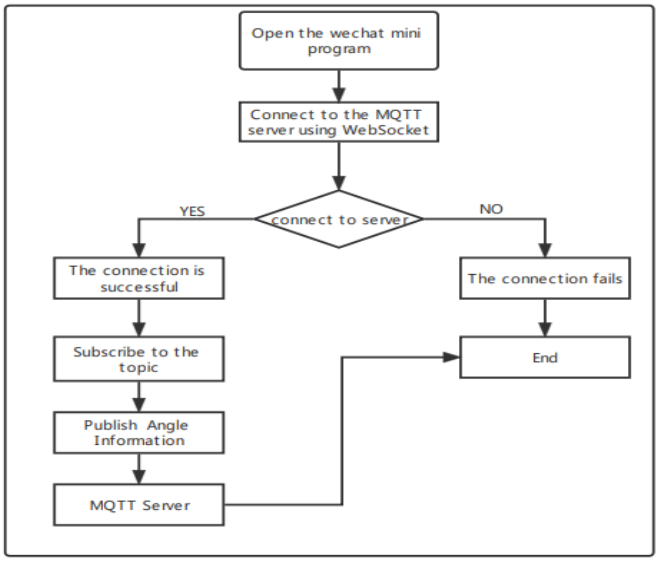

Figure 5 Mobile communication process.

The control node first establishes a server connection, and after the ESP8266 is powered on, it initializes the peripherals like UART and I2C, and reads the Wi-Fi account and password to be connected from the EPROM, and performs Wi-Fi networking. After the connection is complete, the control node creates the MQTT client, establishes a server connection, and connects to the MQTT server, where it begins subscribing to and publishing topics If the Wi-Fi connection is lost, the device switches to "Smart Config" mode and waits for the user to re-establish Wi-Fi using the "Smart Config" setup[8]. Figure 6 depicts the communication flow.

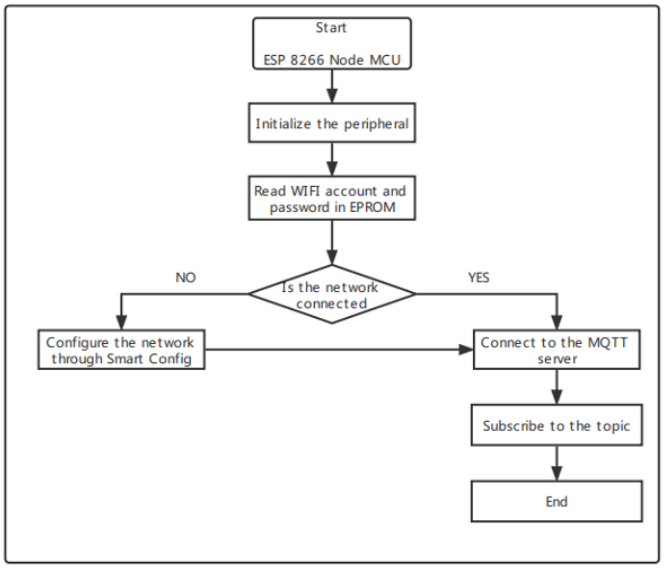

Figure 6 Hardware-side communication flow.

4.2 Wi-Fi configuration and connectivity

Wi-Fi technology provides the benefits of extended transmission distance, high bandwidth, and simple networking, making it more appropriate for usage in real-world IoT application scenarios[9]. The basic wifi configuration (WIFI SSID, WIFI PASSWD) can be carried out directly through the Wi-Fi config file because the ESP8266WIFI wireless communication module serves as the hardware carrier for the Node MCU firmware platform. Following configuration, the Node MCU is loaded with the appropriate application using code burned through the serial port using the Arduino IDE. Figure 7 illustrates this.

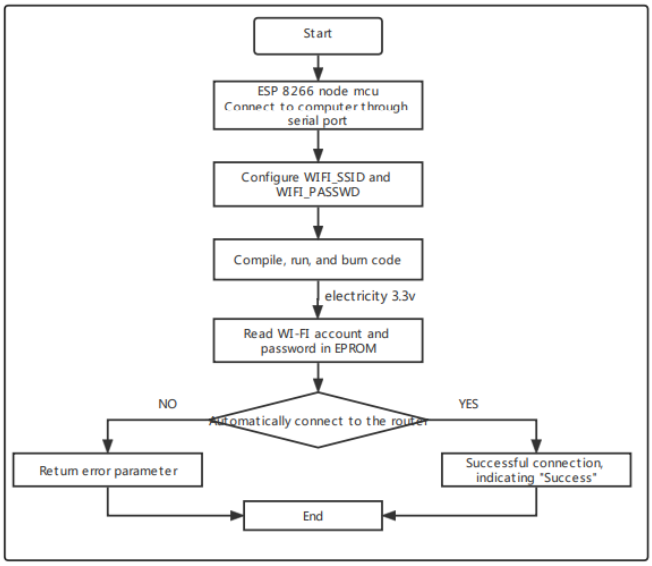

Figure 7 Wi-Fi configuring the connection.

4.3 Controls the angle function

Two primary angle control functions—fixed angle control and angle direction control—are created based on a real scene simulation. Angle direction control first sets the angle of each step of movement, and then through the direction button for each distinct direction of the servo command control. Fixed angle control uses the input box input angle to move the servo at a fixed angle. When the maximum angle of movement is met, the servo will automatically prompt and return to the initial angle.

5. Application value of the system

This intelligent display stand design, which is based on the Ali cloud IoT platform, is simple to use and offers a dependable, consistent connection. With its reliable, fast data transmission and reduced development costs for mobile back-ends, Ali's cloud IoT platform is a great alternative. WeChat applet is a type of mobile application that "does not need to be installed, at your fingertips, used and gone, and does not need to be uninstalled"[10]. WeChat applets and hardware work well together and have the potential to be widely used in smart home design. The smart display market is untapped from the standpoint of the market economy, and the smart display stand created by this system is useful for the right audiences and has some financial worth.

6. Conclusion

To create a smart display stand, this article employs the ESP8266 Node MCU and AliCloud IoT platform. It examines the design in depth from two design sides, the hardware side and the mobile side, and it introduces the protocol system and implementation method of this system. The technology lays the groundwork for further research into the function of face positioning and has strong functional compatibility. This approach eliminates the issue of people maintaining a stable position to face the monitor for extended periods by allowing users to manipulate the monitor using WeChat applets.

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