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Design of Robot Based on Internet of Things

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Abstract. The mobile robot system based on the Internet of things is a combination of mobile phone terminal and mobile robot through the network server, and realizes the interaction of the data by using the Internet of things technology and the control system of the Android mobile terminal. The use of idle old Android mobile phone as the robot's brain, can use the mobile phone control terminal and computer control terminal through the P2P cloud connect platform remote control robot from the remote control terminal, by sending control signals, mobile phone terminal after receiving via Bluetooth single-chip microcomputer to control the robot, robot equipped with DHT11 temperature and humidity sensor MQ2 and gas sensor, real-time monitoring the indoor state and return control terminal interface, a robot can also watch the real-time camera image.

Keywords: Internet of Things, Android system, Robot

1. Introduction

This project designed a remote control system for ventricular robots based on the Internet of Things[1-3]. Use the Internet of Things technology and Android development technology to combine Android phones with mobile robots through P2P cloud platform and Bluetooth module[4-5]. Thereby through the design of the system and its communication with the lower computer, realize remote control and robots to achieve reliable control within the network coverage. It can also realize the real-time network monitoring of the robot action control and the environment of the home robot[6]. Combined with the powerful operating system, camera, networking and other functions of the idle Android phone, combined with P2P network technology, an application- and family-oriented Internet of Things ventricular robot is proposed[7-8]. For example, when you go to work, you can make a response by real-time observation of everything in your home with your mobile phone and mobile robot.

2. System Principle

This paper is based on the design of the indoor intelligent monitoring system of the smart phone as the gateway platform. In the choice of the operating system of the mobile phone, the current mainstream operating systems are WP, IOS and Android. The three systems have their own advantages and disadvantages. Let's briefly analyze the three operating systems to select an operating system that is most suitable for the system.

The innovation of the mobile robot of this system is that it does not need an external USB camera, directly utilizes the high-definition camera of the Android mobile phone, and performs video H.264 compression encoding through the powerful GPU of the mobile phone for network transmission. Using the networking capabilities of Android phones, wifi, 3G, 4G can be networked. And integrated P2P cloud connectivity, you can connect robots from anywhere in the world. Using Android mobile computing power to achieve speech recognition, using natural voice to control robot movements, based on OpenCV software library, to achieve gesture analysis and face tracking.

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3. Design of Hardware System

As shown in Figure 1, the old Android cell phone is used as the brain of the robot. Mobile phone control terminal and computer control terminal can connect the remote control robot from different places through P2P cloud platform, send control signals through mobile phone control terminal, and then connect the robot to MCU via Bluetooth after receiving the terminal mobile phone. The robot is equipped with DHT11 temperature and humidity sensor and MQ2 gas sensor, which can monitor the indoor state in real time and return to the interface of the control terminal to display. The mobile control terminal sends control signals to Android mobile phone through the network. Android mobile phone transmits data to MCU through Bluetooth module to control the angle of the steering gear, so the robot can watch the camera image in real time.

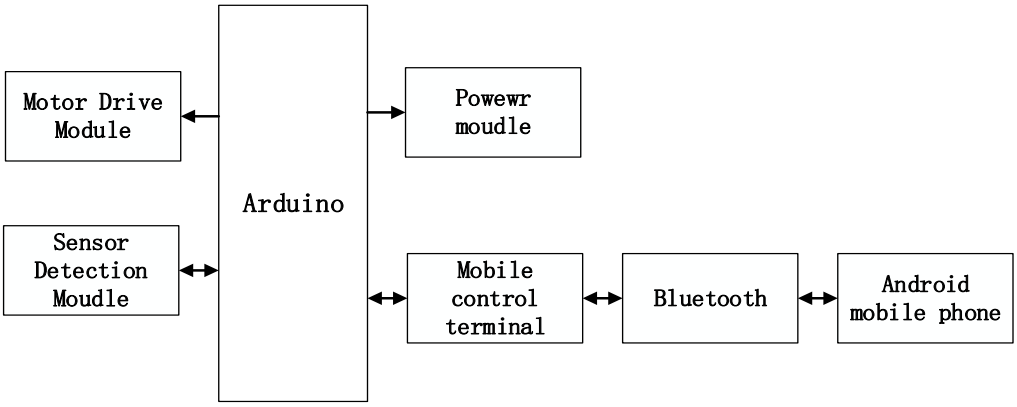

Fig. 1: System schematic diagram.

3.1. Design of interface circuit for MQ2 smoke sensor

The MQ2 smoke sensor is suitable for the detection of liquefied gases, butane, propane, methane, alcohol, hydrogen, smoke, etc. As shown in Figure 2, the MQ2 smoke sensor has four pins. Pins 1 and 2 are connected to VCC and GND respectively. Pin 3 is a digital output and Pin 4 is an analog output. Because we are testing gases such as smoke, we need to use pin 4 of the MQ2 smoke sensor. Therefore, pin 3 is not used, and the pin 4 of MQ2 is connected to the analog channel A4 of the Atmega328 of the single chip microcomputer. The MQ2 sensor is highly sensitive to smoke such as natural gas and liquefied petroleum gas, especially to alkanes, and has very good anti-interference. It can accurately eliminate the interference information of irritating non-flammable smoke. With good repeat ability and long-term stability.

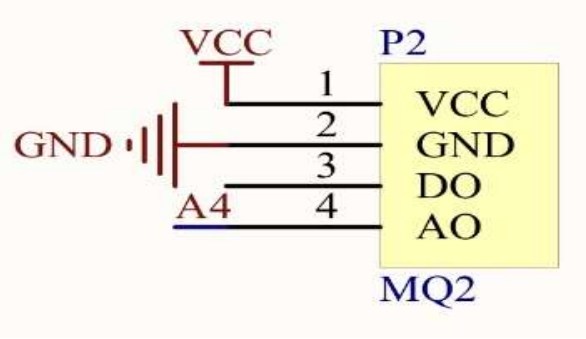

Fig. 2: Circuit schematic diagram of MQ2 smoke sensor.

3.2. Circuit design of manipulator

The steering gear is mainly composed of a casing, a circuit board, a coreless motor, a gear and a position detector. As can be seen from Figure 3, the robot uses two identical servos J1 and J2, and each servo has 3 pins, pin 1 is grounded, and pin 2 is connected to VCC power positive +6V. Pin 3 is connected to the D5 and D6 interfaces of the Atmega328 microcontroller. D5 and D6 are a PWM output of Android UNO, so both pins D5 and D6 are configured with PWM output.

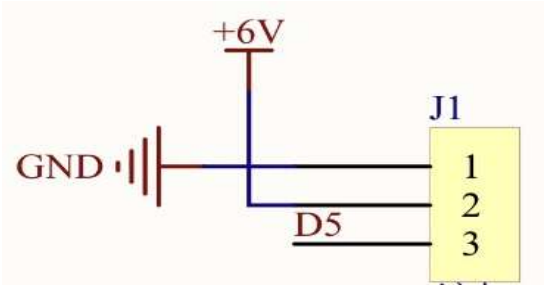

Fig. 3: Circuit schematic diagram of manipulator.

4. System Software Design

After the robot is powered on, it is connected to the wireless network through the Android mobile phone. After the control panel collects parameters such as temperature and humidity and control quality, the data is sent to the mobile terminal for display. When receiving the control terminal or the voice control command, the robot executes the corresponding command, and sends a command through the Bluetooth module to control the movement detection of the ventricular robot. The mobile phone turns on the Bluetooth and connects with the Bluetooth module of the robot. After the connection is completed, the mobile terminal is sent and received via Bluetooth, and the mobile terminal transmits the control signal to the Android chip through Bluetooth. The mobile phone then sends a signal to the MCU through the Bluetooth connection, and then the MCU output controls the motor through L298N, so that the robot can change direction. The DHT11 temperature and humidity sensor and the MQ2 smoke sensor collect the temperature and humidity values through the MCU for processing. After processing, they are sent out from the serial port to the Atmega328 MCU for processing, and then sent to the Bluetooth receiving end to transmit to the mobile phone control terminal for display.

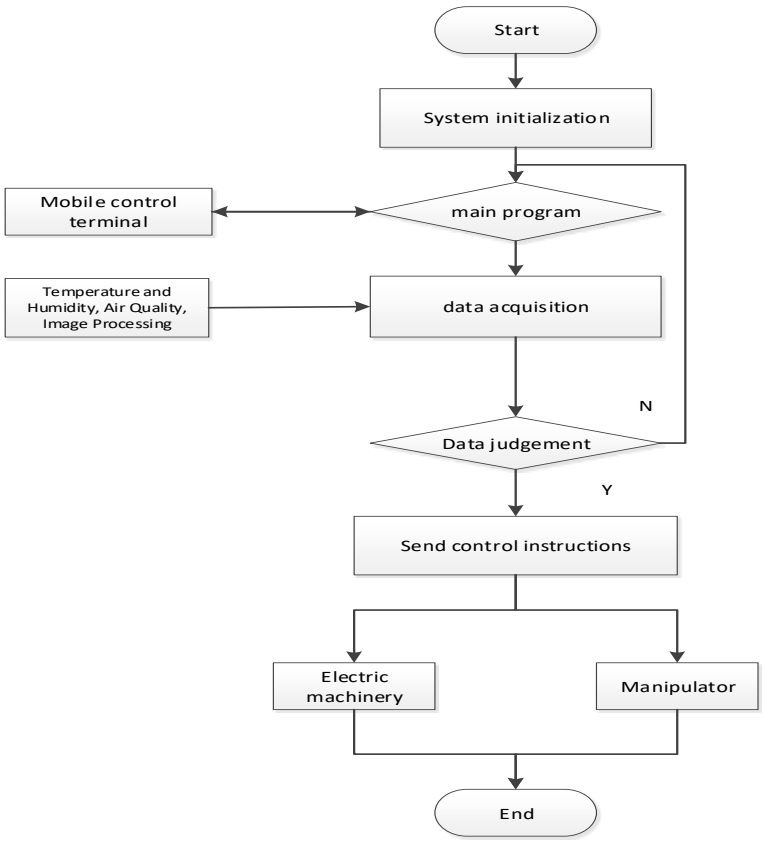

Fig. 4: System flow chart.

First, the robot is powered on and then initialized. Then the data is exchanged between the mobile control terminal and the main program. Then the temperature and humidity value of the DHT11 temperature and humidity sensor, the detection result of the MQ2 smoke sensor and the image processing result are sent to the single chip Meanga328 for data acquisition. Then, the MCU judges the data. If the data is wrong, it returns to the main program to re-acquire the data. If the data is correct, the MCU sends the command to the motor and the robot to let the motor and the robot make the corresponding change and then end.

5. Results

The main functions of ventricular robots are realized through software design. The servant robot mainly uses the Arduino UNO R3 circuit board. The Atmega328 MCU uses the C language to write the program, and the mobile client and the ventricular robot connect through P2P. Because each module is relatively independent, you can write the program of each module first, and then perform combined online debugging to realize all the functions of the servant robot.

In the process of developing a single-chip microcomputer, the developer basically performs the hardware design first, and then performs the software design on the basis of the hardware design. Since the modules of the ventricular robot are relatively independent, the developer can first write the program of each module, and then each module independently performs software debugging, and then each module is combined for online debugging. At the same time of online debugging, you can check the coordination between software and hardware, so as to debug the software or make some changes to the hardware according to the actual situation. Between the powerful functions of the Android mobile phone, through the voice control, the robot can complete the task better, and the work is stable, then the design and debugging is completed. Through the mobile phone control terminal networking, remote video surveillance, data monitoring and control of the robot can be achieved while ensuring a good network.

Fig. 5: The actual physical test diagram of the system.

6. Acknowledgments

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