

Design of Gesture Control TV Infrared Remote Control

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Abstract

This paper combine the analog electronics, digital electronics, PROTEL DXP, single-chip microcomputer and other related knowledge to design and make the whole gesture control infrared TV remote control. Hardware: Arduino uno r3 is used as the main control board, which is connected with corresponding gesture control module and infrared emission module. APDS9960 gesture recognition module is used to detect gesture related information feedback to the main control board, which receives post-processing control infrared emission module and emits the required infrared signal to control TV. Software Arduino IDE is used to write programs, and data lines are used to upload programs to the chip for running. Finally, the system function should be tested to verify the expected effect.

Keywords

Arduino uno r3; Gesture recognition module; Infrared emission module.

1. Introduction

The advancement of technology has penetrated into every aspect of life, and TV remote controls are also indispensable in life. The infrared remote control has a low cost and is effective in all aspects, and almost all televisions on the market are infrared remote controls [1]. But science and technology have not stopped, and most remote controls still belong to the more primitive button controls. Therefore, in order to make it easier to control the TV when using the TV, I have conceived the idea of designing a gesture to control the TV infrared remote control. The Arduino used in this project is a modular product developed on the basis of single-chip microcomputer. The advantages of Arduino are obvious compared with ordinary single-chip microcomputers. First of all, Arduino is a convenient, flexible and easy to use open source hardware product. It has a rich interface, digital I/O buckle, analog I/O port, and supports SPI, IIC, UART serial communication. As long as the corresponding expansion of the Arduino board allows it to extend a variety of capabilities, as long as you have ideas. It has no ambiguous MCU assembly language, and some are just convenient function applications. The programming environment can be installed with the Arduino IDE [2]. It has great freedom and can be extended to a very high performance! Standardized interface. Therefore, the core control part uses Arduino uno r3 to design and make a gesture control TV infrared remote control. Arduino uno r3 is a single-chip board using ATmega328. It has 14 digital input and output ports. There are also six that can be used as PWM output. There are six analog ports, which are powerful and powerful. The programming language used is Arduino C based on C++. It is extremely easy for people with C++ language foundation to get started. The storage space is 32KB and can store quite large MCU programs. It is very convenient to use the USB interface for power supply. It is the price is slightly higher. The programming is easy to get started, the hardware is modular and easy to assemble, and the expansion of hardware is numerous and rich. A rich expansion port, a large amount of program storage space enough to meet the program, can provide 5V through the power interface. The Arduino programming language is a further improved product from the C++ language. It simplifies the parameterization of C++ and makes it functional. It does not need

to understand its underlying structure to use it directly as a tool, and is more suitable for people who are new to contact. Arduino uno r3 main chip only nail size ATmega328 integrated board, Arduino standardized interface is very good to replace the sensor reuse, low power consumption, Arduino is a convenient and flexible, easy to get started open source electronic prototype platform. The Arduino program is easy to burn, and after the program code is written, it can be uploaded to the motherboard after being compiled. Defects are also inevitable. The biggest drawback is that if the source program is lost after burning, it can only be written again.

2. Design Scheme

This paper is mainly to introduce the user to the gesture control TV infrared remote control design. The gesture control TV infrared remote control transmits the signal to the Arduino board through the gesture receiving module and performs signal analysis to control the TV. Designed as an Arduino board connected to the infrared transmitter module and gesture detection module. The Arduino motherboard receives the gesture information recognized by the gesture detection module as the main control block. After the information receiving process is completed, the Arduino motherboard controls the infrared emitter to emit infrared signals to control the effect of the television. The power supply mode of the system is the USB public port. (Type B) interface power supply.

Arduino uno r3 has the Atmega328p-pu master chip, and its Atmega328p-pu performance can meet the design needs. The characteristics of ATmega328p-pu are briefly introduced: 1. Not only its high performance, but also very low power consumption. 2. Ability to simultaneously read and write operations. 3. Lock program security. 4. Write/erase cycle; 10,000 flashes. 5. Advanced RISC structure [3,4]. The pin function is shown in following Figure:

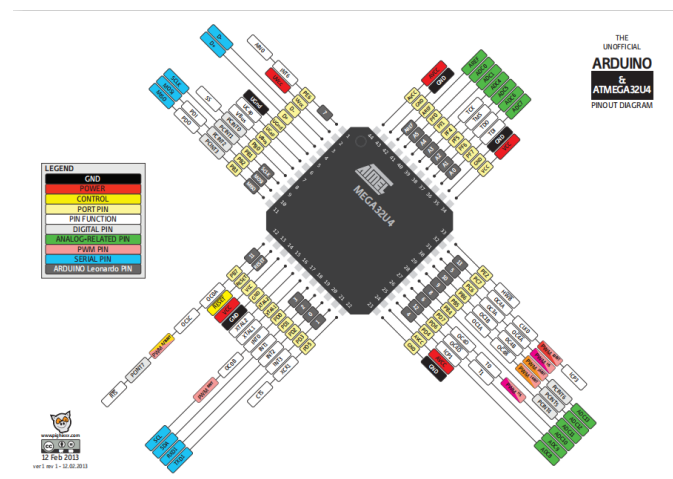


Fig 1: Atmega32 chip pin function

The APDS-9960 chip integrates many different functions such as RGB, gesture detection and environmental detection. The feature I use is the gesture detection feature, which uses the library functions provided to edit the controls. It is very suitable for the application of this topic. The pin functions of the Arduino uno r3 MCU are as shown in following Figure:

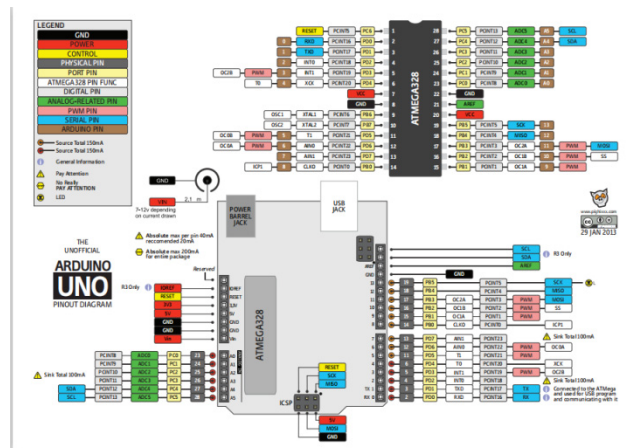


Fig 2: Atmega32 chip pin function

Since we only use some of the interfaces, I will only introduce them. GND-GND, VCC-5V, SCL-A5, SDA-A4, INT-2.+ Connect to 5V, - Connect to GND, S to 3. 1. The A4 and A5 interfaces are analog input ports, but can also be used as digital inputs and outputs. I use it as SDA, SCL, SDA is used as the communication line for transmitting data, and SCL is used as the clock line for synchronous data transmission. 2. GND, 5V interface. GND is a function to keep the loop closed, and 5V is to provide a stable 5V to the external components. The 3.2, 3 interface can be used as a mathematical signal input interface, wherein the 3 interface uses the PWM function, that is, the pulse modulation function causes the infrared transmitting tube to emit the required infrared signal, and the 2 interface is used as the information of whether the gesture module feedback is in normal operation. Other pins are also shown in the figure above.

The Arduino uno r3.ATmega328 interface with the ATmega328p main chip is very rich in design and has strong scalability. The schematic diagram of Arduino uno r3 is shown in following Figure.

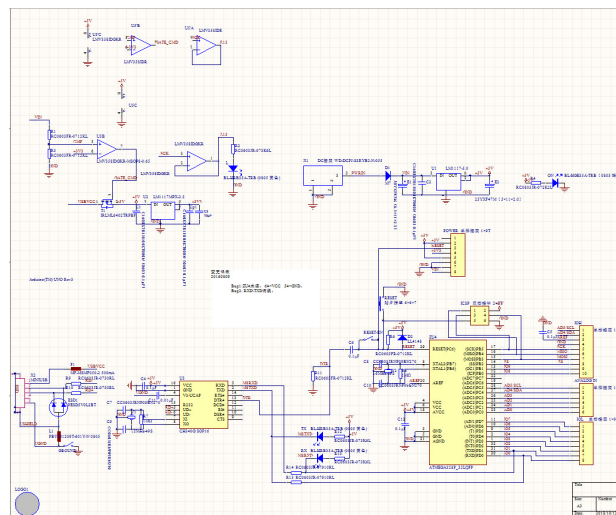


Fig 3: Arduino uno r3 general schematic

The reset circuit is a circuit device that returns the circuit to the initial state. Its function is to prevent the CUP from performing erroneous operations, and it can improve the compatibility performance regardless of the type of the microcontroller and the design of the reset circuit.

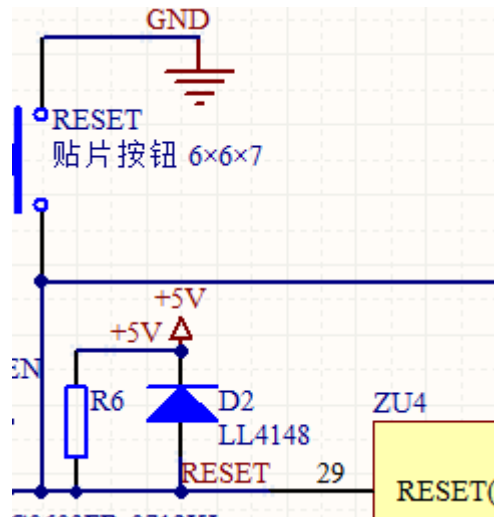


Fig 4: Reset circuit

This design uses the APDS9960 model sensor, which uses four-direction spot diodes to sense the reflected IR energy. The physical information that the sensor can detect is converted into digital information that the Arduino chip can accept. The gesture engine has automatic activation capabilities. It can accurately detect simple up, down, left, and right, and pass the obtained information to the Arduino uno r3 microcontroller. The schematic diagram is shown in following Figure.

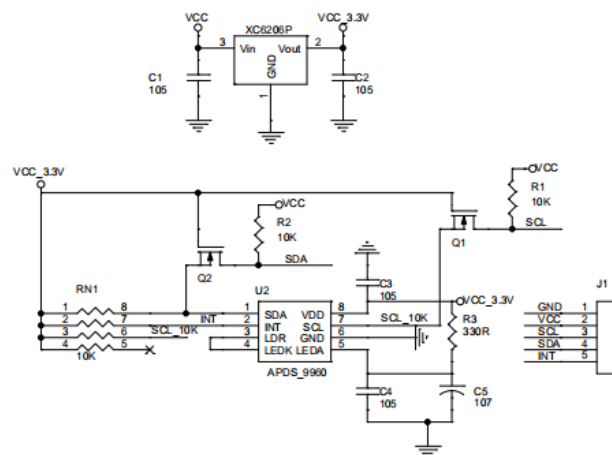


Fig 5: Gesture recognition module schematic

Pin definition:

GND: power supply negative input

VCC: positive input port of power supply, can be connected to 3.3V to 5V

SCL: 12C clock port

SDA: 12C data port

INT: interrupt output

Infrared remote control is a wireless, non-contact control technology that has been developed to be extremely mature, with strong anti-interference ability, reliable information transmission, low power consumption, low cost, easy to implement, etc. The electronic equipment is widely used. Infrared remote control technology is used in most computer and mobile phone systems, and there are many types of external plug-in devices to match. The schematic diagram is as follows.

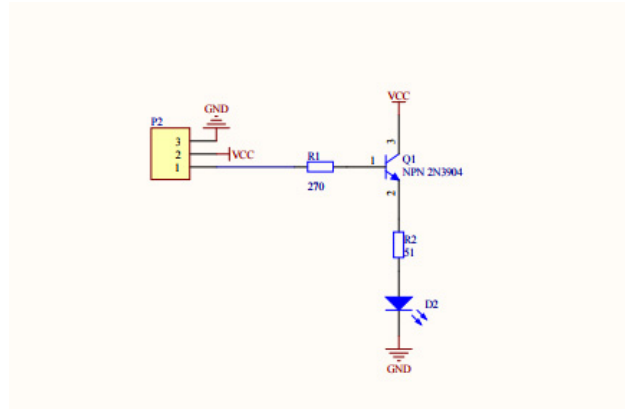


Fig 6: Infrared emission sensor

Pin definition:

+: power positive input

-: power supply negative input

S: digital signal input port

The system of this design requires hardware and software testing. The debugging requires a computer, a USB (B) data cable, and a number of breadboard connections. The physical object used in this design consists of integrated modules, which can be produced with only a small amount of work. The debugging is mainly software adjustment. The Arduino uno r3 main control board has a USB (B) interface. I can use a USB (B) data to supply power. Use the USB data cable to connect to the Arduino uno r3 main control board to check whether the running light is lit. If it is lit, it indicates that the power supply is normal. Use the breadboard connection line to connect the Arduino uno r3 main control board to the gesture recognition module and infrared emission sensor respectively. Connect: GND-GND, VCC-5V, SCL-A5, SDA-A4, INT-2. + 5V, - Connect to GND and S to 3. The program needs to be written and uploaded in the Arduino IDE software dedicated to the Arduino board, and it needs to be tested in the hardware to achieve the desired effect, and various adjustments are made if the expected effect is not achieved. After the compilation is completed, the uploading program enters the Arduino r3 main control board. The uploading process needs to maintain the correct connection between the serial port and the upload. After the upload is successful, the program is running after the USB interface is connected. The following figure shows the entity photos and program running serial port feedback information when the program is running.

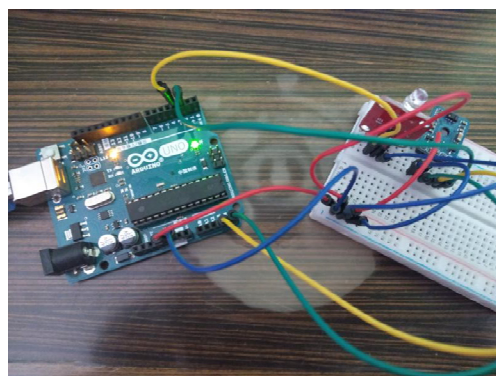


Fig 7: Picture of the system

3. Conclusion

This paper mainly combines the sub-circuits and programs of each module of the initial system, and comprehensively queries the related materials of the components to be used. After the collection is relatively complete, the hardware and software system design begins. After the design is completed, the hardware is produced. The running test, record and perfect the inadequacies, and finally run the good gesture control TV infrared remote control successfully. The gesture control TV infrared remote controller of this design can quickly get a response after repeated tests, which can meet the basic needs of users, but the gesture detection module can only detect a small distance due to cost limitation, and the Arduino uno as the main control board. There is still much room for improvement in r3 performance. There are also many non-design optimization options for this topic design. In the future optimization design, the voice control system can be added, and the types of controllable homes can be increased, which can make the design more competitive.

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