**Robot vacuum cleaner**

**background**

Sweeping robot is a kind of service robot, which can replace people to clean rooms, workshops, walls and so on. This paper presents a design scheme of mobile cleaning robot used in indoor. It has practical value. The main task of indoor cleaning robot is to be able to replace people for cleaning work, so it needs to have a certain intelligence. Cleaning robots should have the following capabilities: be able to self-navigate, detect and avoid obstacles in walls and rooms; It can go through most of the space of the room, can detect the battery power and can return to charge autonomously, and requires a relatively compact shape, stable operation, and low noise; To have a humanized interface, easy to operate and control. The hardware design of the control system of the sweeping robot is discussed based on its main functions.

**Working principle**

The body of the sweeping robot is a mobile device. The robot relies on infrared recognition and ultrasonic ranging to avoid obstacles, and works with the chip to control the rotation of the internal motor and vacuuming in the internal vacuum environment. Through the route design, it walks freely in the room, and is rotated by the central main brush and supplemented by the side brush to clean along the straight or zigzag active path.

**Design**

**Independent keyboard design**

Comprehensive wireless control of the sweeper, the function module is divided into cleaning mode, automatic charging mode, pause three blocks, so there should be buttons for choice. Independent keyboard design is simple in structure and reliable in design.

**Buzzer alarm circuit**

When the logic 1 is written to F1, F1 outputs a high level (+3.3V), and the base current of 8550 is 0. At this time Q1 is in the cut-off state, the power supply cannot be added to the positive terminal of the buzzer, and the buzzer cannot buzz.

When a logical 0 is written to F1, the F1 input is low (0V), and a current is generated between the emitter and base of 8550, at which point Q1 is switched on and the buzzer begins to buzz

**Mobile drive circuit**

|  |  |
| --- | --- |
| lead | Feature |
| SENSA、SENSB | The current feedback feet of two H Bridges can be directly grounded when not in use |
| ENA 、ENB | On the enable side, input PWM signal |
| IN1、IN2、IN3、IN4 | Input, TTL logic level signal |
| OUT1、OUT2、OUT3、OUT4 | The output end is the same as the corresponding input end |
| VCC | Logic control power supply, 4.5~7V |
| VSS | The minimum value of the motor drive power supply must be higher than the input low-level voltage |
| GND | Land |

**Logical function**

|  |  |  |  |
| --- | --- | --- | --- |
| IN1 | IN2 | ENA | Motor state |
| X | X | 0 | stop |
| 1 | 0 | 1 | clockwise |
| 0 | 1 | 1 | anticlockwise |
| 0 | 0 | 0 | stop |
| 1 | 1 | 0 | stop |

**Ultrasonic ranging module**

The ultrasonic audio transmitter head can send out an audio signal of more than 20KHz, and the audio signal will bounce back when it encounters an obstacle. The robot receiver can accept the bounce back of the obstacle and determine whether there is an obstacle ahead by analyzing the echo signal. The biggest advantage of ultrasonic induction technology is that it has a high recognition rate for transparent obstacles, and it can correctly identify obstacles of any color, and it can work normally even in a black environment.

**Infrared module**

The advantages of infrared detection technology: mature technology, low cost, long service life and high reliability. A pair of high-quality infrared tube is cheap, and has the advantages of long working life and stable electrical performance.

The product using this technology is characterized as follows: there is a ring of tea black induction window at the front end of the collision bar of the robot, and the sensor is installed inside the induction window. The detection principle of the detection system is as follows: when the robot encounters obstacles in the process of working, the light waves emitted by the infrared sensor will generate echoes because of obstacles. After detecting the echoes, the infrared receiver inside the robot will think that there are obstacles in front of it, that is, it will command to slow down the forward speed of the machine and collide with the obstacles at a slow speed. After determining the position of the obstacles, the obstacle avoidance behavior will be carried out. The obstacle detection system based on infrared and collision sensors is the most mature and widely used obstacle detection system technology in sweeping robots at present.

**Power remaining detection circuit**

The remaining battery charge is detected using the ADC module, which is a 12-bit sequential approximation analog-to-digital converter. The basic working principle of the successive approximation analog-to-digital converter is to clear all registers before the conversion begins. After starting the conversion, the clock pulse first changes the highest register position to 1, making the output digit 100. 0. This digit is converted to the corresponding analog voltage U0 by a digital to analog converter and sent to the comparator for comparison with Ux. If U0 is greater than Ux, the number is too large. Therefore, clear 1 as the highest digit. If U0 < Ux, the number is not large enough, and the highest digit 1 should be reserved. Then, in the same way, the second highest position is converted to 1, and after comparison, it is determined whether this 1 should be retained. And so on, bit by bit, all the way to the lowest point. After the comparison is complete, the state in the register is the required digital output. It can be seen that the successive approximation conversion process is the same as the operation of weighing an object of unknown mass with a balance, except that the weights used are half the mass of each.

When the voltage resistor is used to divide the input voltage from 12V to less than 5V or 3.3V, the input voltage is sent to the AD conversion module to protect the conversion module. The input voltage passes through the clamp protection circuit and enters the AD module. Since this conversion module is a 10-bit AD module, the digital quantity is obtained after entering, and then the actual voltage of the battery can be obtained after calculation, the actual voltage = the digital quantity \*Vi\*3/4096, vi is the maximum voltage input to the chip when the battery is fully charged. In this way, the remaining charge of the battery can be calculated.

**Liquid crystal display screen**

Features of this module:

1. Support all kinds of Arduino microcontroller in line, without any wiring.

2. Integrated voltage regulator IC, support 5V or 3.3V power supply.

3. Onboard level conversion scheme, truly compatible with 5V/3.3VIO level, support a variety of single-chip IO connection.

4. Integrated SD card expansion circuit,.

5. Reserve SPIFLASH word library circuit for easy expansion of application.

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