The Research of the control system of the intelligent vacuum robot

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Abstract. In this paper, a household intelligent vacuum robot based on STC89C52 is researched. The hardware composition and working principle of the system are introduced, and the program and flow chart are given. After continuous study and discussion, the general research, circuit research, physical welding and system debugging of the whole system are completed. In this paper, the home intelligent dust collection robot is researched to detect the obstacles along the way through e18.d80nk infrared obstacle avoidance sensor, and transmit the detected signals to the single-chip microcomputer for discrimination. The single-chip microcomputer then controls the motor steering through the L298N driving module to achieve the obstacle avoidance function, and carries out the dust collection through the bd6081 fan circuit when traveling. After the completion of the research, it can basically achieve the functions of quick response, obstacle avoidance and dust collection of household intelligent cleaner.

1. Introduction

This research is based on 51 series single-chip microcomputer research, this research uses infrared sensor to avoid obstacles, choose the appropriate control strategy and research the corresponding obstacle avoidance system, drive the motor to rotate through the driver, so as to realize the function of walking. When traveling, it is necessary to conduct the necessary dust collection treatment through the dust collection parts carried by itself. The chassis of this research is a three wheel car structure, the front two wheels are driven by motors, and the rear wheels are universal wheels.

The main goal of the research is to select the appropriate control strategy and research the corresponding obstacle avoidance system. The vacuum cleaner made under the control of 51 single-chip microcomputer has a certain effect of dust collection and can avoid obstacles when encountering.

2. Selection of control mode

This research consists of STC89C52 single chip circuit, two infrared obstacle avoidance sensor module circuits, two key control circuits, L298N motor drive circuit, 12V battery box circuit and fan drive circuit.

2.1. The choice of single chip

The main controller is STC89C52 of Hongjing technology company, which is a CMOS 8-bit microcontroller and a programmable flash memory with 8K byte system. While maintaining high performance, its energy consumption is also relatively low, and the interface of this single-chip microcomputer is more, the cost is low, the basic requirements of this research can be achieved.

2.2. Selection of obstacle avoidance detection module

Adopt infrared photoelectric switch. Because of the long distance and strong directivity of infrared ray in the medium, infrared ray is often used to detect obstacles. Its working principle is: the infrared transmitter carried by itself emits infrared light in a certain direction, because the infrared light also spreads in the air, so when the red light meets an obstacle, it will reflect back, the reflected light will be accepted by the infrared receiver, and then through the corresponding circuit processing, so as to preliminarily determine the location of the obstacle. The infrared sensor is sensitive to near obstacles, but it is easy to be interfered by natural light.

2.3. Selection of motor module

DC motor is adopted. DC motor has excellent speed regulation and starting characteristics. Its speed regulation performance is not only good, but also has a wide range of speed regulation. Not only that, its overload capacity is also relatively strong, and its running distance is also relatively long. DC motor is very common in the market, easy to buy, low price, its later maintenance is also easier.

L298N chip is adopted. This chip adopts H-bridge circuit technology, which can effectively control the speed and direction of the motor, and its duty cycle can be adjusted, so as to precisely control the speed of the motor. This kind of circuit is very effective and efficient. Its processing speed is fast and its stability is guaranteed. It is equipped with step-down components, which can adjust the output voltage according to the actual demand.

3. The research of the core system circuit of single chip microcomputer

The main controller is STC89C52 of Hongjing technology company, which is a CMOS 8-bit microcontroller and a programmable flash memory with 8K byte system. The core of this single-chip is still mcs.51, because it has made some improvements, so part of its function is not the traditional 51 single-chip.

This single chip microcomputer has four main characteristics. The first is that its program storage space is 8K bytes, the second is its data storage space is 512 bytes, the third is its own 4K bytes EEPROM storage space, and the fourth is that it can be downloaded directly by using serial port. The pin diagram of MCU is shown in Figure 1.

The main parts in the figure are as follows:

(1) Indicates that the power supply pins are VCC and GND.

(2) S1, EC1 and R1 form a reset circuit, which has the functions of manual key reset and power on automatic reset. After the time when the voltage detected by the system rises from low level to high level, the system forms a path between the resistance and the grounding, and then automatically pulls the high level down, making the single chip computer change from high potential to low potential, so as to automatically reset the single chip computer, that is, power on reset.

(3) Y1, C1 and C2 constitute the clock circuit. The digital circuit with control chip can't work without clock circuit. It needs clock circuit to send system time automatically so that the control chip can work normally. In order to ensure the normal operation of the control system, 11.0592Mhz crystal oscillator and 30pf capacitor are often used for combination. In order to help the crystal oscillation, the capacitor can work normally after the digital controller is powered on.

(4) Jd1 is the download interface of MCU.

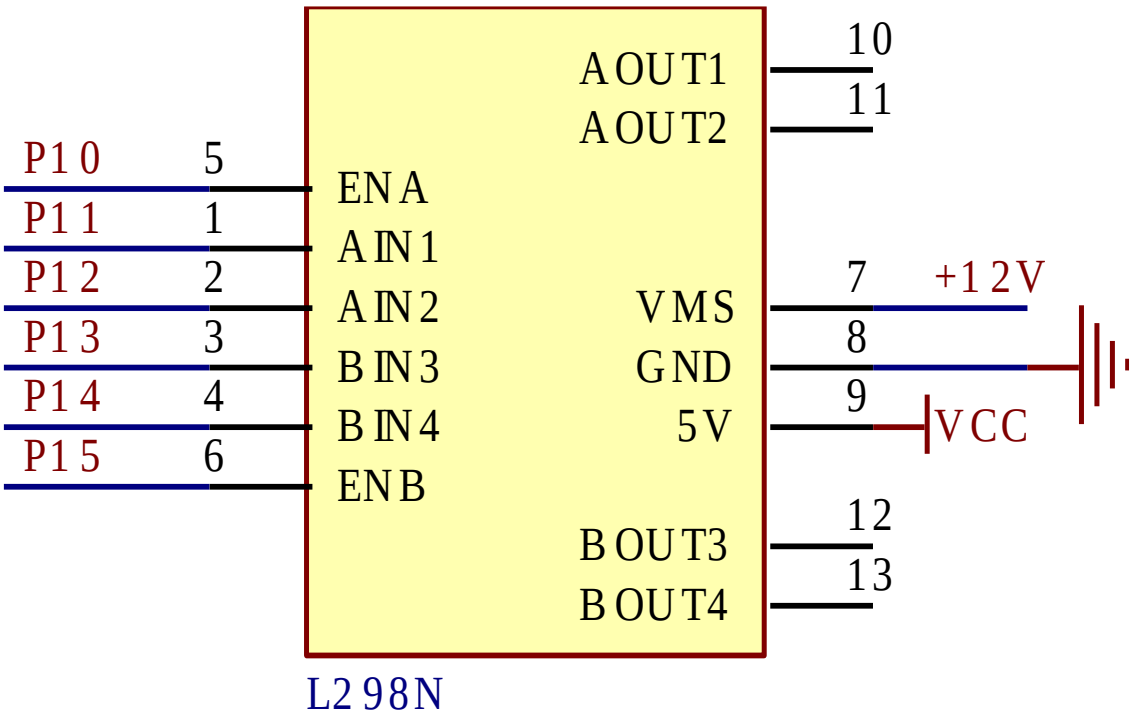

Figure 1. STC89C52 single chip microcomputer pin diagram

In this research, the single-chip microcomputer can not be directly connected to the DC motor, because its I / O port drive ability is weak, so it needs a suitable driver chip to drive. This research adopts L298N motor drive module, which is a high cost-effective module. Its performance is stable and its function is reliable, which meets the requirements of this research.

This drive module is very suitable for this research. It can directly drive two DC motors. It provides 5V output interface, which can reduce 12V power supply voltage to 5V voltage, so as to supply power to MCU. This module can control DC motor more simply. The internal circuit schematic diagram is shown in Figure 2.

Because the single-chip microcomputer can't drive the fan directly, a high-power triode should be selected to control the fan (bd6081 model is selected here). R2 is used to protect the triode, which is a current limiting resistor and plays a current limiting role. When the control pin of the single chip is high power, the triode will be turned on and the fan can work normally; on the contrary, the fan will not rotate. This research uses the fan drive circuit to carry on the dust collection, when moving, the dust on the ground will be absorbed on the dust collection parts carried by itself to achieve the dust collection effect.

In the indoor environment, the placement of each household item is irregular, and the location may change at any time. In this research, we use two groups of infrared sensors to realize the robot's automatic avoidance of obstacles. When the car is cleaning, the infrared light-emitting diode will always send out infrared light. When the red light meets an obstacle, it will be reflected back and received by the infrared receiving diode. Then it will send a signal to the single-chip microcomputer to control the driving mechanism action after being processed by the voltage comparator. Therefore, when the cleaning robot is cleaning, it will always avoid obstacles. This kind of obstacle avoidance research is simple and effective. Based on the working environment of cleaning robot, this obstacle avoidance method is real-time and efficient, which is more in line with our research needs.

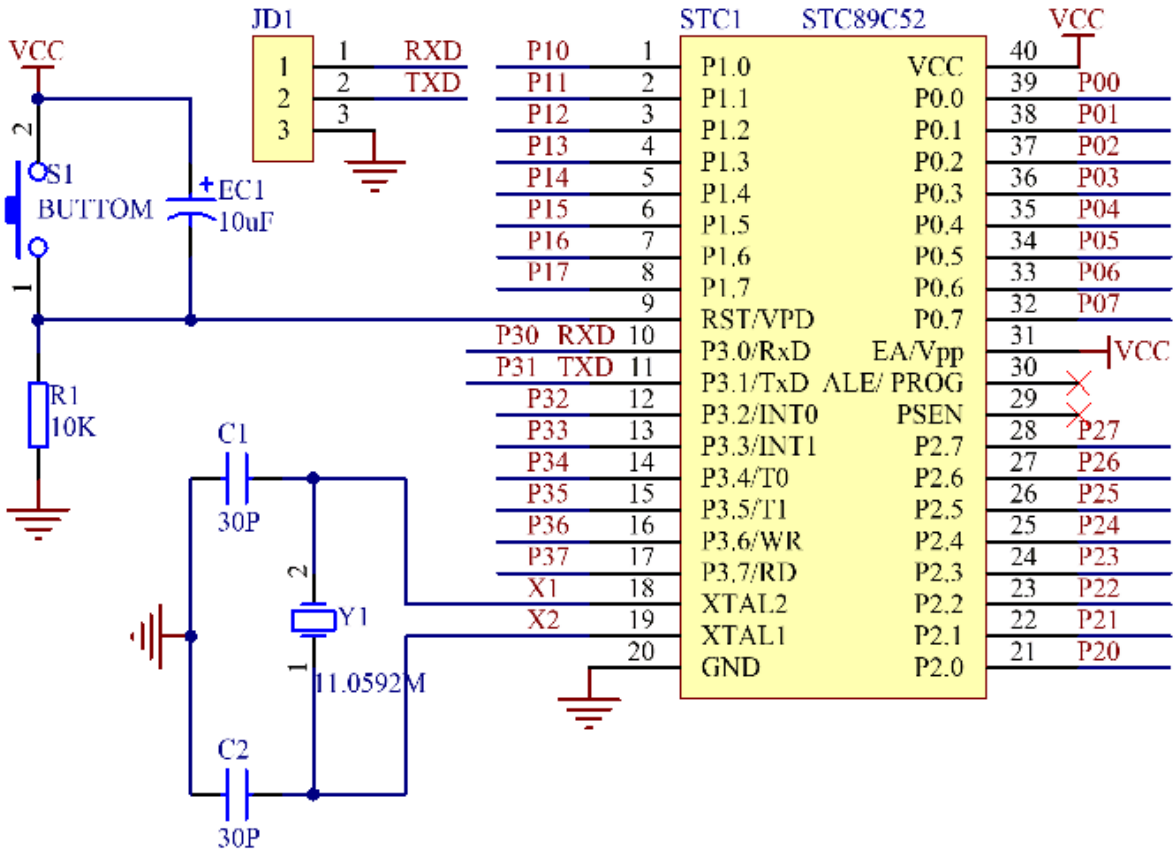

Figure 2. Minimum system schematic diagram of single chip microcomputer

4. Conclusion

In the future, the household intelligent vacuum robot will be intelligent. The operator can give voice instructions, but it can charge itself. In the future, the intelligent household vacuum robot will also conduct more path planning, clean the corner dust, and shorten the reaction time to obstacles. The robot cleaning efficiency in the future will be much higher than the current products

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