Design of motor drive module for all moving platformle

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Abstract

The motor drive module on the mobile platform firstly needs to be connected with the CAN bus which manages the chassis drive in the main control unit, and receives the rotational speed information from the main control unit through the CAN bus so as to be driven by double closed loop control of the chassis motor to reach the set speed. Secondly, in order to enable the sampling robot to download the program without reloading it during the developing process, the parameters can be set or changed. This design incorporates an EEPROM module in the chassis drive for online modification and off-line storage of parameters set by the user.

Keywords

CAN Bus; EEPROM Module; H-bridge circuit.

1. Introduction

The chassis drive module is mainly divided into two parts: the power drive part and the control part[1]. The control part mainly includes a microcontroller, a CAN module, an EEPROM, etc. The power of this part is small. The power-driven part is mainly used to drive the motor on the Mecanum wheel. Because the module is driven by a DC hollow cup planetary gear motor with a rated voltage of 24V, this part has a larger current during operation and a great electromagnetic interference on the surrounding circuits. Therefore, an optocoupler is adopted on the driving board to isolate the two parts, so as to effectively ensure that the control part is not affected by the electromagnetic interference of the power driving part, and the reset of the microcontroller and the running of the program are avoided.

2. Power drive module

In the chassis drive module, the encoder interface is used to receive coded information from an encoder connected to the motor. The coded information is divided into two phases A and B. The microcontroller calculates the rotational speed of the motor by counting the encoders. The phase relationship between the two phases A and B determines the direction of rotation of the motor[2]. EEPROM module by Atmel's AT24C02C-SSHM-T chip as a parameter of the online storage unit, the data are written and read through the I2C protocol, the circuit shown in Fig. 1.

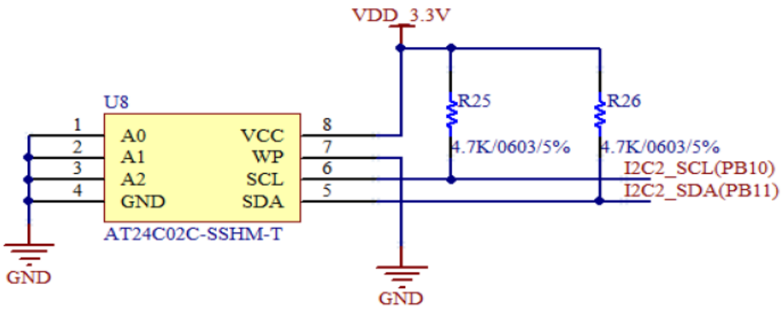

Fig. 1 EEPROM Schematic circuit diagram

3. Control module

In order to enable the motor to achieve the Mecanum wheel forward and reverse rotation speed control according to the micro-controller speed command, the drive part of the chassis motor drive module adopts the H-bridge drive mode, and its principle is shown in Fig. 2. When the MOS transistor at IO1 is turned on with the MOS at IO4, and the MOS transistor at IO2 is disconnected from the MOS transistor at IO3, the current flows from the positive terminal of the power supply through the upper left P-MOSFET and then flows in from the left side of the motor[3]. Through the right bottom of the N-MOSFET, and finally back to the negative power supply, the formation of the current loop, making the motor in one direction to rotate; Similarly, when the MOS tube at IO1 and IO4 at the MOS tube is disconnected, MOS at IO2 When the MOSFET and the MOS transistor at IO3 turn on, the current flows from the positive terminal of the power supply through the upper right P-MOSFET and then from the right side of the motor, and then through the lower left N-MOSFET and finally to the negative terminal of the power supply to form the opposite current. The loop makes the motor rotate in the other direction; When the MOS tubes at IO1, IO4, IO2, and IO3 are disconnected at the same time, the current cannot pass through the motor, and the motor will no longer rotate.

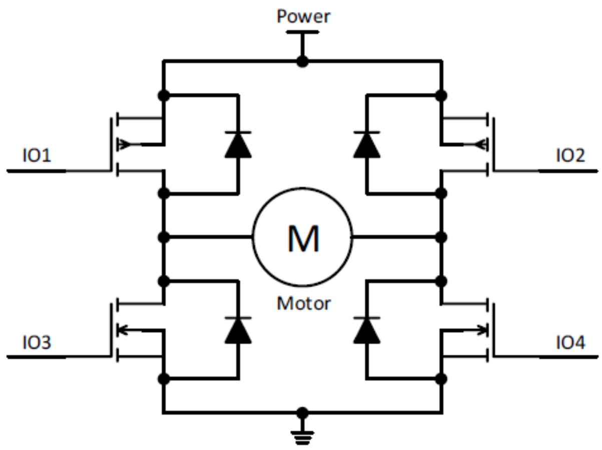

Fig. 2 H bridge Drive schematic diagram

The driver module's H-bridge circuit is built using two Infimeon chips, the BTN7971B, a fully integrated, high-current half-bridge driver with an internal P-MOSFET and an N-MOSFET[4]. The maximum resistance is only 30.5mΩ at 150°C. Supporting up to 50A of drive current, and features current detection, overheating, and overcurrent protection. The circuit diagram shown in Fig. 3.

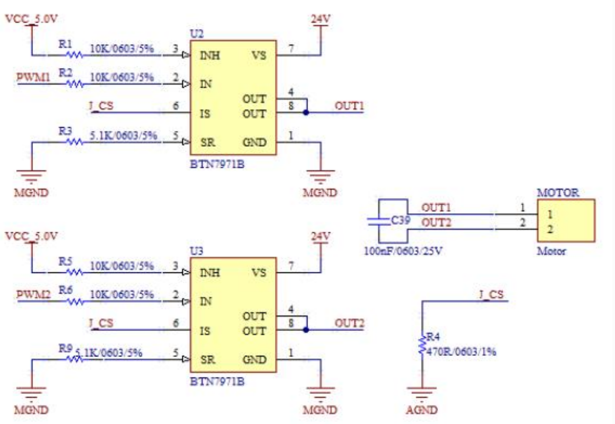

Fig. 3 BTN7971B Drive circuit schematic diagram

The R4 resistor in the BTN7971B driver circuit is the sampling resistor. Microcontroller in the case of known R4 resistance, by measuring the voltage difference U_{IS} across R4, it can calculate the sampling current I_{IS}. After that, the load current can be obtained from the linear relationship coefficient k_{ILIS} ($k_{ILIS} = I_L / I_{IS}$) between I_{IS} and the load current I_L shown in Fig. 4, where k_{ILIS} is typically 19.5.

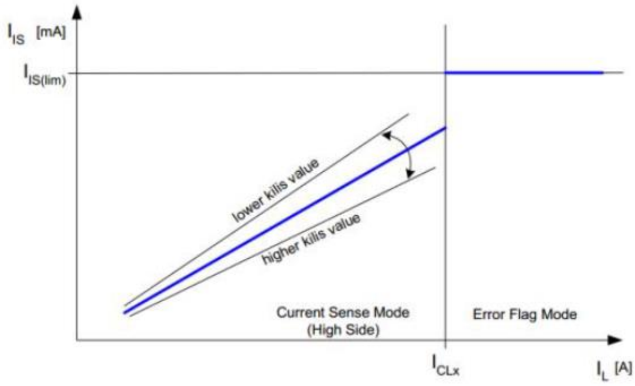

Fig. 4 The relationship between detect current IIS and load current IL

4. Conclusion

In this paper, we studied the motor drive module of the Omnidirectional drive platform. Through the design of power drive part and control circuit, the speed regulation of the Omnidirectional drive platform is realized. By the design of EEPROM module, the user can modify and offline storage the parameters. It is not only convenient for program debugging and shorten the cycle, but also make the Omnidirectional drive platform applicable to more work environment.

References

[1] Quigley M, GerKey B, Conley K,et al. ROS:an open-source Robot Operating System[C]. Proceedings of the ICRA Workshop on Open-Source Software, 2009:1-6.

[2] Srinivasa S S, Ferguson D, Helfrich C J, et al. HERB: a home exploring robotic butler[J].Autonomous Robots, 2010, 28(1):5-20.

[3] Diankov R. Automated construction of robotic manipulation programs [D]. Pittsburgh, USA: Carnegie Mellon University, 2010.

[4] C.H. Han: CANBUS Technology and its application [J]. Manufacturing Automation, Vol. 32(2009), 146-149.