Design of Automobile Brake Lamp Fault Automatic Detection Circuit

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Abstract

It is easy to have traffic accidents such as rear-ended due to automobile brake lamp failure. In order to solve this problem, we design a kind of auto detection circuit of brake lamp fault which uses current detection chip ACS712. The circuit applies Holzer induction to transform the current signal change into voltage change, and judges whether the brake lamp is damaged through the voltage comparison circuit. This circuit is simple, and fault display can be installed in the instrument panel. The design of detection circuit can accurately and reliably light alarm lamp, remind the driver timely maintenance, and effectively avoid unnecessary collision accident.

Keywords: Brake light; Current detection; Holzer induction; Comparison of voltage

Introduction

With the development of economy and the continuous improvement of people's living standard, the car has become a common means of transportation in the daily life. At present, the domestic car is generally not real-time monitoring of the car lights, especially the installation of the brake lights in the rear of the car is not easy to detect damage, causing safety hazards to the driver. Now brake lamp fault detection basically remain in the original level, namely the artificial methods, from the rear view of the brake light is light, or is in the light of the dark, the tail of the car near and facing the wall, through the observation on the walls of the light level judging brake light is stored in the fault [1]. Although the method does not need any additional devices, but it is not convenient and flexible, and is restricted by the environment. Improve road conditions and vehicle speed to vehicle safety monitoring system put forward higher requirements, then there is a wide variety of light detection alarm device, mainly is the taillight (stop lamp, reversing lamp, rear fog lamp) light detection device for. Existing rear light detector has two types: one is an independent set of light detector and the light detector is in the car factory installed, the host needs the local fixed in the cab driver to see [2]. The installation of the light detector is not convenient and not beautiful, and the reliability of the work of the lamp is affected. Another is in the car factory as a standard configuration has been installed, the alarm system is complicated in structure, coupled with the light sensor is formed by the electromagnetic coil and the reed switch, work reliability and

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low, but also the existence of electromagnetic interference [3]. In recent years, due to some traffic collision event occurrence frequency is added in, is expected to not far in the future, brake lamp fault automatic detection will be widely used in the car.

1. Design requirement

Domestic most low-grade cars are not equipped with brake lamp automatic fault detection device, when the brake light damage does not shine driver itself is difficult to find, and brake light does not shine easily cause traffic accidents, to themselves and their passengers bring safe hidden trouble. Therefore, it is required to develop a brake lamp fault automatic detection circuit, real-time monitoring of the brake light is good or bad condition, once the brake lamp does not work, alarm automatic light tip the driver timely maintenance, so that you can reduce due to brake light failure as a result of the automobile traffic accident [4].

In order to solve this problem, some inventors put forward two kinds of programs, one is with the voice to remind function, one is with light display function. Such as Junfeng Lu, Zhi Chen Li et al. have invented a car brake light fault alarm "with voice prompting function, Huang Yusong" automobile brake system fault lights remind device with the buzzer warning function, the disadvantages of this kind of device is, drivers in each step a braking when will a voice reminder, and step on the brake and the frequent moves, frequent voice reminder, easy to let a person feel frustrated, affect driving safety. Li Chao "automobile brake lights state monitor and t. swobodae" automobile brake lamp circuit system indicating device et al. have invented with lights flash display function, the device on the brake lamp circuit in series resistance detection, destruction of the original power supply mode, due to the resistance have been burnt, so easy to introduce new faults. In order to avoid the disadvantages of the invention, the utility model is required to design a circuit which can not destroy the original brake lamp circuit, and has no influence on the brightness of the brake lamp.

2. Design of whole circuit and current detection

2.1 Overall design

Brake lamp power supply of 12V battery (gasoline engine), brake light resistance is generally 8 ohms, when the brake pedal, current through each brake lamp current 1.5A, for brake lamp circuit, the original structure and does not affect the lamp brightness is not changed, the string into the each brake lights of the chip using the acs712 chip, the chip is to change the current change into a voltage change signal, the voltage comparator judgment lighting is good or bad, the overall design diagram is shown in Figure 1.
Figure 1. Frame drawing of the overall circuit design.
2.2 Current detection ACS712

The ACS712 is Allegro company new launched a linear current sensor [5], the chip is completely based on Hall sensing principle of design, by a precise low offset linear Hall sensor circuit and is located in close to the surface of an IC copper foil, the measured current flowing through the pathway of the internal resistance is usually 1.2 m Omega, with low power consumption, which is on into the brake light branch does not affect the work. Through copper conduction path of the current generated by the magnetic field to the Hall IC induction and its transformation into a voltage proportional to [6]. ACS712 according to the tail is not the same, the range is divided into three specifications: + 5A, + 20A, + 30A, coefficient sensitivity of mV/A, respectively, 185 100mV/A, S, 66mV/A, the linear relationship between the input and output as shown in figure 2. Because of the chopper circuit, its output will be loaded on the [7] 1/2Vcc. General Vcc ACS712 power supply for the 5V, the circuit in the light bulb branch of the maximum current 1.5A, range of 5A, the output and input of the relationship between $V_{out}=0.5V_{cc}+I_p * S=2.5+0.185$.

![Figure 2. Linear relationship between input and output.](image)

3. Circuit module design

The circuit is mainly composed of the following parts: (1) 5V voltage regulator circuit (2) current detection circuit (3) voltage comparison circuit (4) fault display circuit, the circuit composition and schematic diagram of the circuit (3).

3.1 Function of each composition circuit

(1) 5V voltage regulator circuit is mainly composed of LM7805, C2, C3, C1 DC voltage down to +12V, for current detection chip ACS712 and voltage comparison chip LM339 using +5V.

(2) The current detection circuit mainly detects the "through" and "off" state of the branch current of the brake lamp through the current detection chip ACS712.

(3) Compared with the standard voltage 2.6V, the voltage output of the voltage comparison circuit is mainly controlled by the voltage output of the ACS712 and the standard voltage.

(4) Fault display circuit mainly display fault information: when the brake lights are normal, step on the brake S1, and a red light emitting diode does not shine; when one or both of which are damaged, the brakes S1, and a red light emitting diode emits red light, the left red light emitting diode light shows that the left brake lights are bad, right red light-emitting diode light show that the right brake lights are bad.
3.2 Design features of each component circuit

(1) Electric, R4, bad; 0.24mA, R4, 5V voltage stabilizing circuit design requirements of the load current is ma (low power consumption), the load resistor divider circuit R2, R3 R1, LED1, LED2; when the two brake light normal load resistor divider circuit R2, R3, the current when the left (right) brake lights, load resistor divider circuit R2, R3, R1, LED1, current of 25 Ma; when the two brake lights are bad, the load resistor divider circuit R2, R3 R1, LED1, LED2. At the same time, the current of 50 ma. Therefore, the whole circuit in the low state (maximum power consumption is less than 250 MW).

(2) Current comparison circuit design requirements on the resistance of the circuit must be small, does not affect the brake lamp brightness, so the use of Hall effect current detecting chip acs712 range + 5A chip, the chip input part for a wire, the resistance is very small.

(3) Voltage comparison circuit design requirements in the two brake light is normal, corresponding to the light emitting diode is not bright, the damage is only lit, so the voltage comparator LM339 inverting input voltage design 2.6V.

(4) The fault display circuit design requires that the light emitting diode is a small power light emitting diode, and the series resistance is 120Ω.

3.3 Circuit working principle

(1) About brake lights are normal, hit the brakes S1, two brake lights current through U2, U3 chip acs712, its voltage output 7 feet to 2.8V, voltage comparator U4 and U4a inverting input end of 2.6V, positive input end > inverting input terminal, 2 feet of U4 pin 1 and u4a output to a high level, light emitting diode LED1, LED2 does not shine.

(2) The two brake lamp has a bad (such as left brake lights, brake lights left bad) due to bad brakes in S1, on the left side of the U2 current detection chip IP+, the IP- terminal is not current, the output voltage is 2.5V, U4, U4A voltage comparator inverting input to 2.6V, so U4 positive input the anti-phase input end of < 1 feet, U4 output is low, the red light emitting diode LED1 is lit, indicating the left brake lamp bad, the need for timely maintenance and replacement; the U3 current detection chip IP+, IP- current, the output voltage is 2.8V, U4, U4A voltage comparator inverting input to 2.6V, normal phase the input end of the inverting input is > U4A, 2 pin U4A output is high, not bright red light emitting diode LED2.

(3) Two brake lights are bad, in the hit the brake S1, U2, U3 current detecting chip IP +, IP no current, the output voltage 2.5V, voltage comparator U4 and u4a inverting input of 2.6V, so U4 and u4a positive phase input end < inverting input end, U4 pin 1 of the output to a low level, red hair light diode LED1 lit up, 2 feet of u4a output to a low level, the red light diode LED2 is light, red light emitting diode light show two brake lights are bad, the need for timely replacement.
Conclusion
Automobile brake lamp fault automatic detection circuit adopts the technical route is reliable and easy to realize, the use of ACS712 and LM339 these two mature small modules, to solve the current detection and alarm lamp trigger function. The circuit is different with the previous device, without changing the original brake lamp circuit, does not affect the brightness of the lamp, fault display can be installed in the instrument panel, only at the time of the brake lamp is damaged, the brakes, and red LED light can accurately and reliably light alarm lamp, remind the driver to maintain in time, can effectively avoid unnecessary collision accident.

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References