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An Anti-Collision Early Warning and Detection System for Vehicle Visual Blind Area and Its Control Method

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Abstract: This paper designs a collision prevention warning detection system and proposes a control method based on this system. The system and its control method have the paired photoelectric signal transmitting unit and the photoelectric signal receiving unit around the vehicle to detect and prevent the collision in the the driver's visual blind area. The system and its control method can realize the real-time voice alarm inside and outside the vehicle, so as to improve the driving safety and reduce the crash accident during the vehicle driving.

1. Introduction

In the process of vehicle driving, especially for large transport vehicles, the driver's visual blind area is more larger. Especially in the process of the transport vehicle turning right, because the length of the truck is relatively long, the visual blind area in the process of turning is really larger. It is extremely important to real-time monitor the visual blind area of the transport vehicle when turning. The visual blind area is the area surrounded by the right front wheel and the right back wheel of the large transport vehicle, and it cannot be clearly observed by the driver at the situation that the pedestrian enters the visual blind area [1] .

Due to the existence of visual blind areas, obstacles within a certain range are not easy to be found, so drivers can not observe the situation of visual blind areas, prone to traffic accidents. Under special circumstances, such as the vehicle turning, some low obstacles were not easy to be noticed, and then resulting in a collision accident [2-4]. If a child enters the blind area and is not noticed by the driver in time, it may cause serious safety accidents [5].

In order to solve this problem in real life, the judgment and warning of the obstacles or pedestrian in the visual blind area is necessary, the collision prevention warning detection system can realize the real-time voice alarm inside and outside the vehicle, so as to improve the driving safety and reduce the vehicle collision accidents.

2. Scheme Design

As shown in Figure 1, a vehicle visual blind zone collision warning detection system and its control method for heavy trucks include a cockpit and a transported cargo placed on the rear side of the cockpit. Pairs of photoelectric signal transmitting units and photoelectric signal receiving units are installed in the sides of the vehicle, and the optical signal emitted by the photoelectric signal transmitting unit is received by the photoelectric signal receiving unit. An inductive interrupt signal is generated when the light between the photoelectric signal transmitting unit and the photoelectric signal receiving unit is interrupted. A full-size touch sensor set in the periphery of the vehicle to detect whether there is a person or obstacle collision with the vehicle during the vehicle driving. The full-size touch sensor is installed on the lower edge around the vehicle and operates when the vehicle is started and moving. And a voice alarm system provided for the voice warning is installed in the cockpit and outside of the vehicle when an obstacle or pedestrian is located in the driver's blind area or collision with the vehicle [6]. And the system control processor set in the cockpit for judging and warning of dangerous conditions, after the system control processor receives the interrupt signal, the voice alarm is send out to remind the driver and pedestrian. The photoelectric signal transmitting unit, photoelectric signal receiving unit, full-size touch sensor and voice alarm system are respectively connected to the system control processor to realize real-time voice alarm inside and outside the vehicle, so as to improve driving safety and reduce vehicle crash accidents [7].

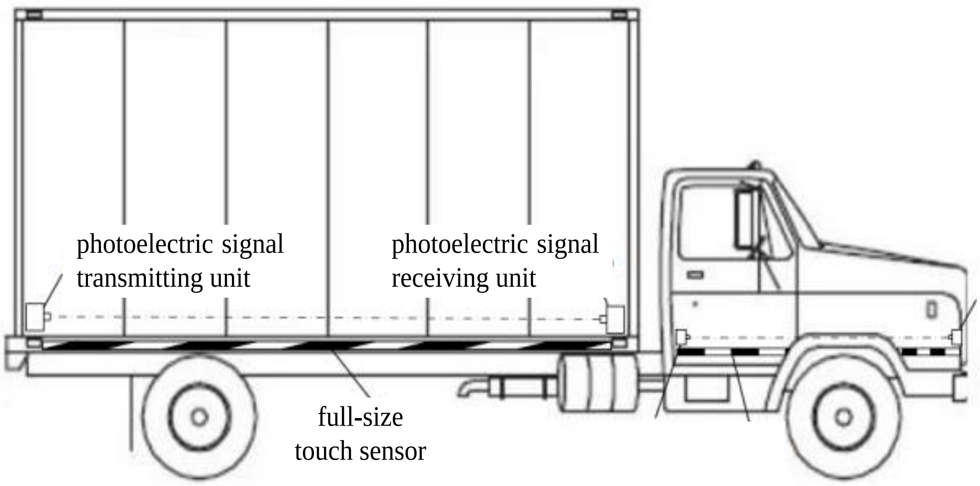

Figure 1: System design drawing.

3. Basic Principles of System Design

A collision warning and detection system can realize the anti-collision warning function through two schemes.

The first anti-collision scheme: when the system control processor processes the light signal received by the photoelectric signal receiving unit to judge whether there is an obstacle or the distance between pedestrian and vehicles is too close, resulting in light interruption, when the photoelectric signal receiving unit can not receive the light signal, the control voice alarm device issues a voice alarm to remind the driver and pedestrians[8-10].

The second anti-collision scheme: The system control processor always detects the pressure signal feedback by the full-size touch sensor, and when the pressure signal feedback by the full-size touch sensor is received, the control voice alarm device issues a voice alarm to remind the driver and pedestrian to pay attention.

The vehicle visual blind area anti-collision warning and monitoring system integrates the above two schemes to complete the obstacle avoidance task when the vehicle encounters obstacles in the process of driving. Due to the driver's blind area, if a collision with obstacles occurs, the above two warning and monitoring schemes work at the same time. The voice alarm device can issue a voice alarm when receiving the inductive interrupt signal, and the voice alarm device can also issue a voice alarm when receiving the pressure signal feedback by the full-size touch sensor, which improve the safety of the vehicle on driving, especially at the time that the vehicle is turning easy to form the driver's visual blind area. The monitoring system can effectively ensure that the vehicle does not collide with pedestrians or other vehicles[11-12].

4. Hardware System Design

4.1. Selection of Each Module

The vehicle visual blind area collision warning monitoring system is designed as shown in Figure 2. The full-size touch sensor uses a piezoelectric coaxial cable mounted around the vehicle and located at the lower edge of the vehicle box, which length can be customized according to the demand, and it can add decorative parts on its outside to play a beautiful role. The photoelectric signal transmitting unit and the photoelectric signal receiving unit adopt the radiation correlation sensor, with the light source on one side and the photosensitive resistance on the other side receiving the photoelectric signal, the on and off states of the photoelectric signal are judged by the high and low levels detected by the system microprocessor[7]. System microprocessor can choose STC89C52RC microchip, microchip N2010H is optional for voice alarm system module, and microchip 74LS74 is optional for dual D trigger.

4.2. The Connection Principle of the Micro-Controller and Each Module

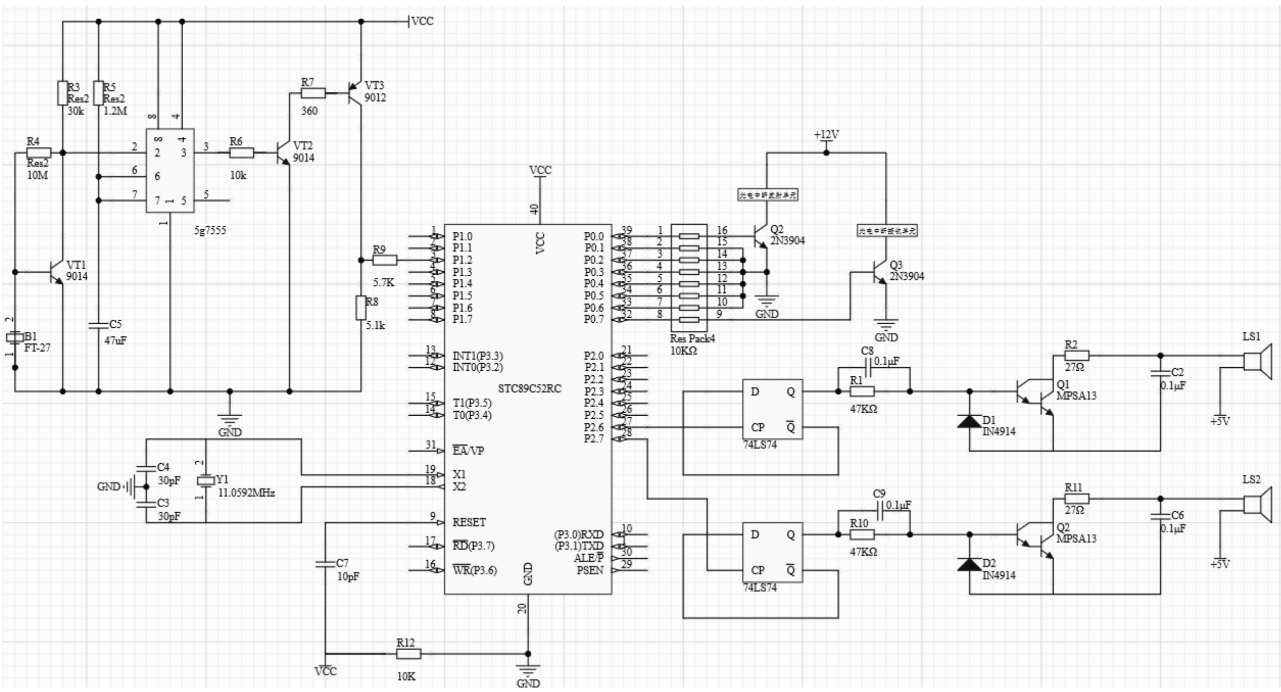

Figure 2: The schematic diagram of the connection of the microcontroller and modules.

The P0.0 ports and P0.7 ports of the system microprocessor are connected to the photoelectric transmitting unit and the photoelectric receiving unit respectively through the resistance. The P2.6 and P2.7 ports of the system microprocessor are respectively connected to a voice alarm module, which is used to send an alarm signal reminding pedestrian and driver to attention. The voice alarm module consists of a dual D trigger and a filter amplification circuit. The P1.2 port of the system microprocessor is connected to the full-size pressure sensor, and Pins 12 and 19 of the STC89C52RC are connected to the crystal oscillator Y1 which plays the role of timing. The RESET pin of the STC89C52RC control chip is the reset pin[13-15].

5. Implementation of the Program

5.1. Realization of the System Alarm Function

Vehicle visual blind area collision early warning detection system is set in the cockpit for dangerous condition voice warning system, and the dangerous condition judgment and early warning system control processor, and installed around the vehicle in the dangerous case voice alarm to remind the pedestrian voice alarm system. In the process of the vehicle running, When an obstacle or pedestrian in the driver's blind area approaches or touches the vehicle, the photoelectric signal receiving unit may generate an inductive interrupt signal. Meanwhile, a pressure signal is generated by the full-size touch sensor. Both signals are transmitted to the system control processor, which sends a voice alarm to remind both the driver and pedestrian.

5.2. Realization of the System Photoelectric Signal Alarm

The photoelectric signal transmitting unit and photoelectric signal receiving unit is not only paired installed on the both sides of the vehicle, and also installed on the front and the back of the vehicle, so that it can fully solve safety accident problems due to the visual blind area of the vehicle. The photoelectric signal transmitting unit and the photoelectric signal receiving unit operate in the vehicle startup and motion state, and the photoelectric signal receiving unit is used for receiving the photoelectric signal emitted from the photoelectric signal transmitting unit. When the transmitting signal is interrupted, the signal transmitted to the system microprocessor is different, and the system microprocessor determines whether there is an obstacle or pedestrian approaching the vehicle, then sending a voice alarm signal to alert the driver and the pedestrian or not.

5.3. Realization of the System Pressure Signal Alarm

The full-size touch sensor is installed on the lower edge of the vehicle, which operates when the vehicle is started or in moving state. In the process of vehicle driving, when there is an obstacle or a pedestrian in the driver's visual blind area and a collision occurred with the vehicle, the full-size touch sensor produces a pressure signal which is send to the system microprocessor, meanwhile, the system microprocessor send a voice alarm signal to remind the driver and the pedestrian.

5.4. Control Procedure

Firstly start the system to run the program, the photoelectric signal transmitting unit sends out the light signal, the photoelectric signal receiving unit receives the light signal from the photoelectric signal transmitting unit, and then when the pedestrian or obstacle in the driver blind area approach or touch the vehicle, the processor controls the voice alarm system to send a voice alarm to alert the driver and pedestrians. The control procedure is as shown in Figure 3.

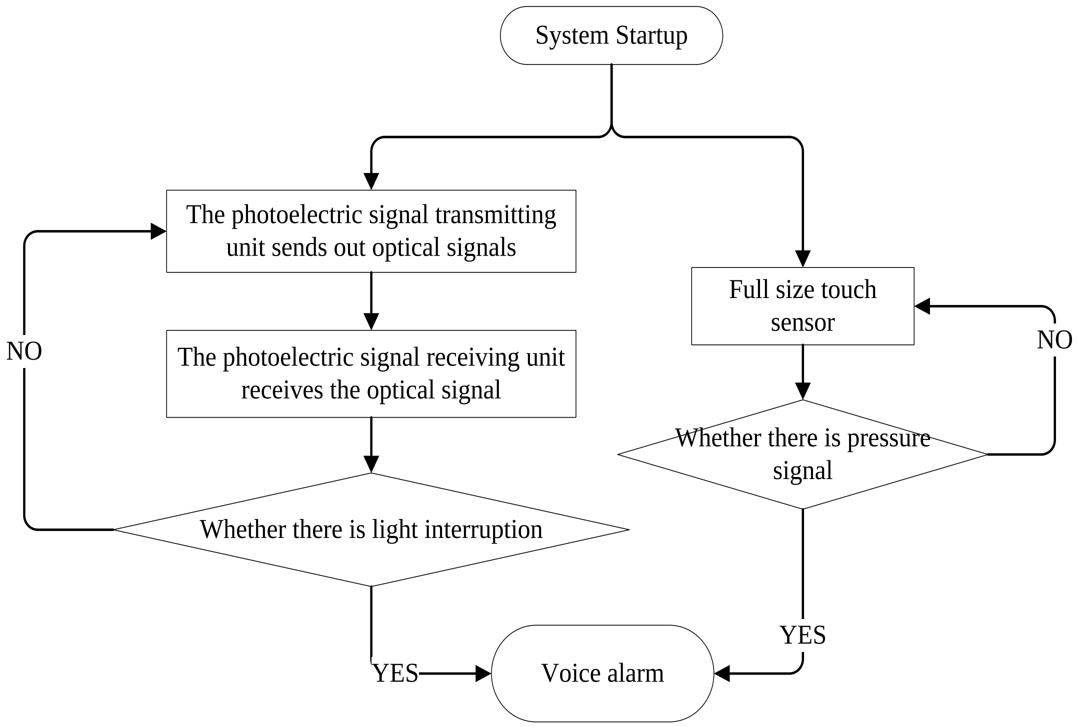

Figure 3: Control flow chart.

6. Conclusions

This paper provides a collision prevention early warning and detection system and its control method. The system and its control method can effectively improve the driving safety, play the role of reducing vehicle collision accidents. When an obstacle or a pedestrian in the driver's blind area approach the vehicle, the photoelectric signal receiving unit cannot receive the optical signal, then an inductive interrupt signal is generated and a voice alarm is send to remind driver and pedestrians to prevent collisions. When an obstacle or a pedestrian touches the vehicle, full-size touch sensor generates a pressure signal, which is transmitted to the system control processor, then the processor control the voice alarm module to send a voice alarm, reminding driver and pedestrians to take notice. The system and its control method realize the real-time voice alarm function inside and outside the vehicle, effectively avoid the vehicle collision accidents.

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