Truck Position Monitoring System Using the Photoelectric Signal Detection Method

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Abstract. The truck position cheating method can lead to large economic losses. Aimed at the truck cheating method, a new truck position monitoring system based on the photoelectric signal detection method is brought out. According to the falling edge number of the rectangle wave, whether the truck position cheat method exists or not can be determined. Based on the monitoring principle, the truck position monitoring system is designed. Experimental results show that the monitoring system can on-time detect the truck position cheating method.

Keywords: monitoring, cheating, truck position, photoelectric, electronic truck scale.

1 Introduction

Electronic truck scale, as a convenient, fast, standard weighing instruments, are widely used in automotive transportation. With China's rapid economic development, cargo traffic has grown rapidly, more and more electronic truck scales are used for the accounts. So it becomes the more important measurement equipment in trade settlement,

To seek illegal profits, lawbreakers make many kinds of electronic truck scale cheating system. The main cheating method is to reduce truck self-weight and increase the goods weight when weighing through a variety of methods. Many companies have a very large economic losses and even cause some serious economic disputes. With the technological development, the cheating methods of the electronic truck scale are more and more sophisticated.

The truck position cheating method is more convenient, so it is brought more serious consequences. In this paper, the truck position cheating monitoring system is designed to reduce the economic losses.

2 Principle of the Electronic Truck Scale

The electronic truck scale weighing system is mainly composed by the scale platform, the pressure sensors, the signal conversion and the weighing meter. Electronic truck scale system is shown in Figure 1.
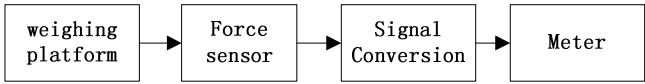
Fig. 1. The electronic truck scale weighing system

The scale platform is supported by the four sensors. Under the action of the truck force, the deformation of the pressure sensors is generated and the mV signal which is proportional to the truck weight is output. The mV signal is transmitted to the meter by the signal conversion. The truck weight data is displayed on the meter after processing. The goods weight is the difference between the full loaded weight and the empty weight of the truck.

3   Principle of the Truck Position Cheating Method

The principle of the truck position cheating method is shown in the figure 2. It can be divided into two kinds. The one is that the truck is not driving on the platform entirely. That is to say the back wheel or the front wheel of the truck is not on the platform in order to reduce the empty truck weight. The other is that many trucks are on the platform. That is to say the front or back wheel of the other truck is driving on the platform while the truck weighing in order to increasing the full loaded truck weight. So the goods weight is heavier than its actual weight.
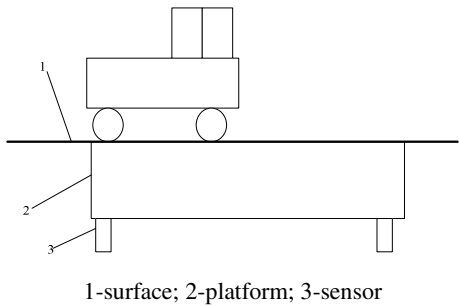

1-surface; 2-platform; 3-sensor

Fig. 2. The truck position cheating method

4   Principle of the Truck Position Cheating Monitoring System

Aimed at the truck position cheating method, the truck position cheating monitoring system is brought out. The monitoring system includes two parts: the photoelectric signal detection system and the data processing system. Take the double-axial truck for an example. The multi-axial car is similar with the double-axial truck. The photoelectric detection system is shown in figure 3.
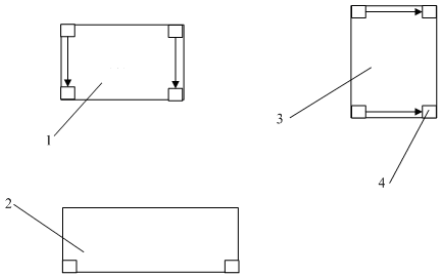
1 - front view; 2 - side view; 3 - Top view; 4- infrared sensor.

Fig. 3. The photoelectric detection system

The infrared sensors are respectively installing on the front and back of the weighing platform. The infrared light is emitted from the infrared emission device and can be received by the photoelectric sensor. The light signal is changed into the current signal.

The output light current signal is shown in the figure 4. While the electronic truck scale weighing, the infrared emission device emits the infrared light. When there is no wheel between the emission device with the receiving sensor, the receiving sensor can receives the infrared light, so the output current signal remains high level. When the truck front wheel is on the scale stage, the receiving sensor can not receive the infrared light at the same time and the output current signal is changed into the low level signal.

While the truck front wheel is out of the photoelectric measurement area, the output current signal is changed into the high level signal. At the moment of the truck back wheel on the weighing platform, the infrared light can not be received by the receiving sensor and the output current signal is changed into the low level signal. When the truck is entirely on the weighing platform, the output current is changed into high lecel signal and remains the high level while weighing. The current signal while the truck is driving out of the weighing platform is opposite to the signal while the truck is driving on the weighing platform. So in the current signal figure, there are
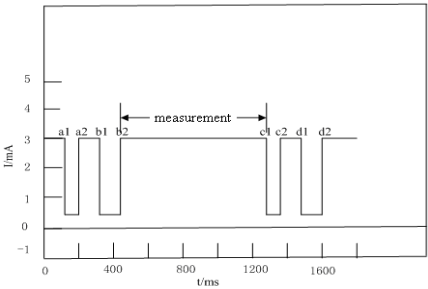

Fig. 4. The output current signal

four falling edge of the rectangular pulse in turn in which two pulse edges are generated when the truck is driving on the platform and the others are generated when the truck is driving out of the platform.

According to the sensor output current signal figure of the double-axial truck, whether the truck position cheat exists or not can be judged directly. If the falling edge number of the pulse is less than 2, it shows that the truck is not on the platform entirely. If the falling edge number of the pulse is more than 2, it shows that the other truck wheel is driving on the platform. So the truck position cheat is existed in the weighing system, refuse to weighing and alarm.

5   Design of the Truck Position Cheating Monitoring System

The truck position cheating monitoring system is mainly consists of the photoelectric detection system, the A/D conversion unit and the data processing system, the watchdog system, the Communication system and the power system. The truck position monitoring system is shown in figure 6. The photoelectric detection system is consists mainly of the photoelectric sensor, LM324 amplifier and A/D converter chip ADC0832. The photoelectric detection circuit is shown in the figure 7. The infrared light signal is received by the photoelectric sensor and light signal is changed into the voltage signal. The voltage signal is amplified by the amplifier LM324 and is changed into the digital signal by the ADC0832.

6   Conclusion

The truck position cheating monitoring system is experimentally studied. The experiment results shows that the monitoring system can detect the cheating method on time.
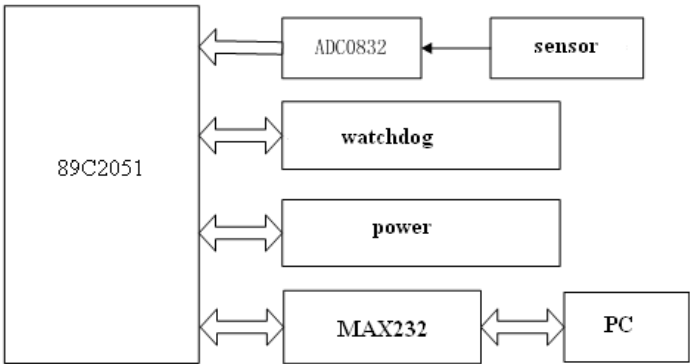

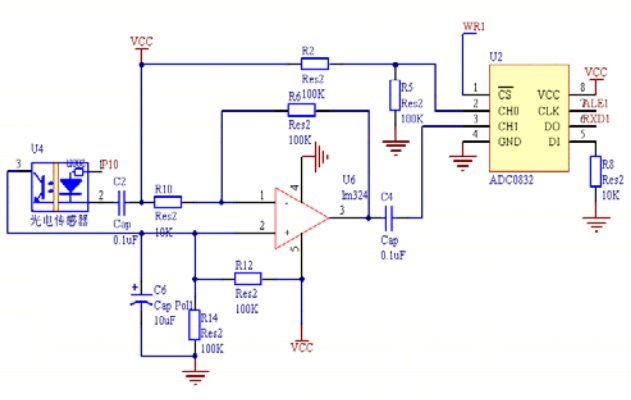**Fig. 6.** The truck position monitoring system

Fig. 7. The photoelectric detection circuit

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