Solution Brochure

LiDAR Height Restriction System

Version 1.0

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Application Background

Traditional height restriction barriers (HGBs) primarily focus on preventing over-height vehicles from passing but do not consider the safety of the driver and passengers. In the event of a collision with a barrier or bridge, not only are the vehicle and HGB damaged to varying degrees, causing traffic congestion, but the more robust and stronger the HGB, the greater the threat to life and property. The main causes of such accidents include:

1. Drivers being unaware that their vehicle exceeds the height limit ahead.
2. Drivers having a false sense of security, believing their vehicle can pass through the HGB or bridge underpass.
3. Drivers not paying attention to the presence of HGBs.
4. Poor visibility due to rain or fog, making it difficult for drivers to judge height, or high speeds preventing timely height assessment.
5. Lack of effective warning, alerting, guiding, and control measures.



In February 2015, a bus in Guangdong collided with a height restriction barrier, resulting in one-third of the front of the bus being sheared off and causing 2 deaths and 9 injuries.



In April 2014, a double-decker bus in Wuhan had its roof sheared off by a height restriction barrier, resulting in injuries to 2 passengers.

TraffiClair addresses the root causes of accidents by designing an intelligent collision prevention solution based on LiDAR technology for height restrictions at highway entrances, bridges, tunnels, underpasses, and other special road segments. Utilizing the proactive and precise detection capabilities of LiDAR, the system provides audible and visual warnings to over-height vehicles approaching these height-restricted areas. This effectively prevents collisions with height restriction barriers, bridges, and underpasses, and promptly directs or halts over-height vehicles.

System Overview

The TraffiClair LiDAR Height Restriction Intelligent Collision Prevention System uses LiDAR as the core sensor to anticipate whether vehicles entering the detection area are over-height. When the LiDAR detects an over-height vehicle, it can immediately activate the corresponding height restriction warning devices. This provides the driver of the over-height vehicle with timely warning alerts, helping to prevent tragic accidents.

System Components and Working Principles

This system employs advanced LiDAR detection technology. The distance measurement principle of the LiDAR in this solution is based on the Time of Flight (ToF) method. The laser emitter sends out a laser pulse, and the internal timer starts counting time (t1). When the laser pulse hits an object, part of its energy is reflected back. When the laser receiver detects the returned laser pulse, it stops the internal timer (t2). The distance value is calculated using the following formula:

Distance = Speed of light * (t2-t1)/2

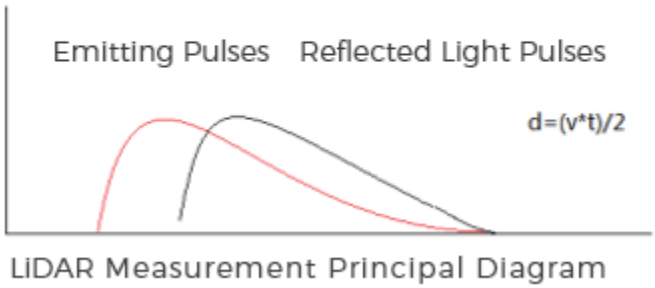


Figure 1: LiDAR measurement principal diagram

Due to the non-contact, active, and rapid scanning characteristics of the radar emitting laser pulses, accurate sensing of whether vehicles entering the detection range are over-height is achieved through data processing. It offers advantages such as rapid response, high reliability, and strong anti-interference capabilities. Moreover, it is unaffected by day or night lighting conditions, enabling stable operation around the

clock. It is currently the most advanced and reliable sensing tool available.

The system mainly consists of a LiDAR, central processing unit, and optionally a camera, which can be selected according to requirements and simultaneously used for capturing images of triggering vehicles. Using LiDAR detection technology, the front-end equipment installation is simple, requiring no road surface damage and remaining unaffected by road construction activities.

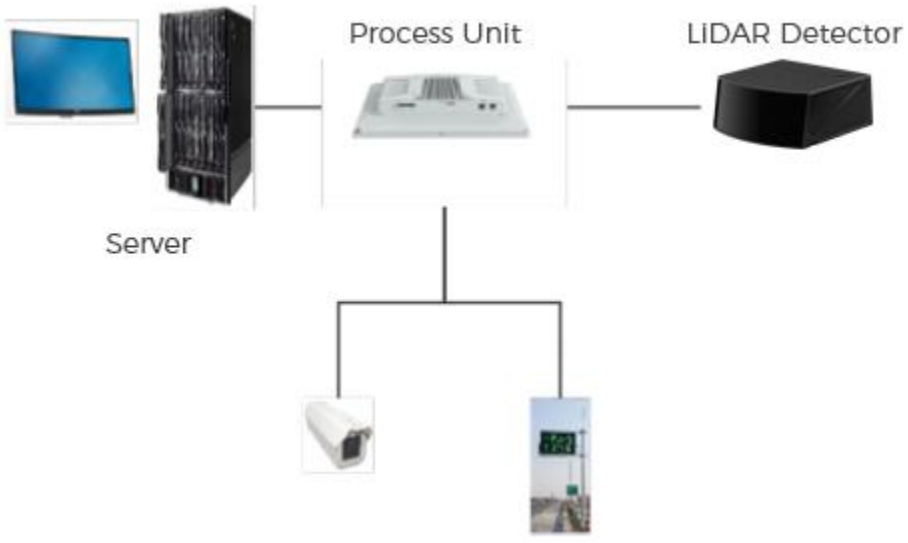


Figure 2: System Topology

Implementation Plan

Currently, there are two installation options for LiDAR:

Option 1: Using the independently developed L1 series high-speed LiDAR by TraffiClair. As shown in Figure 3 below, the LiDAR can be directly installed either on a gantry positioned 200 meters ahead of the height restriction point (the specific distance depends on the current road speed) (Figure 3a) or on a side pole (Figure 3b) based on the characteristics of the scene. The LiDAR is installed vertically, and when vehicles pass through the gantry, their height can be accurately detected. This option can provide real-time output of vehicle height and can simultaneously control multiple lanes.

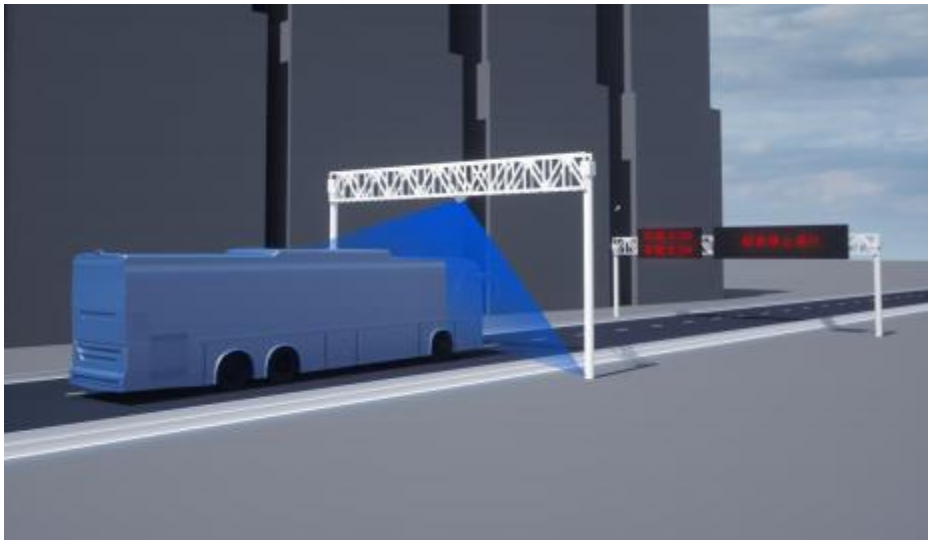


Figure 3a

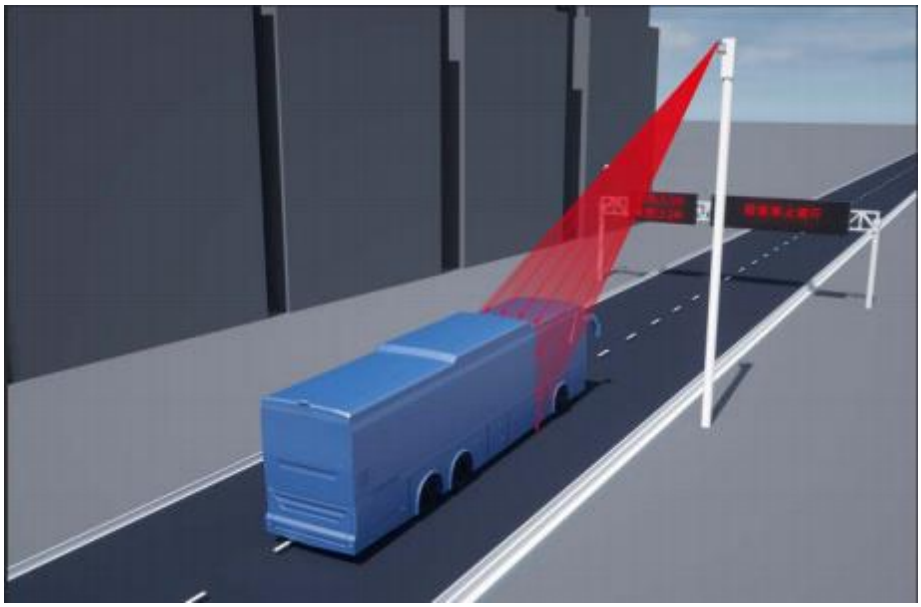


Figure 3b

Option 2: Using the independently developed L1 series high-speed LiDAR by TraffiClair. As shown in Figure 4, the LiDAR can be directly installed either on a gantry positioned at the height restriction point or on a side pole based on the characteristics of the scene. The LiDAR is installed horizontally, and when vehicles pass through the gantry, their height can be accurately detected. Additionally, the detection area can be flexibly configured to adapt to the requirements of complex scenes. This option offers simple and flexible installation.

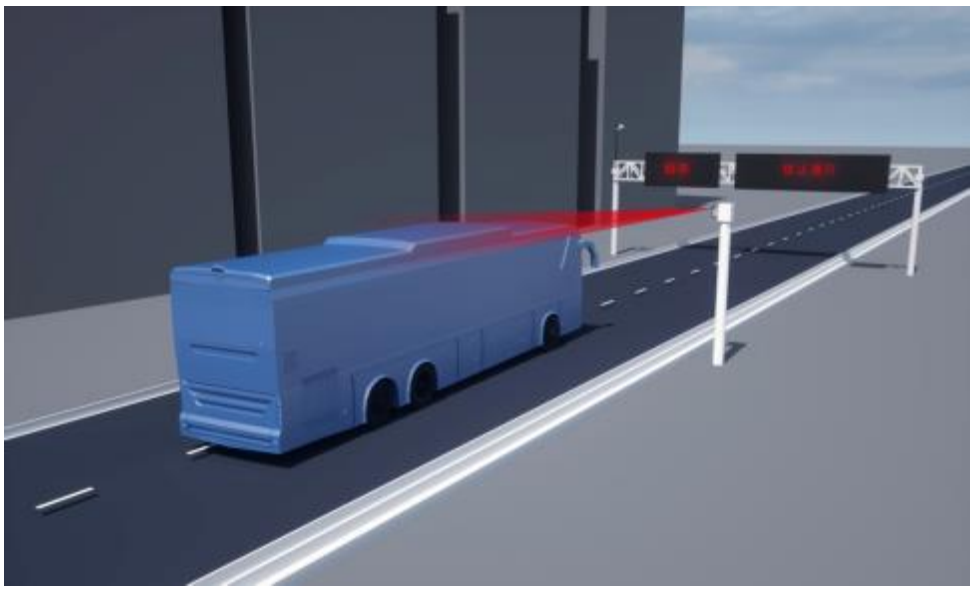


Figure 4

System Advantages

- Real-time and accurate detection of whether vehicles are over-height, with fast speed.
- Active collision prevention warning, efficiently avoiding accidents.
- The equipment is not affected by external light, ensuring good detection performance at night, and stable performance in fog, rain, and snow conditions.
- The system is easy to install and maintain, without the need to close roads, only requiring the installation of poles or simple gantries. It can be installed indoors and outdoors, with simple construction that does not damage the road surface, resulting in low maintenance costs.
- The equipment is fixed on height restriction barriers or poles, allowing users to flexibly adjust based on actual road conditions.
- Using lightweight height restriction barriers is sufficient, providing higher cost-effectiveness.

System Main Hardware and Specifications

1. LiDAR

ClairLDR-L1 LiDAR Detector



Model	CLAIRLDR-L1
Detection Method	ToF
Wavelength	905 nm
Laser Class	Class 1 (eye-safe)
Channels	1
Detection Range	150 m (@10% reflectivity)
Range Accuracy	±3 cm
Data Point Generating Rate (Single Echo Mode)	150,000 pts/sec
Horizontal FOV	120°

Scanning Frequency	30 Hz	60 Hz	90 Hz	120 Hz	150 Hz
Horizontal Angular Resolution	0.024°	0.048°	0.072°	0.096°	0.12°
Communication Interface	Gigabyte Industrial Ethernet (1000 Base-T)				
Time Source	gPTP				
Operating Voltage	9 V ~32 VDC				
Operating Temperature	-40℃ ~ +85℃				
Storage Temperature	-40℃ ~ +105℃				
Shock Test	500 m/sec², lasting for 11 ms				
Vibration Test	5 Hz ~2000 Hz, 3G rms				
IP Grade	IP 6K9K				
Dimensions	110*100.4*45 mm				
Weight	635 g				

2. Processing Unit

The central processing unit adopts an industrial-grade industrial control computer, featuring a diamond cutting process for exterior design, along with die-casting and wireless cable technology to showcase quality and stability. The whole machine is developed based on the Intel Bay Trail platform, with directly onboard high-speed memory to effectively resist vibration impact. It utilizes a zero-distance heat dissipation scheme with reverse-mounted heat dissipation technology, along with wide-voltage

power input performance, to meet various demanding industrial application scenarios. Integrated Intel dual-network ensures efficient and error-free terminal data acquisition, monitoring, and control.

