

Vehicle Radar Speed Measurement System

GA600

Features

- Vehicle Speed Detection Function.
- Vehicle Image Recording Function (Local Network Computer Recording & Cloud Platform Recording).
- Overspeed Capture Function.
- Intelligent Fill-light Function.
- Automatic License Plate Recognition Function.
- Overspeed Capture and Display Function.
- Overspeed Capture and Broadcast Function.
- Vehicle Logo Recognition Function.
- Vehicle Sub-brand Recognition Function.
- Front-end Backup Storage Function.
- Image Anti-tampering Function.
- Network Remote Maintenance Function.

Description

GA600 Radar Speed Measurement System. Used in internal roads of factories, hospitals, schools, etc., to regulate traffic, ensure safety, and control vehicle speed.

The system includes front-end subsystems, speed detection units, image capture and recognition units, license plate display, automatic license plate recognition, and overspeed capture display modules.

Key components: high-definition capture units, fill lights, radar, license plate display screens, warning lights, along with supporting software for LAN-based capture, cloud platform, and public account services.

Attached are the system's site layout top view, side installation diagram, and side view.

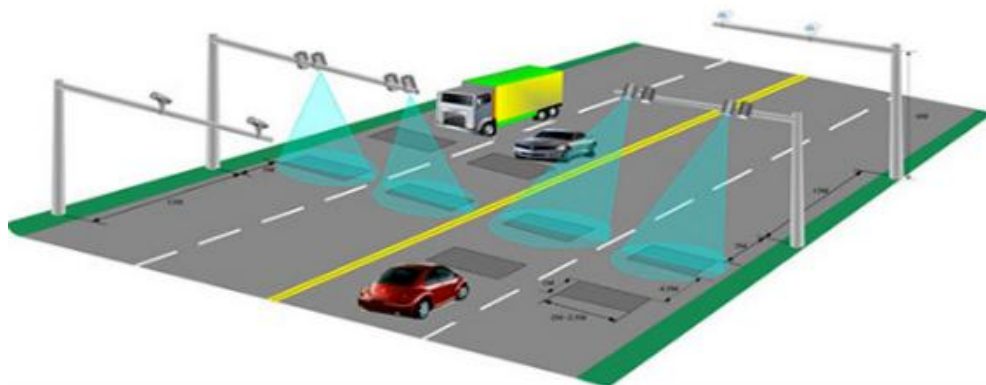


Figure 1 Top View of Speed Measurement System On-site Layout

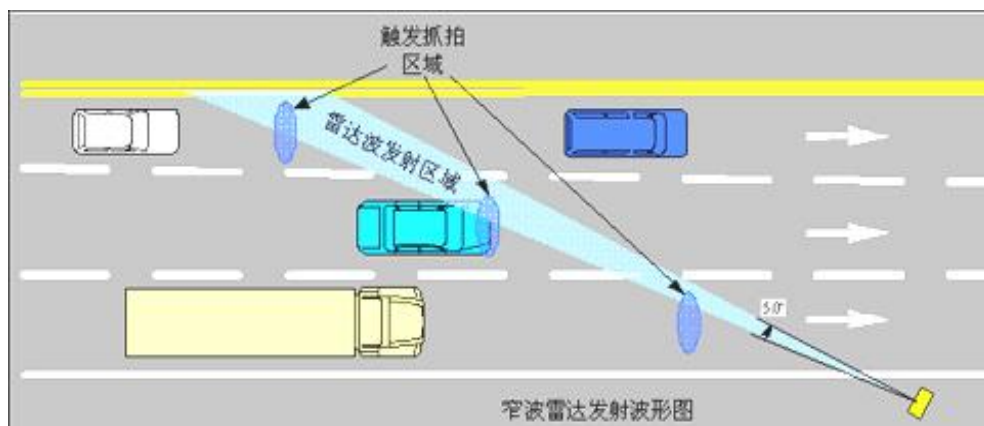


Figure 2 Side-Mounting Schematic Diagram

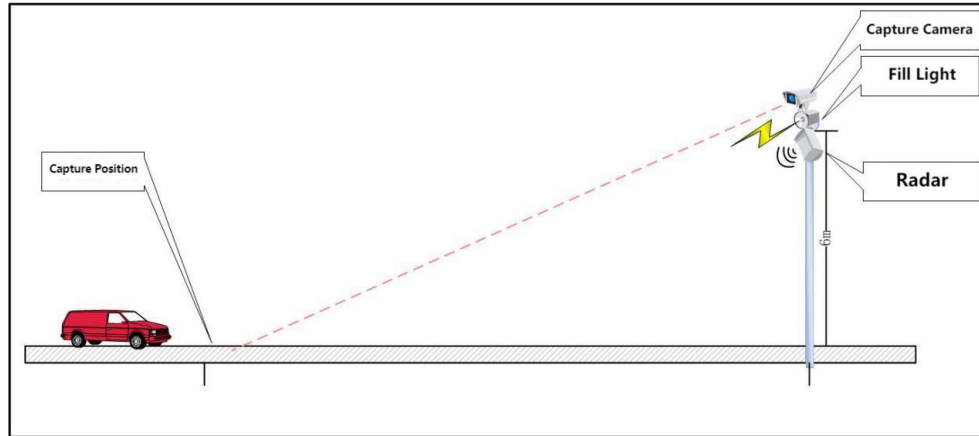


Figure 3 Side View of On-site Layout

1. System Composition

1.1 Front-end Subsystem Composition

The front-end subsystem in the vertical fixed installation mode mainly consists of the following functional units:

- (1) Vehicle Speed Measurement Unit: Speed detection radar;
- (2) Image Capture and Recognition Processing Unit: Includes capture unit and fill light;
- (3) Front-end Data Processing and Upload Unit: Includes terminal server;
- (4) Network Transmission Unit: Includes switch or 4G module;
- (5) Video Surveillance Unit: Includes high-definition panoramic camera and auxiliary lighting equipment.

1.2 Vehicle Speed Measurement Unit

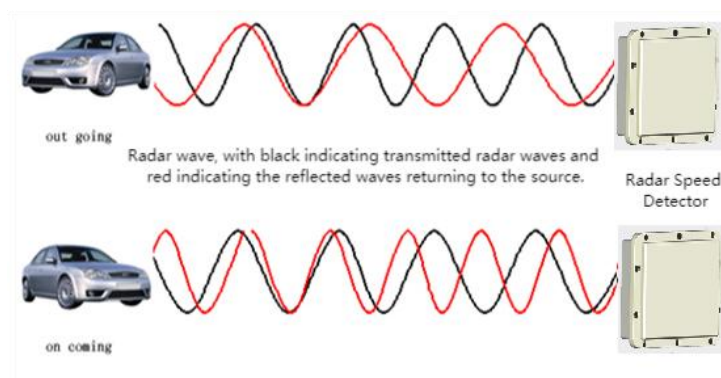


Figure 4 Radar Speed Measurement Principle

The system employs narrow-beam radar speed detection to measure vehicle speeds. The effective detection range of the radar is confined to a single lane, effectively avoiding interference from vehicles

in adjacent lanes. Based on the Doppler principle, the radar calculates the vehicle's speed and transmits the corresponding speed information to the high-definition camera.

Communication between the radar and the high-definition camera is achieved via an RS-485 serial interface. The radar relays vehicle speed information to the camera through the 485 signal.

1.3 Image Acquisition and Recognition Processing Unit

The image acquisition and processing unit consists of a high-definition camera and a fill light.

The high-definition camera selected for the system adopts an integrated architecture design with a high-definition CMOS sensor, high-definition ISP (Image Signal Processor), and a high-performance embedded DSP (Digital Signal Processor). It integrates core functions such as high-definition video capture and high-definition video processing.

The 4-megapixel high-definition capture camera has an effective resolution of 2048×1536 , enabling the captured images to clearly distinguish license plate numbers, plate colors, vehicle types, body colors, and other details. The accuracy of license plate recognition depends on the number of pixels occupied by the license plate in the photo. The license plate recognition algorithm used in this system can achieve over 95% recognition accuracy when the horizontal pixel count of the license plate is no less than 120.

The high-definition camera can simultaneously output high-definition photos and license plate recognition data. It features strong light (backlight and frontlight) suppression capabilities, reducing the impact of daylight on the camera during the day and the glare from vehicle headlights at night. This ensures that the captured photos clearly display the full frontal view of the vehicle and its license plate characteristics.

1.4 Vehicle Speed Detection Function

Based on various auxiliary methods to improve speed measurement accuracy, the system adopts radar speed detection technology, fundamentally minimizing issues such as inaccurate speed readings and abnormal speed data.

When a vehicle enters the speed detection zone, the license plate camera first identifies the license plate number, and then the radar measures the vehicle's current speed. When the vehicle speed is below 80 km/h, the practical road test error does not exceed -6 km/h to 0 km/h. When the vehicle speed is less than or equal to 60 km/h, the practical road test error remains within -3% to 0% of the actual speed.

Speed detection relies on license plate recognition. If a vehicle does not have a standard license plate, its speed cannot be measured. For any license plate from which speed can be detected, both the license plate number and the measured speed are stored in the front-end system, server, or cloud platform. The information is also displayed on an LED screen or other terminals.

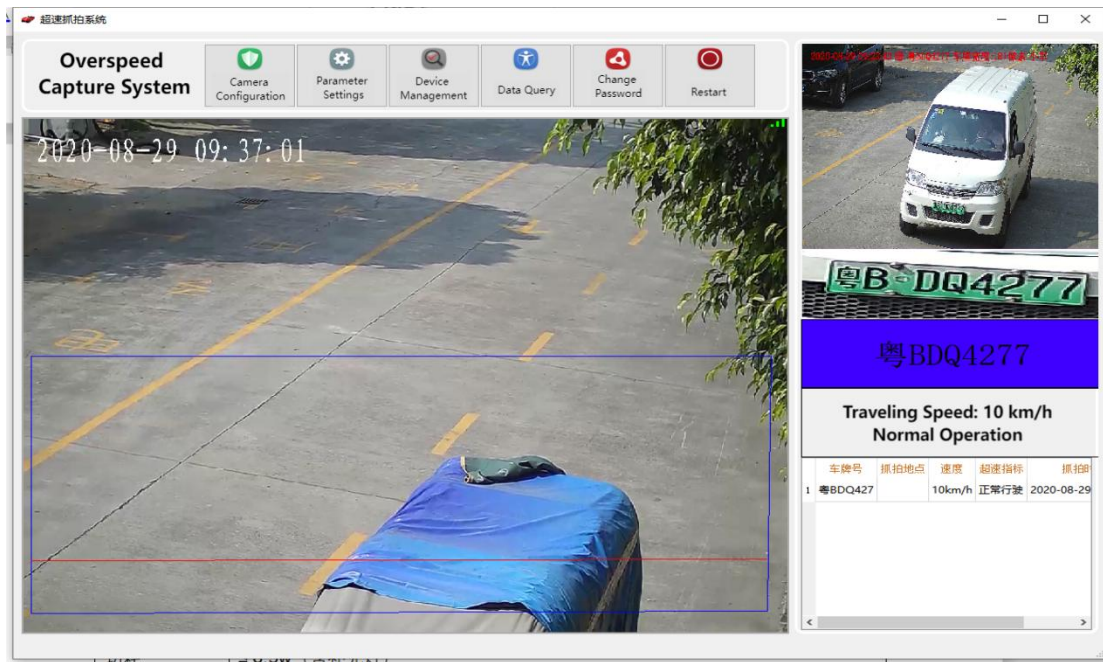


Figure 5 On-site Actual Capture Effect of the 4-Megapixel Capture Camera

1.5 Vehicle Image Recording Function

The system is capable of accurately capturing and recording information of passing vehicles. In addition to image data, the recorded vehicle information includes textual details such as date, time (accurate to the millisecond), location, direction, license plate number, plate color, vehicle body color, speed, etc. This vehicle information is written to an associated database, and the relevant textual data is stored either in the front-end camera's memory, a local area network (LAN) platform, or a cloud platform.

LAN Platform: Each integrated speed measurement device and server computer form a local area network, with all data transmitted to the server for centralized configuration, management, and querying.

Cloud Platform: Each integrated speed measurement device connects to the internet via a 4G module or 4G router, forming a network in the cloud. The cloud platform provides centralized configuration, management, and querying functionalities.

2. Parameter

Project	Specifications
Speed Measurement Error	When the vehicle speed is below 80 km/h, the on-road measured error does not exceed -6 km/h to 0 km/h; when the vehicle speed is less than or equal to 60 km/h, the on-road measured error does not exceed -3% to 0% of the vehicle speed.
Speed Measurement Range	5km/h ~80km/h;

Minimum Capture Interval	<40ms;
Recognizable License Plate Types	License Plate Categories: Civilian vehicle plates (excluding small category 5 vehicles), police vehicle plates, new energy vehicle plates, military vehicle plates, and armed police vehicle plates.
License Plate Recognition Rate	≥95%.
Image Compression Method and Resolution	JPEG format.4-megapixel resolution: Single image resolution (pixels) 2048 × 1536.
Number of Captured Images for Passing Vehicles	1 photo.
Number of Captured Images for Overspeed Violation Vehicles	Capture 1 or 2 photos, configurable on the camera (default is 1 photo).
Interface	RJ45, 100 Mbps Ethernet, TCP/IP protocol.

3. Key Equipment Parameters

3.1 High-Definition Intelligent Bayonet Capture Unit



Product Parameter Features:

- 4MP deep-learning intelligent bayonet capture camera unit
- 1/2.8" 4-megapixel CMOS image sensor
- Supports dual-stream video output
- Image resolution: 2048 × 1536
- Encoding protocols: H.265, H.264, MJPEG
- Supports dynamic adjustment of image parameters (saturation, brightness, contrast, sharpness, etc.)
- Supports image rotation (configurable 90°, 180°, 270°) — suitable for corridor mode and mirrored application modes
- Supports overlay of no less than 16 lines of text; font alignment and overlay position configurable
- Features whitelist/blacklist function; whitelist can store no less than 100 IP/MAC addresses
- Supports recognition of new energy vehicle license plates
- License plate recognition range: plate width 80×25 to 1200×380 pixels, tilt angle 0 to 40 degrees
- Supports multiple overlay contents: video OSD, photo OSD
- Includes adaptive Ethernet port, I/O interface, RS485, and other interfaces
- 16GB front-end EMMC storage

- Camera unit power supply: AC220V $\pm$ 35%
- Operating temperature: -40°C to +85°C
- Protection rating: IP66

3.2 Lane Fill Light

Product Features and Specifications

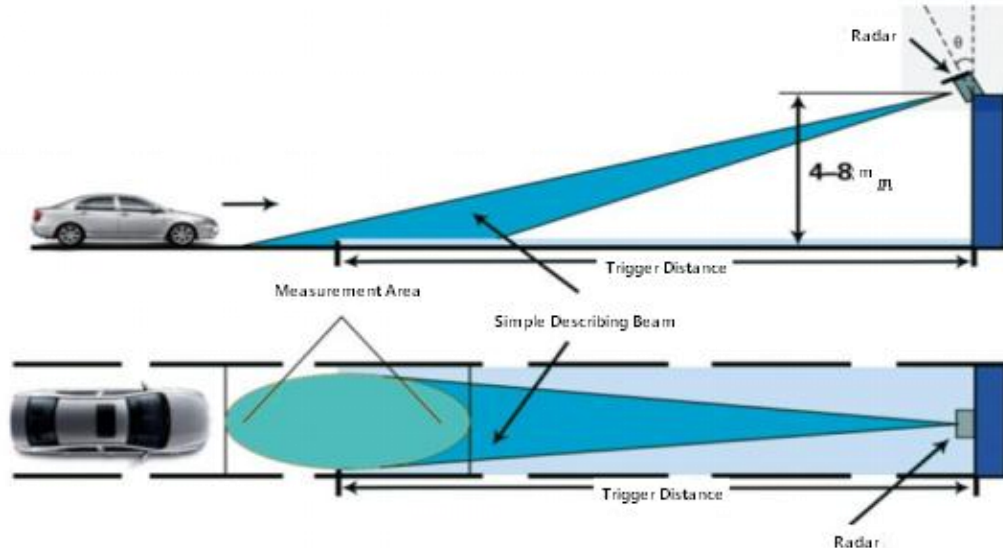
- Smart Auto On/Off: Automatically turns on at night and off during daytime, enabling longer service life.
- Color Temperature: 5500 $\pm$ 500K.
- Optimal Illumination Distance: 18-31 meters.
- Power Consumption: < 4.5W (in standby mode).
- Luminous Flux: 1400 lumens @ 20% duty cycle.

3.3 Positioning and Capture Radar

Product Features and Specifications

- This radar speed measurement device adopts modern microwave technology and high-speed digital signal processing technology, enabling precise positioning and accurate speed measurement. It features high accuracy, no need for debugging, and high stability. It can be applied in various traffic environments such as gantry structures, tunnel entrances, and under elevated interchanges, making it particularly suitable for demanding road speed monitoring and evidence collection. It provides accurate, reliable, and real-time detection information for traffic management, ensuring the normal operation of traffic management systems.
- Real-Time Speed Measurement and Triggering: It measures the speed of target vehicles in real time and provides trigger signals. Combined with high-precision microwave positioning, it ensures accurate and consistent triggering positions for checkpoint vehicles, enabling the capture of different speeds, sizes, and types of vehicles at a "fixed point position" (based on license plate recognition).
- Real-Time Tracking and Detection: Employs reliable and continuous tracking technology to monitor the movement trajectories of any vehicle within the detection area, accurately measuring vehicle speed and position.
- 24GHz MMIC Technology: Utilizes 24GHz Monolithic Microwave Integrated Circuit technology for superior performance.
- High-Gain, Low Side-Lobe Microstrip Antenna Design: Effectively avoids interference from targets in adjacent lanes.
- High-Precision Fixed-Point Capture: Captures images with a positioning error of less than 1 meter and a capture rate exceeding 99%.
- Advanced Signal Processing: Ensures stable performance and low false alarm rates.
- Easy Installation and Maintenance: Requires no debugging and is simple to maintain.
- Strong Environmental Adaptability: Detection performance remains unaffected by external factors such as light, dust, rain, or snow.

- **Flexible Installation:** Can be installed in various orientations (front-facing or slanted side-facing) at any position above the monitored lane or area.
- **High Capture Rate:** Capture rates can reach up to 99%.
- **Precise Positioning:** Vehicle capture trigger signal positioning accuracy within $\pm 0.5\text{m}$.



3.4 License Plate Display Screen



- Speed Limit: 30 km/h
- Automatic Speed Measurement
- Please Slow Down
- Normal Driving

Product Features and Specifications:

- **Slim and Standardized Enclosure Structure:** Utilizing high-strength sheet metal processing technology, it achieves outstanding features such as high precision and lightweight design. The screen display is uniform and consistent, with a basic uniformity of 99%, enabling high refresh rates, high grayscale levels, and more realistic images.
- **High Load-Bearing Strength and Flexible Installation:** With high load-bearing capacity, it supports quick installation using connecting pieces and offers versatile mounting options, suitable for traffic gantries, F-poles, and more. Even in high or low-temperature environments, there is no risk of mutual compression or deformation between modules.
- **Low Heat, Low Noise, and Low Radiation:** Through an excellent structural heat dissipation design, it operates at low decibel levels under normal temperatures, ensuring stable screen performance.

- **Internal Wiring and High Protection Ratings:**All wiring is internally routed, offering excellent waterproof and dustproof performance. The dustproof level meets the IP5X test requirement of GB4208, and the waterproof level meets the IPX4 test requirement of GB4208.
- **Spacious Interior and Optional Features:**The enclosure has ample internal space to accommodate a distribution board with surge protectors and solid-state relays, as well as an asynchronous control card. Additionally, an ambient light sensor can be optionally configured to automatically adjust screen brightness based on the environment.
- **Strong Resistance to Light Interference:**The display unit can withstand strong light interference such as sunlight and remains clearly visible under illuminance above 90,000 Lux.
- **User-Friendly Design and Durability:**The module base is equipped with installation and maintenance handles, and the faceplate is anti-reflective and UV-resistant, with a contrast ratio of 3000:1. The enclosure flatness coefficient is less than 1mm.
- **All-Weather Use and Intelligent Protection:**Suitable for all-weather operation, the display unit features effective brightness monitoring, warning, cooling, and power-off protection functions.
- **High Electrical Safety Performance:**The LED display module is highly resistant to voltage fluctuations and can withstand a 50Hz, 1500V (AC RMS) test voltage for 1 minute without breakdown.

Product Features and Specifications:

- P10 Full-Color LED Display Unit for Traffic Enforcement Applications
- Pixel Configuration: 1R1G1B
- LED Packaging Type: SMD
- Brightness: 6,500 cd/m²
- Contrast Ratio: 5,000:1
- Pixel Pitch: 10 mm
- Module Dimensions: 320 mm × 160 mm
- Enclosure Dimensions: 1,280 mm × 640 mm × 139 mm
- Horizontal Viewing Angle: 80°
- Vertical Viewing Angle: 60°
- Enclosure Weight: 40 kg/m², Rear Maintenance Type
- Enclosure Protection Level (Front/Rear): IP65/IP54
- Operating Voltage: AC 220 V
- Average Power Consumption: 325 W/m
- Maximum Power Consumption: 800 W/m²
- Operating Temperature: -30 to +65 °C
- Operating Humidity: 20–90% (Non-Condensing)
- Storage Temperature: -40 to +85 °C
- Storage Humidity: 10–95%

3.5 Police Light



Overspeed Audio-Visual Alert: When overspeeding is detected, the strobe light above will flash continuously and emit an audible alarm to alert the speeding vehicle.

3.6 LAN-Based Overspeed Capture Software

A single platform software supports the connection of up to 16 license plate recognition cameras. It allows configuration of various parameters and enables data query and statistics based on factors such as time, license plate number, and vehicle speed. The main functions are as follows:

1. Camera Configuration: Add cameras to the software. After restarting the software, video feeds from speed detection cameras are integrated. When a vehicle passes, the system displays a panoramic image, a license plate image, license plate color, license plate number, vehicle speed, and the current time in the corresponding sections on the right side.
2. Parameter Settings: Configure relevant information such as the development unit, user unit, and image storage path. The speed limit for specific cameras is generally adjusted directly on the hardware device and is not supported for modification within the software.
3. Device Management: Add license plate recognition cameras and configure LED display settings.
4. Data Query: Supports multiple query methods, including querying captured images by time, searching for speeding vehicles, and using advanced queries based on license plate numbers and vehicle speeds. Query results can be exported as reports.
5. Password Modification: Allows users to set login passwords according to their requirements.

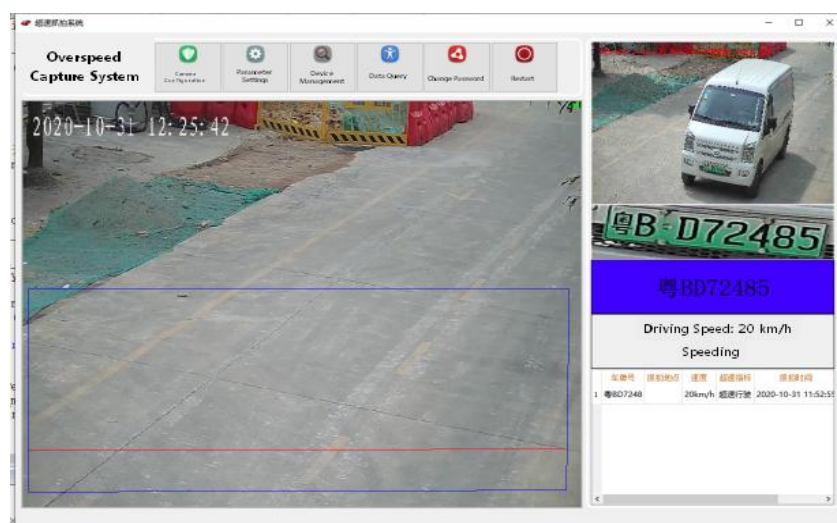


Figure 6 Main Interface of the Overspeed Capture Software

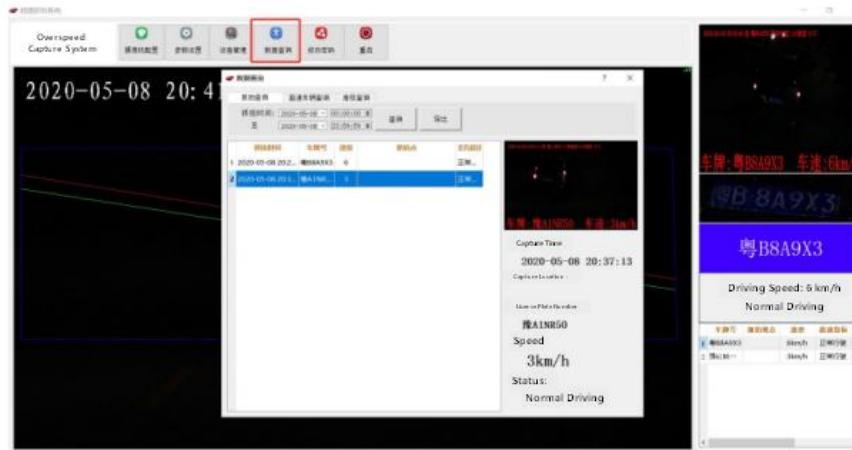


Figure 7 Data Query Interface of the Overspeed Capture Software

Multiple query methods are supported:

Filter capture records by time range, search for speeding vehicle data, or perform precise searches in advanced queries using conditions such as license plate number and vehicle speed.