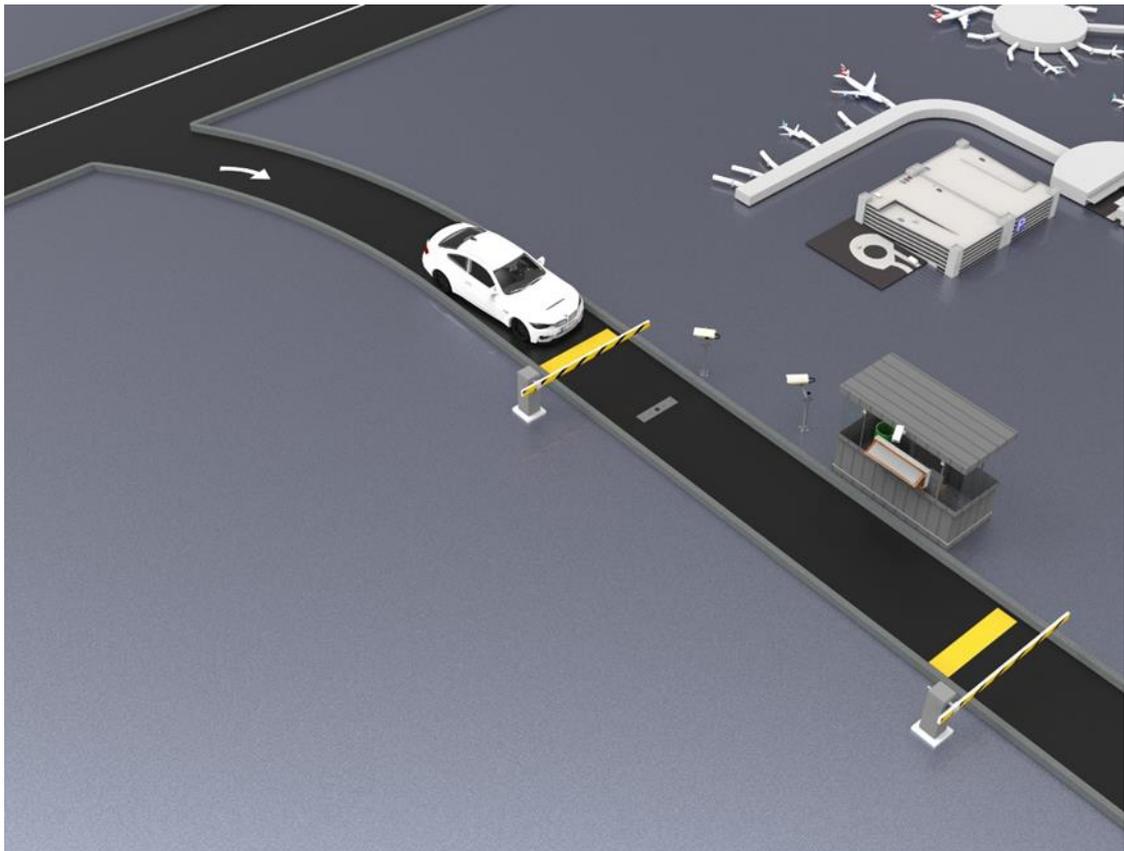ELITEUN Multi-factor Vehicle Clearance System

MVCS

System Introduction

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ELITEUN INTELLIGENCE TECHNOLOGY LTD

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1　System Overview

1.1　Background

Security management and vehicle inspection are of great importance at places such as government buildings, airports, custom ports, transport stations, military institutions and bases, embassies, checkpoints, banks, industrial plants, research facilities, confidential sites, large-scale convention center, stadiums, business buildings, high-end restaurants and hotels, parking lots, space bases, nuclear power plants, etc. Traditional vehicle inspection is executed manually, which is inefficient, especially during rush hour or when the inspectors are inexperienced. Some users have set up ground monitor system at entrance, but the inadequate intelligence and over-simplified functions may miss out important information that leads to security risks. ELITEUN offers an all-round, thorough security solution featuring Multi-factor Vehicle Clearance System (MVCS). Supported by a series of sub-systems which can inspect drivers, license plates and vehicle undercarriage simultaneously, MVCS helps to forge a tough shield to safeguard all facilities and assets.

There are challenges and potential risks with current vehicle security systems:

➢ Single-dimensional security management system is slow and inadequate for scenarios with high safety requirement.

➢ The separation of subsystems at each entrance and exit leads to disintegrated and insufficient use of data.

➢ Current manual safety inspection conceals security risks as efficient and instant history record and data references are missing in the process.

➢ The efficiency of re-inspection in traditional security management is dampened due to inability to create and update safety files quickly for person or for vehicle.

1.2　Positioning

MVCS is comprised of under vehicle surveillance scanning system, smart license plate recognition system, vehicle smart feature analysis system and smart driver identification system. MVCS acquires vehicle and driver information through terminal HD cameras, conducts automatic analysis and processing, and feeds the processed information back to MVCS application, assisting on-site security staff to identify and respond to abnormalities or threats immediately. MVCS can be deployed in government buildings, airports, military units, embassies, consulates, checkpoints, borders, banks, classified facilities, prisons, detention centers, conference venues, commercial buildings, restaurants, hotels, parking lots, nuclear power plants, etc.

1.3 Highlights

ELITEUN MVCS has the following characteristics:

➢ License plates, driver faces, vehicle undercarriage and structured video are displayed, identified and recorded on the same platform to quickly create multi-dimensional security files.

➢ Seamless coordination among each module enables a unified, multi-integrated security management mechanism.

➢ Powerful safety functions are embedded, such as mass storage of 50,000 faces on one single AI camera, accurate recognition of driver's face behind windshield, and supporting different license plate format of multiple countries.

➢ Innovative built-in technologies such as video structuring and vehicle undercarriage imaging ensure the accurate recording of vehicle characteristics from multiple scenarios as well as the completeness of its underside image.

➢ Information such as license plate, driver's face, vehicle undercarriage imaging and structured video can be captured while vehicles are in motion at a speed up to 30km/h, which significantly boosts inspection efficiency.

1.4 Benefits

ELITEUN MVCS brings the following benefits to customers:

➢ The system delivers an efficient, multi-dimensional and vigorously secured management mechanism to meet high safety requirements.

➢ The unified communication and coordination among multiple subsystems are managed on the same platform to greatly improve operation efficiency.

➢ All data are securely collected and stored to provide a multi-dimensional data reference for future management analysis, safety optimization and for elimination of potential risks.

➢ The industrial-grade design and world-class quality make sure the devices to be deployed conveniently and the system to function stably in harsh environments.

2   Network Architecture

2.1 Networking Overview

MVCS is an integrated platform that combines multiple ELITEUN sub-systems. The entire system is connected by gigabit Ethernet cable (Cat 6) and is powered by regulated voltage supply. Each sub-system can be deployed and run independently. They can also be integrated on the same server.
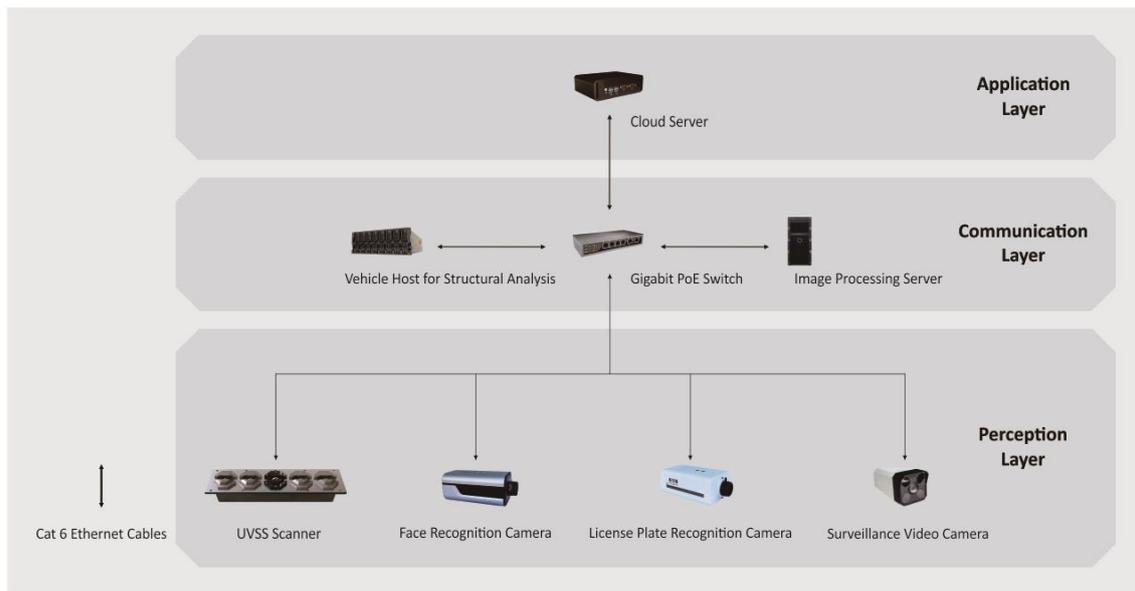
3   Functions of MVCS

MVCS adopts a Server/Client software structure, which can be divided into four sub-systems according to their functions: under vehicle surveillance scan, smart license plate recognition, vehicle smart feature analysis and smart driver identification, which can be independently deployed or partially combined according to customer needs.

3.1 Under vehicle surveillance scanning system

Under vehicle surveillance scanning system aims to scan vehicle undercarriage intelligently with comprehensive functions such as automatic vehicle detection, image acquisition, image display, image stitching and fusion, anomaly alert and control. The system automatically detects the entry of vehicle, activates a CCD linear array scanning, and scanner begins to snap photos of undercarriage. These images are processed then sent to server for stitching and fusion. System components include UVSS scanner, smart control box, image processing server, Gigabit switches, system server, and other ancillary equipment.

3.2 Smart license plate recognition system

Smart license plate recognition system applied advanced machine learning technology to acquire high-resolution images of license plates. AI algorithms are optimized to convert images into computer data quickly and accurately. The IP67-rated housing and industrial-grade structural design of LPR camera and other hardware will ensure that the system remains healthily functional even under harsh environmental conditions. System components include license plate recognition camera, Gigabit switch and system server.

3.3 Vehicle smart feature analysis system

Vehicle smart feature analysis system also applies advanced computer vision algorithm to classify the brand, model and color of the vehicle leveraging deep learning and other artificial intelligence technologies, then conducts higher-level analysis during the process of identifying key information. The system automatically analyzes and extracts of major feature information of the vehicle, identifies its license plate, color, type, vehicle characteristics, etc. System components include surveillance video camera, vehicle structural analysis host, Gigabit switch and system server.

3.4 Smart driver identification system

Smart driver identification system is suitable for all environments, enabling real-time facial detection and identification of front-row vehicle occupants in a variety of conditions, such as daytime or nighttime, harsh weather or bright light, or even through dark-colored windshield. Thereafter, the system can quickly complete face comparison and matching. High-definition computer vision camera is adopted to optimize day and night operations. The camera with powerful LED arrays can capture clear photos of the driver and other front passengers despite tinted windshields or variable lights. System components include face recognition camera, Gigabit switch and system server.

4   Functions of Components

4.1 UVSS scanner

ELITEUN UVSS scanner is the key equipment in MVCS. It is used to capture vehicle undercarriage and send images to processing server for real-time stitching. The system applies advanced color linear CCD imaging technology to achieve a real-time scan and imaging at once.

➢   Linear CCD camera which has high resolution and definition.

➢   Images are processed intelligently to improve the quality.

- ➤ It supports remote trouble shooting and maintenance.

- ➤ Video monitor and recording from multiple angles.

- ➤ IP68 grade, shockproof and compressive, adaptive to different weather conditions.

4.2 Server

ELITEUN server with strong computation can provide ultra-fast data processing and access.

- ➤ Dual ethernet ports perfectly fit for flexible configuration.

- ➤ High performance processing achieves fast and smooth data experience.

- ➤ Small size design takes up less space, making it light and easy to install.

- ➤ Synchronous / asynchronous dual-display and supports VGA and HDMI.

4.3 Face recognition camera

ELITEUN Face recognition camera is a 2 PM (megapixel) bullet network camera. Powered by intelligent visual processing chip and deep learning algorithm, it can detect, track and snap multiple photos in real time. The photo with the best quality is selected based on a variety of computing strategies.

- ➤ AI processor with 1 Tops performance is embedded.

- ➤ 1080P@30fps real-time face detection, maximum 200 faces detection in a single frame.

- ➤ Capture rate >99%; false capture rate < 10%; repeated capture rate <120%.

- ➤ Horizontal angle of 90° between front and side face, vertical angle of 30° between looking up and looking down, simultaneous face tracking.

- ➤ The camera supports regional face capture from different angles.

- ➤ It supports clear face snap under different lighting conditions (such as overexposure, underexposure, partial exposure, backlight, low illumination, etc.).

4.4 License plate recognition camera

ELITEUN license plate recognition camera can achieve high speed image processing. It is based on an industrial-grade processor with a FPGA ISP dual-core processor architecture. Self-adaptive AE and WDR intelligent exposure technology are applied to yield excellent picture quality, thus gaining a competitive market advantage.

- ➤ It captures and recognizes license plates quickly and efficiently.

- Real-time recognition and display of vehicle information such as license plate, color, type, etc. on video stream.

- It supports multiple types of license plate and is open for access to third-party software.

- The image is enhanced via self-adaptive mode to ensure the best quality.

- Automatic gain, automatic white balance and other functions to restore the natural colors of an image.

- Various exposure modes such as digital wide dynamic range (D-WDR), highlight compensation (HLC), backlight compensation (BLC), to adapt to various lighting conditions.

4.5 Vehicle structural analysis host

ELITEUN vehicle structural analysis host can automatically recognize vehicle color, type and other information in captured image. Its high recognition capability comes from deep learning training based on massive vehicle images. Users can find the specific vehicle in the system according to the color, type and or the make.

- Recognizable vehicle colors include black, blue, silver, blue, yellow, red, green, purple, etc.

- Information such as vehicle brand, sub-model (BMW 5 Series 2010) is identified and displayed in system.

- Feature recognition of vehicle refers to sun visors, annual inspection labels, tissue boxes, pendants, ornaments, co-pilots, seat belts, etc.

- Feature identification of vehicle type contains cars, SUVs, commercial vehicles, minivans, small/large trucks, small/large buses, station wagons, etc.

5 Performance and Specifications

5.1 MVCS User Interface
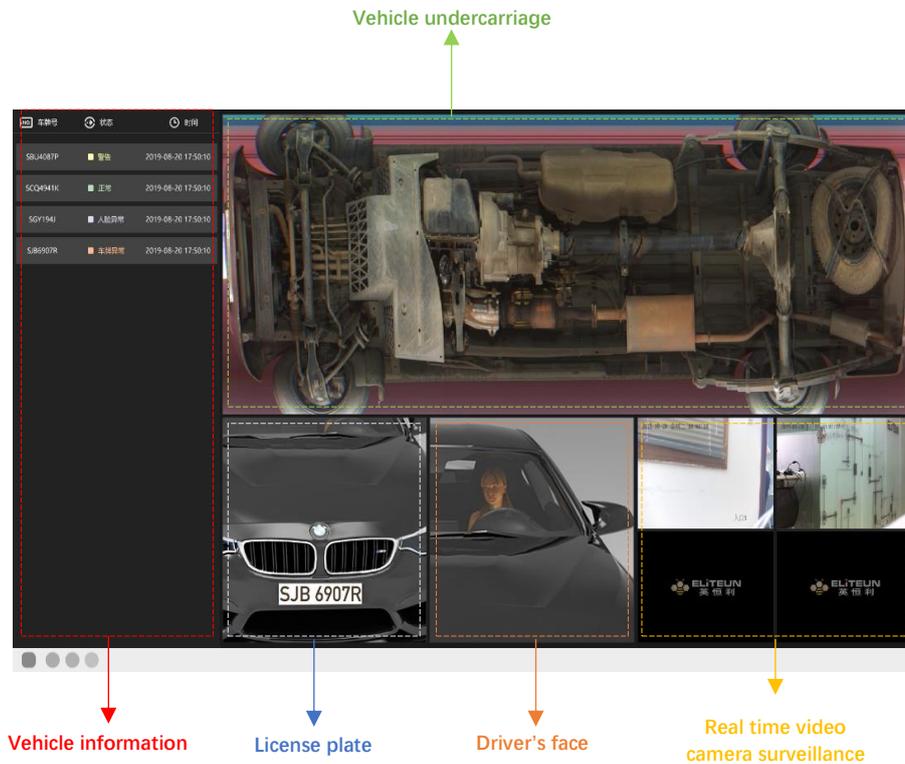
5.2 Specification of Server

Category		Specification
Processor	CPU	Intel Celeron Processor J1900, 4 core
	Frequency	2.0GHz Turbo 2.42GHz
	L2 Cache	2MB
	BIOS	American
Memory	Type	1 single channel SODIMM slot, DDR3L 1066/1333/1600MHz
	Max capacity	8GB
	Socket	1*204-pim SO-DIMM
Display	Chipset	Intel IBay Trail, max power consumption: 10W
	Graphic Engine	DirectX11.1.OCL 1.2,OGL 3.2

	VGA	Maximum resolution: 2650×1600@60Hz
	HDMI	Maximum resolution: 1920×1200@60Hz
	Dual-display	VGA+HDMI, Synchronous / asynchronous dual-display
Ethernet	LAN1	10/100/1000/ Mbps Realtek 8111F, wake-on-LAN
Audio	Main system	Audio control chip: Realtek ALC662, dual track, stereophonic, line out
I/O	Serial	scalable
	USB	1×USB3.0 4×USB2.0
Other	Watch dog timer	
Extension	Mini-PCIE	1 × Standard Mini-PCIE
Storage	HDD	SATA2.5"HDD（Highest data conversion rate: SATA2.0)
	SSD	1 × Standard mSATA socket
Software	OS	Windows7 Windows8 Windows10
	Linux	ubuntu/LINUX/CENTOS
Power supply	Power type	DC-IN5.5*2.5
	Input voltage	12V
	Power adapter	DC 12V 3A/36W (AC TO DC,100~240V)

5.3 Specification of UVSS scan camera

Category	Specification
Scan mode	real-time color linear CCD imaging
CCD resolution	Line array 9000 pixels
Image resolution	≥12000 x 7500
Success capture rate	≥99%
Data interface	RJ45
Ingress Protection	IP68
Vehicle speed	≤30 km/h
Height of undercarriage	60~3000mm
Width of undercarriage	≤4500mm
Power supply	DC24V 400W
Operating temperature	-40°C~70°C

5.4 Specification of face recognition machine

Category	Specification

Camera	Image sensor	1/1.9" 207-megapixel progressive scan CMOS
	Min. Illumination	Color: 0.001Lux/F1.4; B/W：0.0001Lux/F1.4
	Electronic shutter	Auto/manual (1/30 (25) ~1/10000) FLK
	SNR	≥ 50db (AGC off)
	Wide dynamic range	120 dB
	Exposure control	Auto/manual
	Settings	Brightness, contrast, sharpness, saturation, and color are adjustable
	Region of interest (ROI)	Up to 4 areas (multiple levels can be set)
Audio/video	Max. image resolution	1920 x 1080
	Video Compression	H.265/H.264/MJPEG
	Stream feature	NTSC: Main stream: 1920×1080@30fps; sub stream: 1280×720@30fps; third stream: 1920×1080@15fps
	Video code rate	CBR/ VBR (32Kbps~16Mbps)
	Audio compression	G.711U
	Stream form	Video & audio stream / video stream
Network	Protocol	TCP/IP, UDP, HTTP, DHCP, RTSP, DDNS, NTP, PPPoE, UPnP, SMTP, FTP, HTTPS, DNS, ARP, RTP, SNMP
	Interface protocol	ONVIF, GB28181
	Safe mode	Authorized username and password; HTTPS; AES; RTSP
Face capture	Face detection performance	up to 200 faces per frame (Max.)
	Face image selection	Automatically select the best quality face photos according to algorithm
	Min. face pixel	32x32, 40x40, 60x60, 80x80 @ 1080p (can be set)
	Success capture rate	> 99%
	False capture rate	<0.7%
	Face capture area	supports ROI face capture scope, including drawing, modifying and deleting detection area
	Motion detection	Detection area can be set against different sensitivity scale

Other function	Camera block alert	1 area
	Privacy Mask	Up to 4 areas
	Event coordination	Capture coordination; FTP upload or email coordination; alert output coordination; preset point coordination
	Exception detection	Network disconnection, IP address conflict, illegal login
	Character display	Title, time and date are displayed over video; multi-line OSD format, colors and fonts are all optional
General	Operation condition	Temperature: -20°C ~ 55°C / Humidity: 0％-90％ (non-condensing)
	Power supply	DC12V/ PoE
	Power consumption	< 6W
	Weight	405g

5.5 Specification of license plate recognition camera

Category		Specification
Camera	Processor	Industrial grade processor
	Image Sensor	1/2.8" Machine vision CMOS Sensor
	Min. Illumination	Color: 0.01Lux @F1.2(ICR); B/W: 0.001Lux @F1.2 (ICR)
	Shutter time	1/2S - 1/8000S
	Lens	CS/C Fixed Iris Lens
	Day & Night	Auto (ICR)
	Dynamic range	≥120db
License plate recognition	Capture rate	≥99%
	Recognition rate	≥98%
	Recognition time	≤200ms
	Max. speed	40KM/h
	Type of license plate	Common blue and yellow plates, police license plates, military license plates, Hong Kong and Macau license plates, new energy license plates, etc.
	Trigger method	Video/virtual coil
Audio/video	Video compression	H.265+/H.264 /MJPEG
	Video bit rate	30Kbps ~ 16Mbps (continuously adjustable)

	Audio compression	G.711A/ G.711U/ G.726
	Audio bit rate	8K ~ 32K
Image	Max. resolution	1920*1080
	Frame rate	50Hz:25fps (1920×1080,1280×720) 60Hz: 30fps (1920×1080,1280×720)
	Settings	Grayscale, brightness, and hue are adjustable
Function	Wide dynamic range	Linear/ WDR/ mix
	Noise Reduction	2D&3D DNR
	Alarm trigger	Motion detection, camera blocking alert, network disconnection
Network function	Protocols	TCP/IP、UDP、RTP、RTSP、RTCP、HTTP、DNS、DDNS、DHCP、FTP、NTP、PPPOE、SMTP、UPNP
	General function	Heartbeat, password protection, dual-stream
	WIFI probe	WIFI probe detects the MAC address of the mobile phone carried by the pedestrian passing the camera
Interface	Communication interface	1 RJ45 10M/100M Ethernet port
	Alarm	2 inputs; 2 outputs
	Serial interface	1 RS485; 1 RS232
	Audio interface	1 input (line in/mic. in) / 1 output
	Video interface	1 output (BNC analog video)
	SD card slot	SDXC standard Micro SD(TF) card, up to 128G
Others	Temperature/humidity	-40℃ - +55℃/0% - 90%
	Power supply	DC12V/2A
	Power consumption	15W(MAX)
	Ingress Protection	IP66
	Fill-in light distance	Built-in 4 high power white light lamps; 15m-20m adjustable for fill-in light on license plate
	Dimension	459mm ×150mm ×117mm
	Weight	2.2 kg