TraffiClair

ClairGeo Geomagnetic Vehicle Detection System

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Pros & Cons of Geomagnetic Sensor

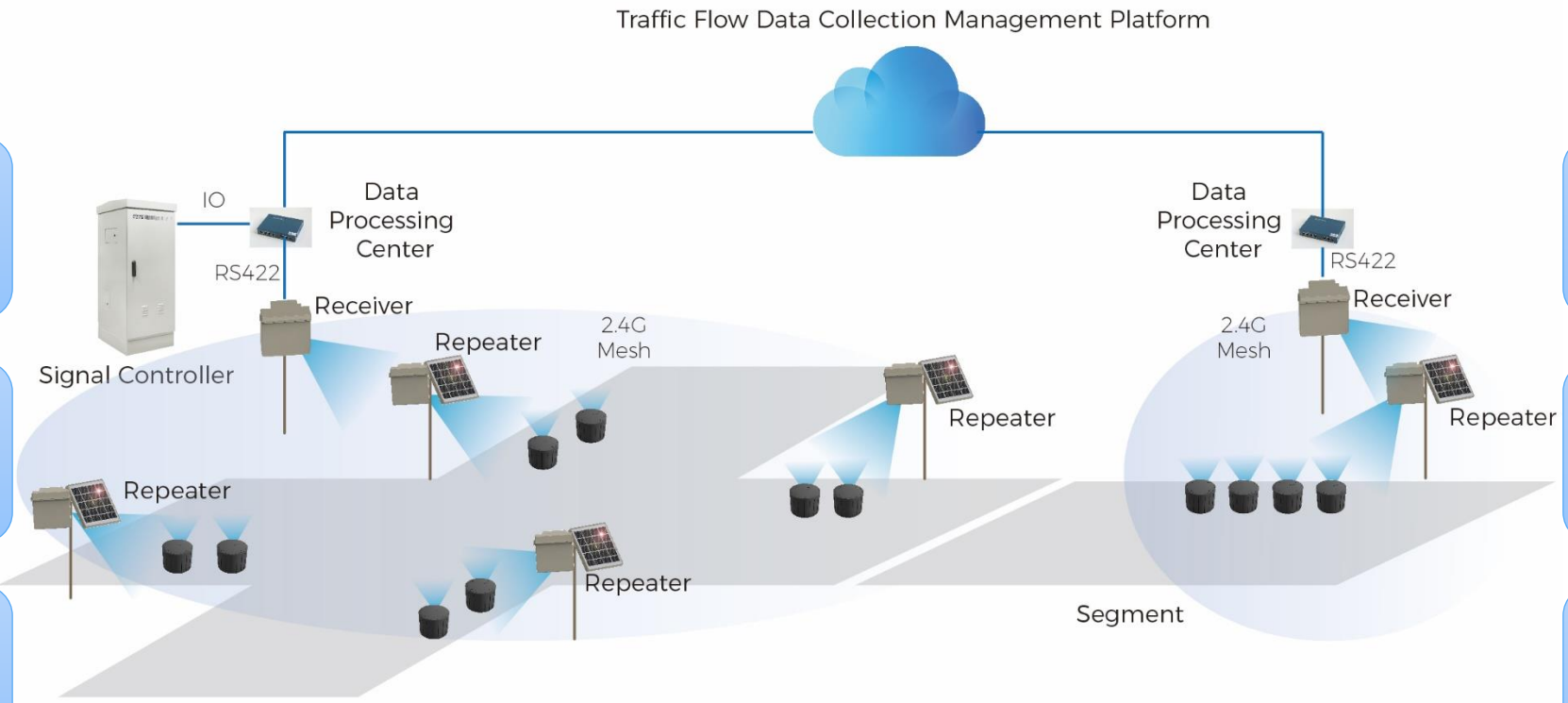
Pros	Cons
• No need for wiring, easy construction • Minimal damage to the road surface • Short construction time, minimal road occupancy • Not susceptible to crushing damage • Can be removed for reuse due to road maintenance or other reasons • Low susceptibility to weather conditions, not affected by rain, snow, or fog	• Requires a small number of road surface perforations during construction • Improper construction may damage the road's lifespan • Construction and maintenance require road closure • Detection area is relatively small • Requiring software compensation for long-term stationary vehicle detection.

ClairGeo Geomagnetic Vehicle Detection System

A Perfect Substitute of Inductive Loop Detectors

Perfect Match with SCATS/SCOOTS System

Robust Structural Design



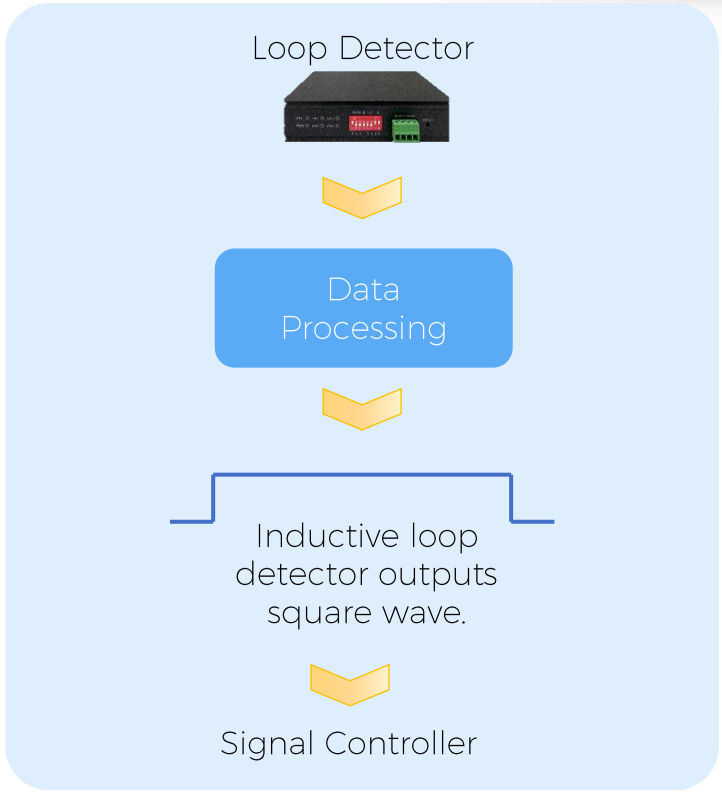
- Distance between Repeater and the nearest Detector: <30m
- Distance between Repeater and the nearest Repeater/Receiver: <300m (200m in the presence of obstacles such as tree leaves or other obstructions.)

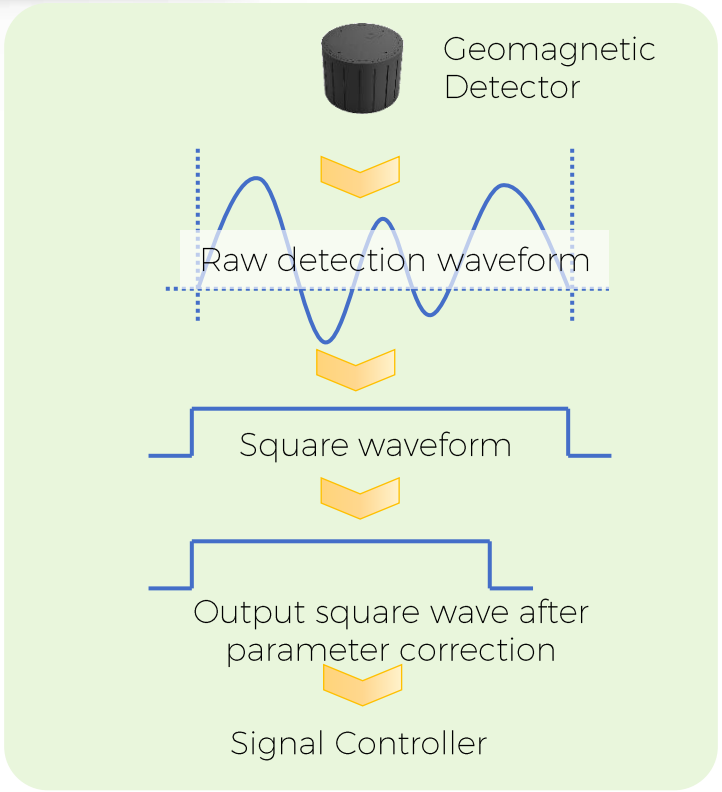
Expected 10-year Lifespan

Anti-interference Capability

99% Data Accuracy

A Perfect Substitute of Inductive Loop Detectors





The loop outputs typically include TTL High-Level Effective, TTL Low-Level Effective, Normally Open Digital Output, and Normally Closed Digital Output.

For inductive loop detectors, the output modes usually consist of Pulse and Dry Contact.

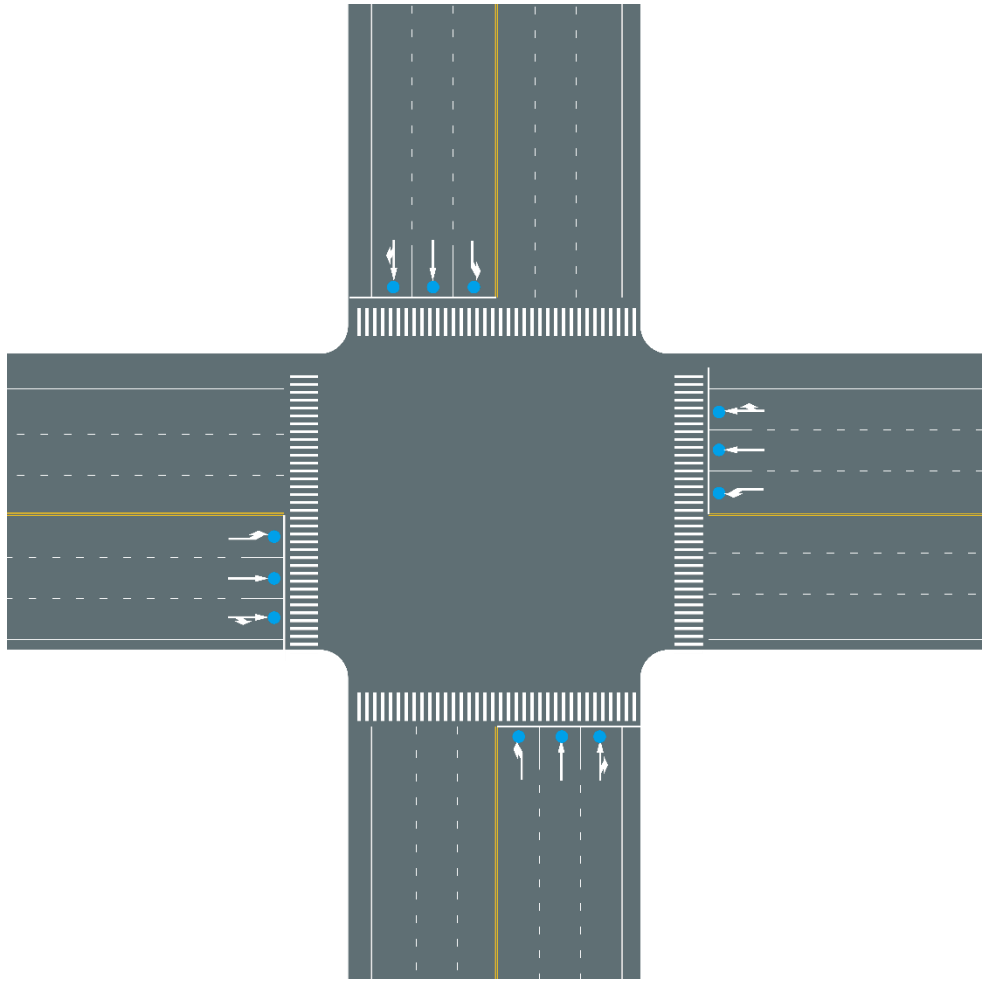
Geomagnetic Detector is fully capable of emulating the output modes of inductive loop detectors, achieving two-state outputs for "vehicle present" and "no vehicle."

The occupancy time can be determined based on the length and width of the installed inductive loop. The output function can be customized according to specific needs.

Perfect Match with SCATS System

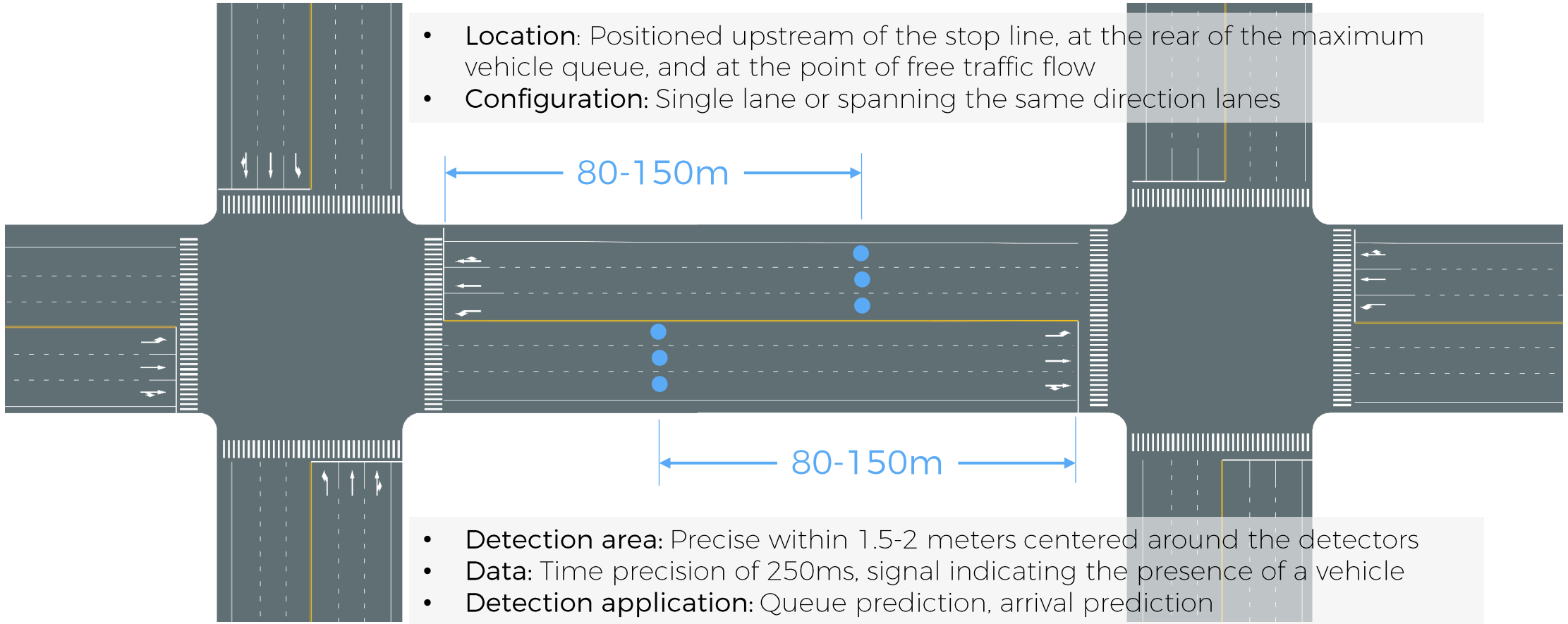
SCATS Optimization Control

- **Location:** Stop line online, 1-3 meters after the stop line
- **Configuration:** Single lane configuration
- **Detection area:** Detection area along the direction of travel, precise within 1.5-2 meters
- **Data:** Time precision of 250ms, signal indicating the presence of a vehicle
- **Detection Application:** Detecting vehicle passage characteristics



Perfect Match with SCOOTS System

SCOOTS Optimization Control

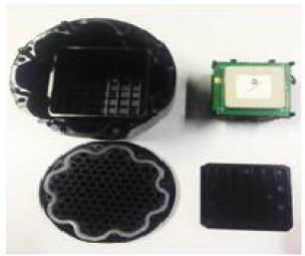


- **Location**: Positioned upstream of the stop line, at the rear of the maximum vehicle queue, and at the point of free traffic flow
- **Configuration**: Single lane or spanning the same direction lanes

- **Detection area**: Precise within 1.5-2 meters centered around the detectors
- **Data**: Time precision of 250ms, signal indicating the presence of a vehicle
- **Detection application**: Queue prediction, arrival prediction

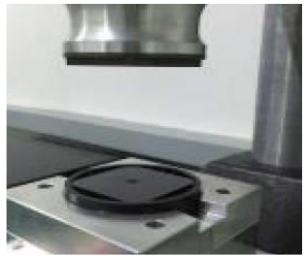
Robust Structural Design

Waterproof



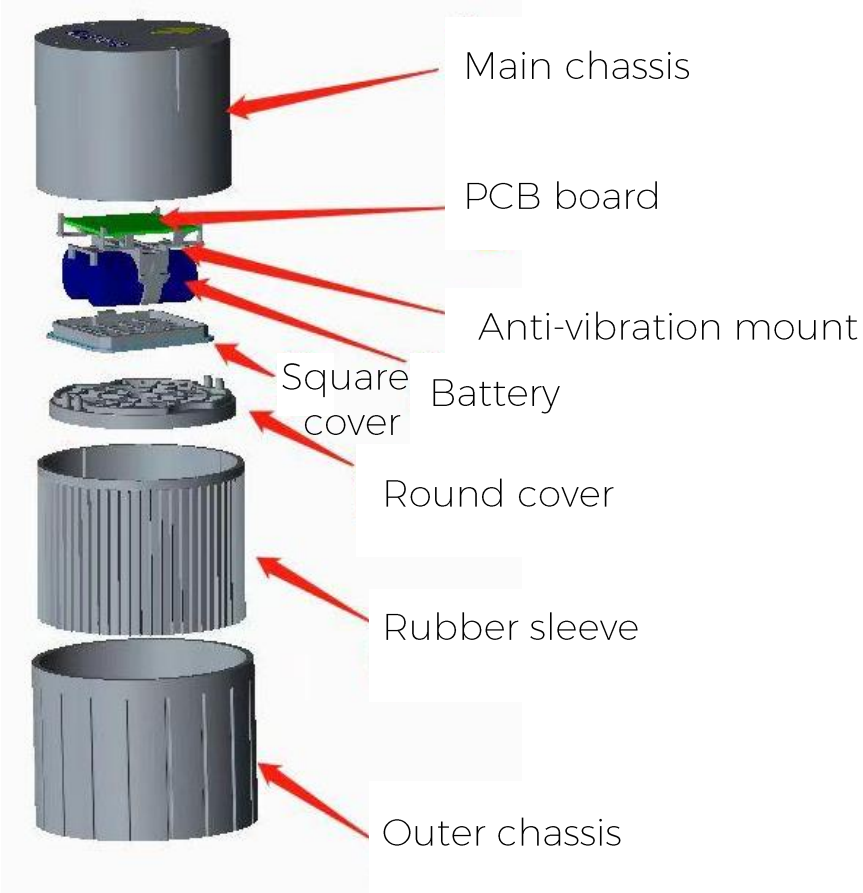
1

2



3

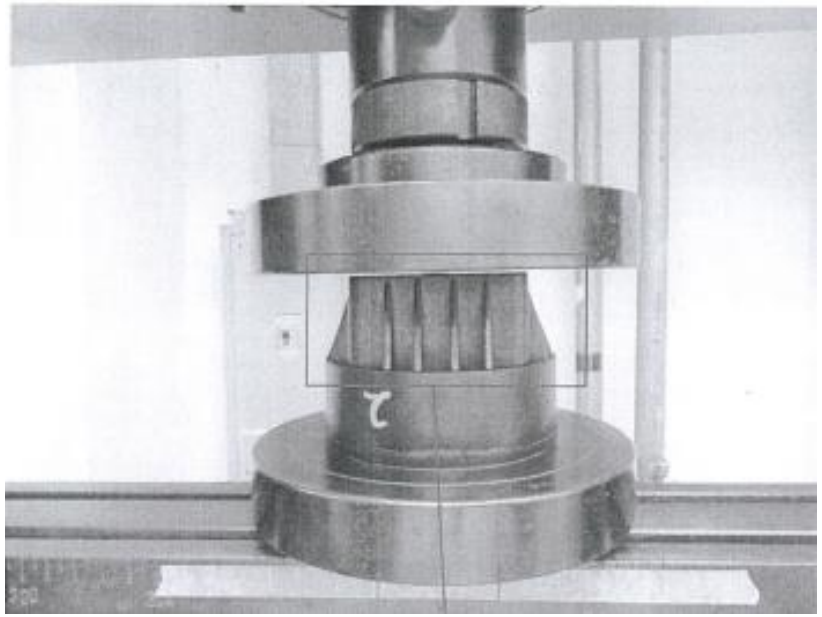
1. Double-layer sealing, integrated without screw threads
2. Ultrasonic welding for the outer shell
3. Ultrasonic welding for the inner shell



Robust Structural Design

Impact resistant

- Bottom: Designed in a cylindrical shape to better disperse the pressure from the ground to the ground magnetic detector.
- Top: Designed for a smaller volume to reduce the stress area.
- Shell: Reinforced internally and externally to dissipate force and provide strong support.
- Interior: Equipped with a lock and shock-absorbing fixing device.
- Testing: Withstands 7 tons of compression and undergoes 450,000 impact tests.



Expected 10-year Lifespan

Ultra-low power consumption

- Ultra-low power consumption IC
- Independently developed low-power networking solution

- 18AH battery (theoretical calculation) operates for over 10 years.
- Test environment:
  - 7.8ms magnetic field sampling rate (ensuring accuracy for 120km/h speed testing as a basis)
  - Single sampling time of 50us (ensuring ultra-low power consumption)
  - Counting for 1800 vehicles per hour

Strict control of production materials

Strict In:

- Careful selection of high-quality raw material suppliers.
- Strict performance testing of purchased raw materials.
- Stringent compliance of raw materials with industrial standards.

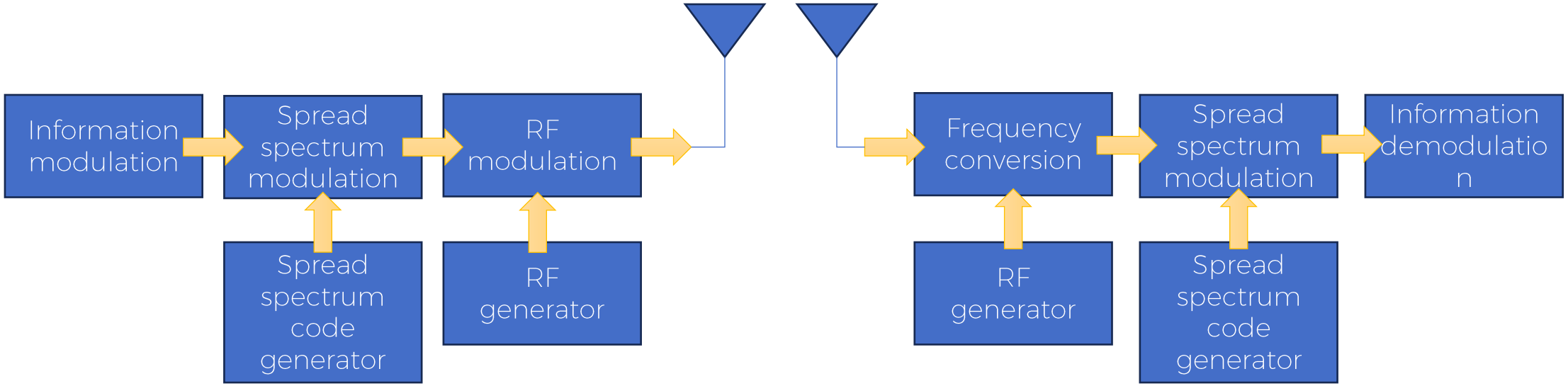
Strict Out:

- High standards (waterproof, stamping, corrosion resistance).
- Environmental testing.
- Comprehensive functional and performance testing.

Anti-interference Capability

DSSS（Direct Sequence Spread Spectrum）suppresses in-band interference

- Transmit signals in a broadcast format within the specific transmission frequency of the device.
- Before spatial transmission of user data, a "spreading code" is attached to achieve spread spectrum transmission.
- The receiver eliminates interference during the demodulation process. Noise signals are simultaneously removed during the extraction of the spreading code and extraction of the valid signal.



Anti-interference Capability

Effective suppression of 100% of out-of-band interference

Adding a shielding cover

Increasing the rectangular coefficient of the filter

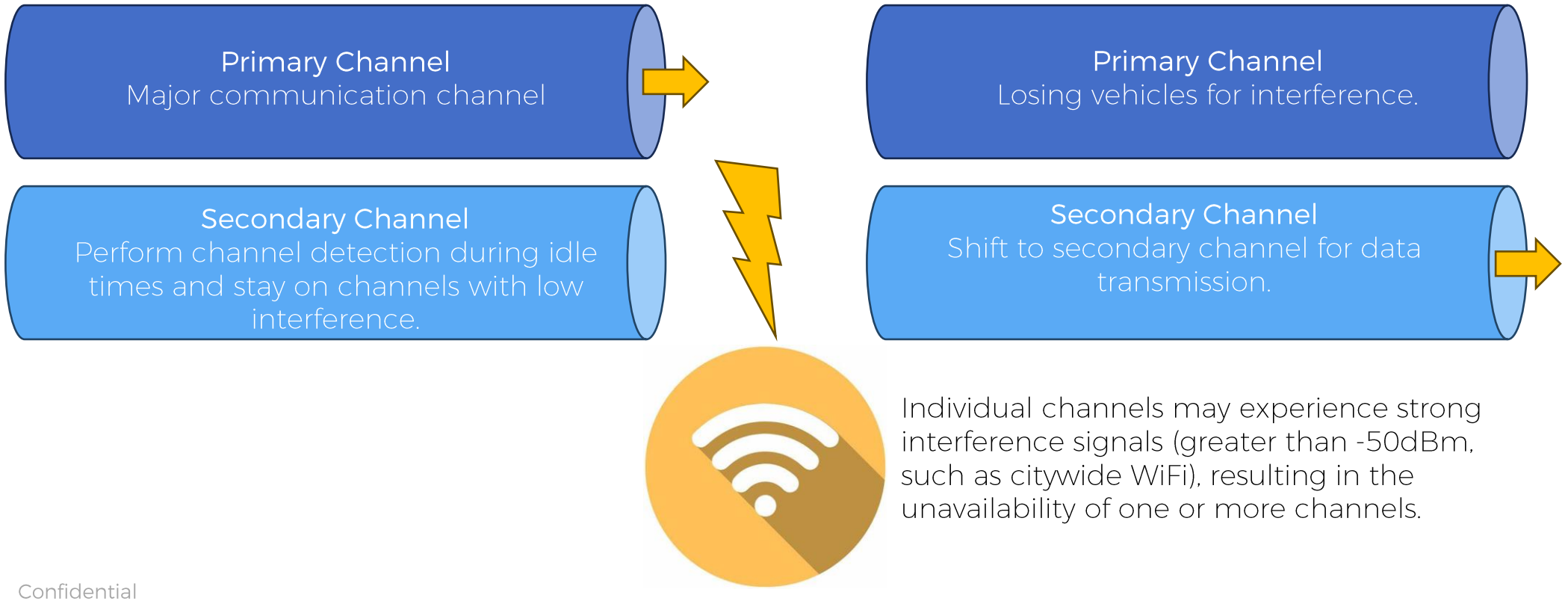
Enhancing the frequency-selective capability of the antenna

Improving the receiver's anti-blocking capability

Through the above four technical means, it is possible to effectively suppress 100% of out-of-band interference.

Anti-interference Capability

Dual-channel communication technology

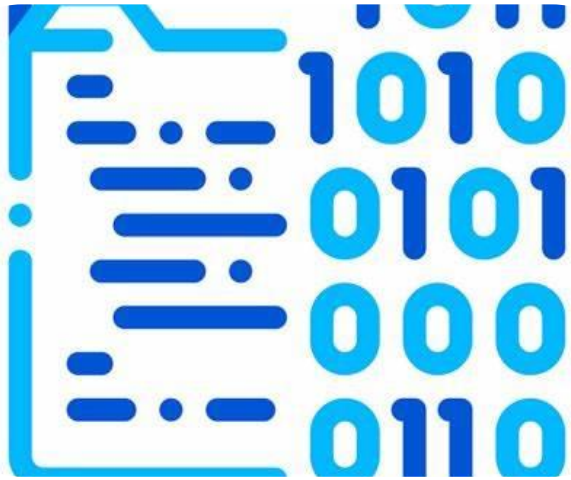


Individual channels may experience strong interference signals (greater than -50dBm, such as citywide WiFi), resulting in the unavailability of one or more channels.

Anti-interference Capability

System networking technology

Introducing the concept of time slots to reduce transmission time and mitigate the probability of interference



Pre-coding intersection lock-in technology to ensure the accuracy of transmission

Using directional antennas for transmission, constructing angles reasonably to reduce the strength of interference signals

99% Traffic Data Accuracy

Accurate Data Acquisition

- High-precision magnetic sensor
- 12-bit ADC resolution
- High sampling rate
- Triaxial three-dimensional sampling
- Optimized software algorithms

Accurate Data Transmission

- Custom Protocol
- Data Validation/Checksum
- Handshake Mechanism
- Data Retransmission Mechanism
- Data Error-Tolerance Mechanism

- Flow accuracy not less than 99%.
- Average occupancy accuracy not less than 95%.
- Average vehicle speed relative error less than 2 km/h, detection speed range 0 to 180 km/h.
- Detection speed relative error less than 2 km/h, detection speed range 0 to 180 km/h.

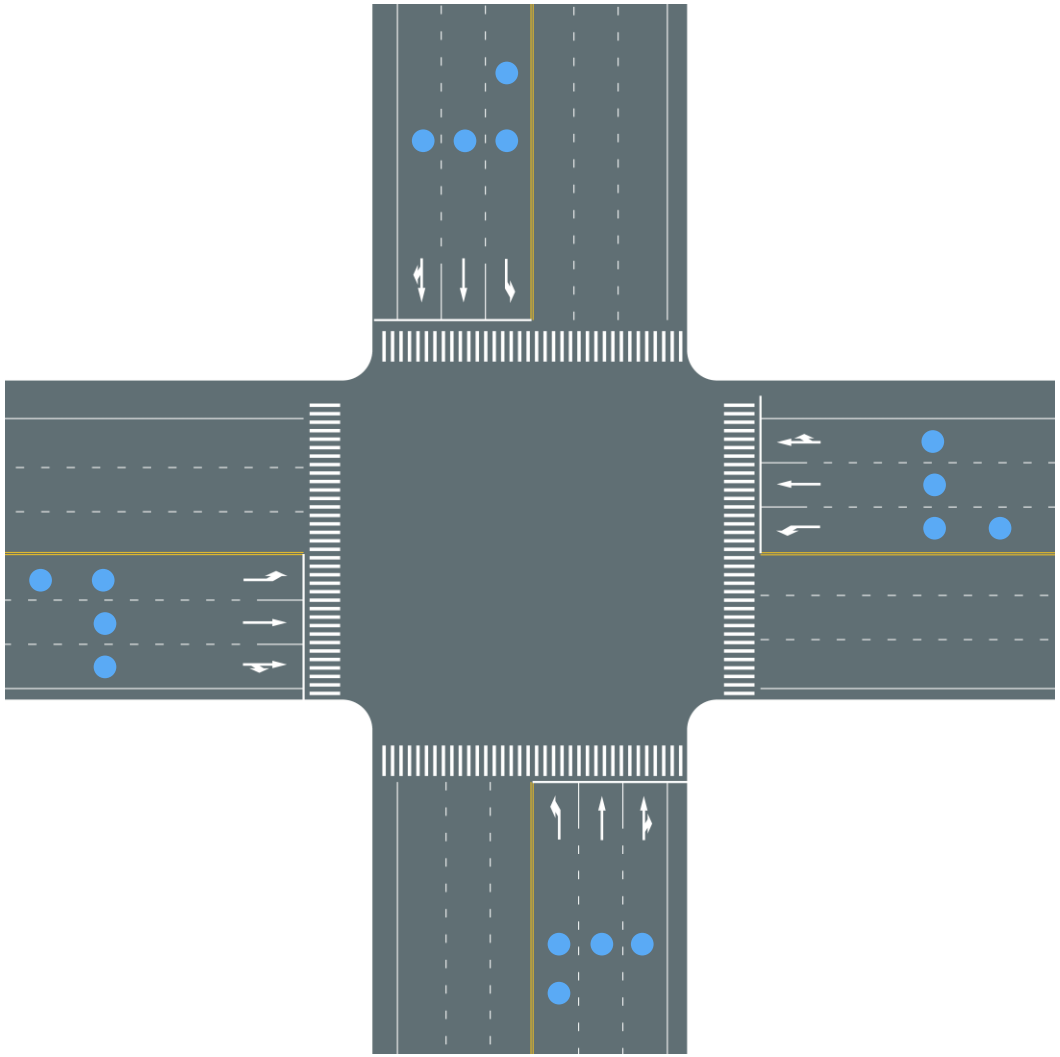
Applications

Inductive Control

Inductive control adjusts signal times at intersections based on real-time detection of approaching vehicles. It starts with a minimum green light duration, extending it if vehicles continue to arrive. The process repeats until the accumulated green time reaches a maximum or no vehicles are detected, triggering a switch to the next signal phase.

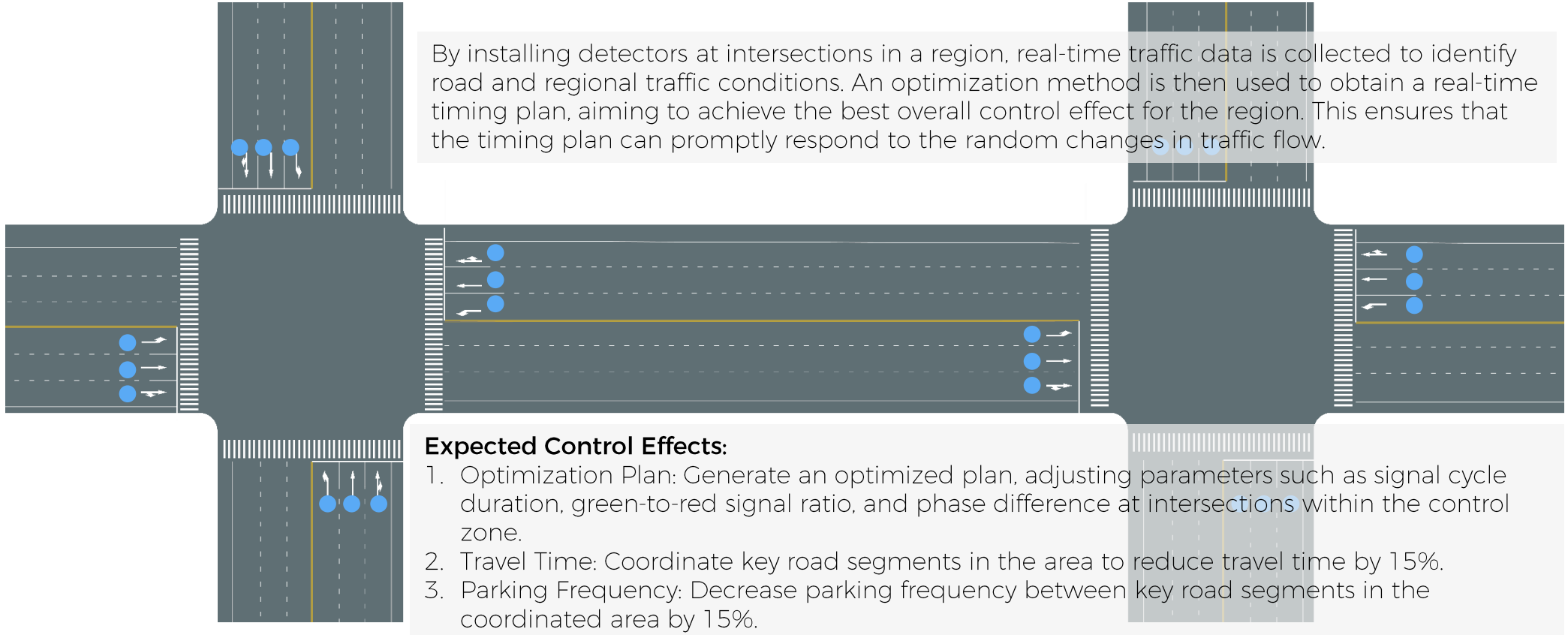
Expected Control Effects:

1. Queue Length: Reduce vehicle queue length to 20% of the original.
2. Green Loss Time: Ensure green loss time is no more than 5 seconds.
3. Second Pass: Eliminate vehicles queuing for a third pass at the intersection; reduce the number of vehicles making a second pass by 30% compared to the original.



Applications

Adaptive Coordinated Control



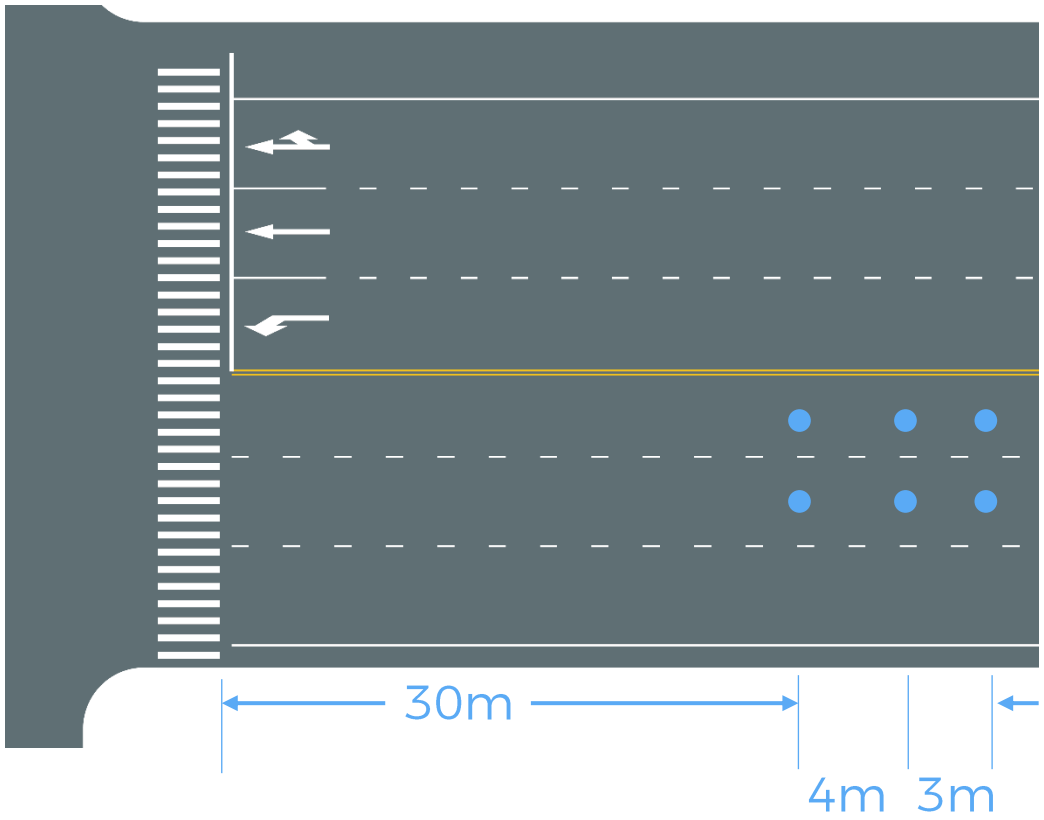
By installing detectors at intersections in a region, real-time traffic data is collected to identify road and regional traffic conditions. An optimization method is then used to obtain a real-time timing plan, aiming to achieve the best overall control effect for the region. This ensures that the timing plan can promptly respond to the random changes in traffic flow.

Expected Control Effects:

1. Optimization Plan: Generate an optimized plan, adjusting parameters such as signal cycle duration, green-to-red signal ratio, and phase difference at intersections within the control zone.
2. Travel Time: Coordinate key road segments in the area to reduce travel time by 15%.
3. Parking Frequency: Decrease parking frequency between key road segments in the coordinated area by 15%.

Applications

Overflow Control



Overflow control involves placing detection points on lanes a certain distance from the exit direction at the current intersection. If vehicles come to a prolonged stop at these points, it indicates that the exit lane has reached maximum saturation. In response, entry into the central area from that direction is prohibited.

The triggering condition is when two lanes are simultaneously occupied for more than 5 seconds (adjusted accordingly).

Expected Control Effects:

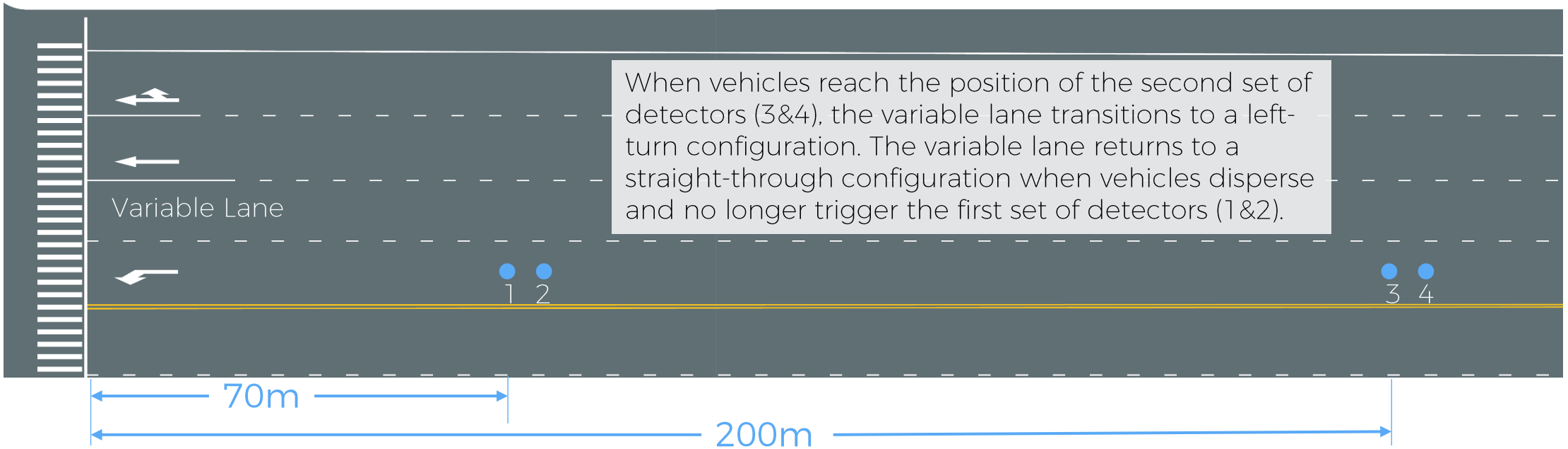
- Detect and trigger overflow control whenever a queue overflow occurs, preventing deadlock situations at the current intersection. This ensures maximum utilization of road resources while promptly addressing overflow incidents.

Applications

Variable Lanes

Variable lanes change their indicated direction based on traffic flow characteristics.

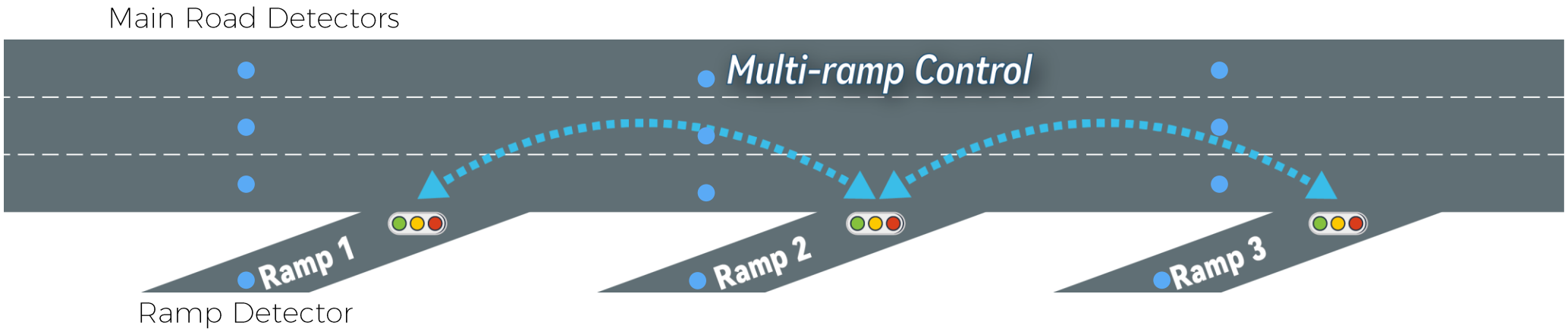
Expected Control Effects:
Improving left-turn lane efficiency by 10-30% to alleviate traffic congestion and reduce queue lengths at intersections.



Applications

Ramp Control

- The entrance of the expressway ramp is equipped with detectors and traffic lights. Based on the congestion situation on the main road of the expressway, the ramp signal control system is used to control the number of vehicles entering the main road and coordinate the control of the ramp queues to ensure the smooth flow of the expressway.
- When one or more ramps are queued for warning, an automatic adjustment mechanism can be established for each ramp upstream and downstream, ensuring that the queues of connected ramps are balanced and maintaining the efficiency of traffic flow on the main road.



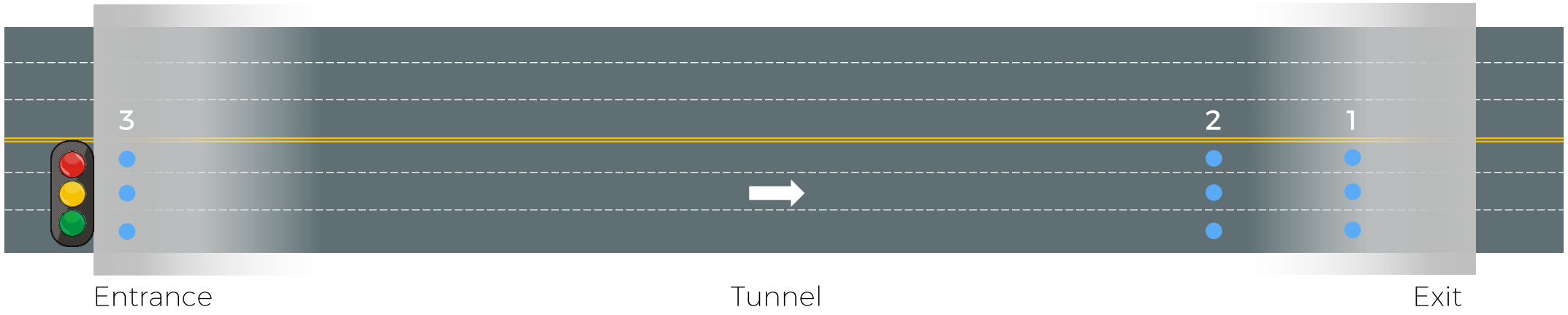
Applications

Tunnel Control

Reduce congestion inside the tunnel, ensure that the vehicles in the maximum queue can exit the tunnel exit within one cycle, and maximize the elimination of safety hazards inside the tunnel caused by accidents and other incidents.

Steps:

- When the queue extends to location 1, the traffic light at the tunnel entrance switches to red.
- Based on vehicle counts recorded by detectors at location 3, only a specified number of vehicles are permitted to enter the tunnel.
- As the queue reaches detectors at location 2, progressively decrease the allowed number of vehicles for entry in subsequent cycles.



Applications

Highway Traffic Flow Detection

Challenges	Solutions
1. Poor real-time performance, unable to upload data promptly. 2. Low data accuracy and insufficient detection precision. 3. Unreasonable deployment of data collection devices. 4. Severe damage to equipment during use, leading to the inability to guarantee normal operational status and data validity.	1. Collect traffic volume and vehicle speed at the entrances and exits of highway toll booths. 2. Collect traffic volume and vehicle speed at entrances and exits of highway service areas. 3. Collect traffic volume on various bridges connected to the highway and perform congestion analysis. 4. Implement warnings and management for vehicle queues passing through toll booths.

Installation points for road segments:

- Distance from toll booths: 100m/200m/150m/500m
- Installation near highway ramps

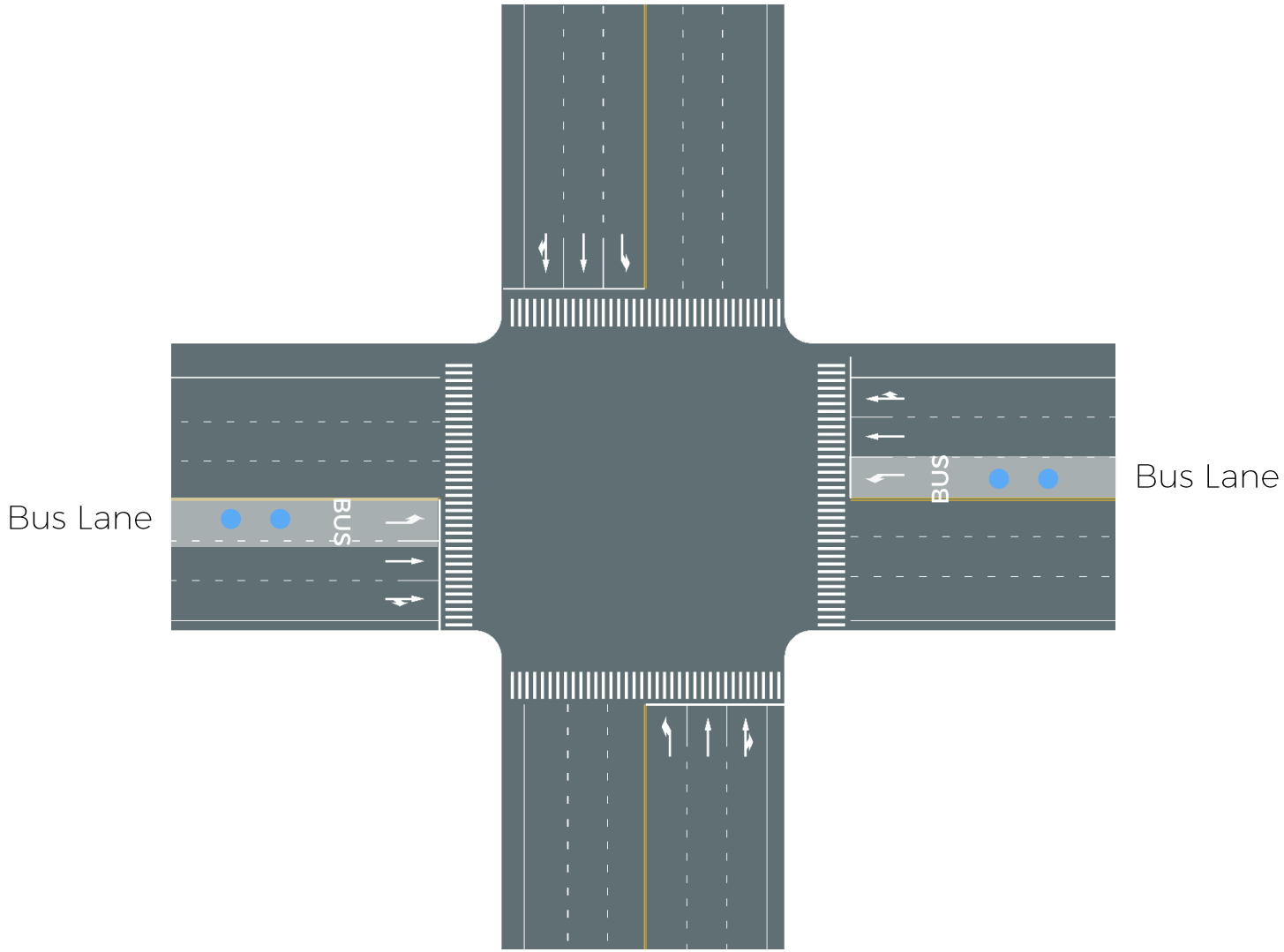
Node position installations:

- Service area entrances and exits
- Installation at the head of elevated bridges
- Entrances and exits in airport areas

Applications

Bus Priority Control

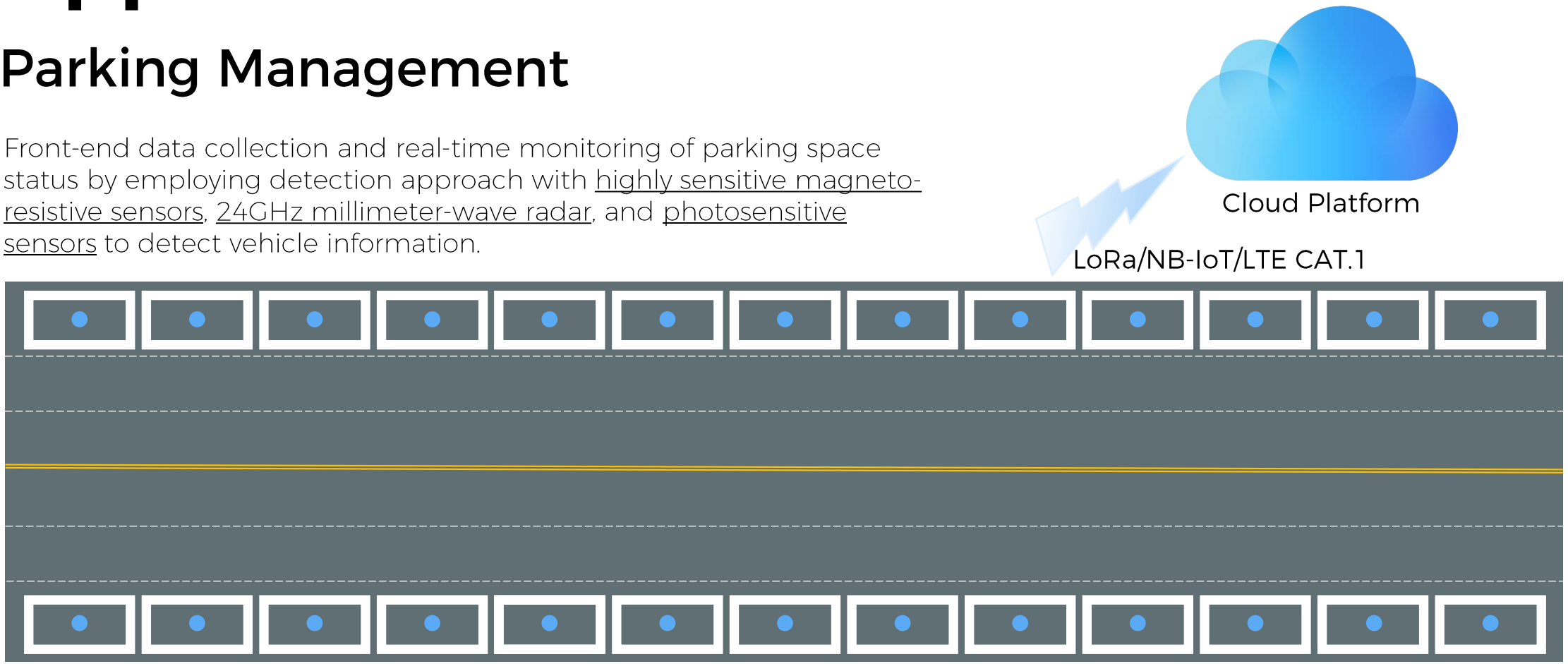
- Each dedicated bus lane is equipped with two magnetic sensors to provide information such as traffic flow, speed, and occupancy. The data is then transmitted through the network to the signal control system and the rapid transit system platform.
- Before a bus approaches an intersection, if the traffic light at the intersection is currently green, it will be timely extended to allow buses that have not yet reached the intersection to have sufficient time to pass through.
- This approach enhances the efficiency of bus transit, ensuring operational speed.



Applications

Parking Management

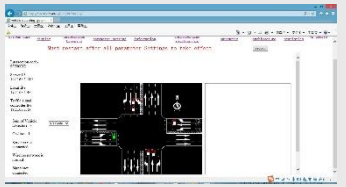
Front-end data collection and real-time monitoring of parking space status by employing detection approach with highly sensitive magneto-resistive sensors, 24GHz millimeter-wave radar, and photosensitive sensors to detect vehicle information.



Roadside parking, residential area parking, highway service area, guidance for parking in large parking lots, airport parking guidance

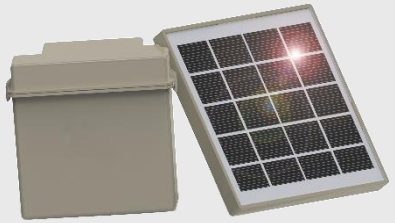
Ordering Options

S Series Geomagnetic Vehicle Detection System

ClairGeo-SDET	ClairGeo-SRPT	ClairGeo-SRCV	ClairGeo-SPDC	ClairGeo-SMGT
Detector	Repeater	Receiver	Data Processing Center	Management Platform
				
• Streamlined Factory Configuration • Integrated Power Control Module • 360° Wireless Signal Coverage • Self-Adaptive Position Learning	• Be needed to ensure reliable communication while the distance between the detector and receiver exceeds 80 meters.	• Act as the central hub where wireless data converges, and it subsequently transmits this data to the data processing center via an RS422 interface.	• LCD screen displays geomagnetic operational status: • On-site access to parameters • Quickly pinpoint maintenance device locations	• Subarea Management • Intersection or Road Segment Management • Detector Installation Position, Lane Mapping, and Parameter Configuration • Intersection Host Device Synchronization

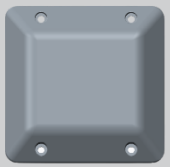
Ordering Options

M Series Geomagnetic Vehicle Detection System

ClairGeo-MDET	ClairGeo-MRPT	ClairGeo-MRCV	ClairGeo-MPDC	ClairGeo-MMGT
Detector	Repeater	Receiver	Data Processing Center	Management Platform
				
• X, Y, Z axis detection • Double-layer ultrasonic welding waterproof design • Anti-interference capability • Flow accuracy not less than 99%	• Broaden the signal range and coverage of a receiver • Bidirectional wireless communication between devices	• Capable of processing detection data into different formats • Synchronization of all lower devices • Wireless signal quality detection	• Processes and generates detection data • Transmitting scheduled and real-time data to the central platform server • Locally store detection data	• Geomagnetic device status monitoring • Query and export historical data • Data statistics and chart display • Integration of third-party platform

Ordering Options

MP Series Packing Detector

	Model	In-ground Installation	Surface-mount Installation	Dual-mode, supporting geo/radar	Triple-mode, supporting geo/ radar/photosensitive	LoRa	NB-IoT	CAT.1
	ClairGeo-MP2LR	√		√		√		
	ClairGeo-MP2NB	√		√			√	
	ClairGeo-MP2CA	√		√				√
	ClairGeo-MP3LR	√			√	√		
	ClairGeo-MP3NB	√			√		√	
	ClairGeo-MP3CA	√			√			√
	ClairGeo-MPS		√	√		√		

Ordering Options

How to select between S Series & M Series

	S Series	M Series
3 axis detection	Single axis detection: suitable for the cases while vehicle's passage is overhead the detectors.	X,Y,Z 3-axis detection: suitable for cases the passage is not directly above. Less interference between multiple lanes.
Antenna range	360° Omni-directional will ease the installation, however consumes more power and be with less anti-interference performance	±60° Directional antenna will have better anti-interference performance.
Repeater needed	While the distance between receiver and detectors are within 80m, no repeater will be needed.	Since repeaters are with directional antenna, repeater will be mandatory for each of the detectors.
Overall cost	Lower	Higher
Suitable cases	Small size installation with not too much wireless interference	Big size project with complicated environments

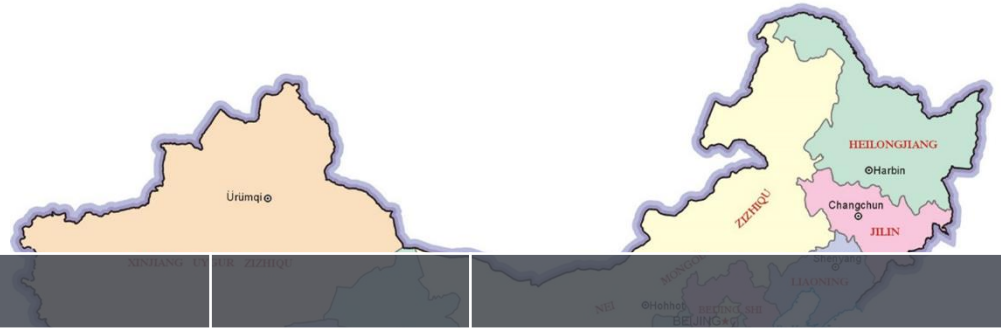
TraffiClair

Benchmark

	Sensys FlexMag Flush	Sensys FlexMag Mini	ClairGeo S	ClairGeo M
Dimension	74mm x 74mm Height: 54mm	Diameter: 56mm Height: 77mm	Diameter: 87 mm Height: 96 mm	Diameter: 107mm Height: 80mm
3-axis detection	3-axis detection	3-axis detection	Single axis detection	3-axis detection
Battery lifespan	Expected to be 10 years	Expected to be 10 years	10 years (5 years under extreme conditions with daily single-lane vehicle traffic exceeding 10,000 vehicles in a megacity)	10 years (5 years while single lane daily average traffic calculation reaches 20,000 vehicles)
Product sealing method	Screws	Screws	Screws	Ultrasonic welding (better waterproof performance)
Antenna type	Directional antenna	Directional antenna	Omni-directional antenna	Directional antenna
Antenna range	±60°	±60°	360°	±60°
Nominal transmit power	+3dBm	+3dBm	+18dBm	+15dBm
Typical receive sensitivity	-101dBm	-101dBm	-110dBm	-100dBm
Data Accuracy			Flow data accuracy 99%	• Flow accuracy not less than 99%. • Average occupancy accuracy not less than 95%.

Cases

Onsite installs 150,000+ units



Beijing	In the Olympic area around the Temple of Heaven, the Qinghe area, SCOOT adaptive control is coordinated to provide real-time data. Nearly 50 intersections within the Second Ring Road operate with induction control throughout the day, offering real-time data.	Chongqing	More than 200 intersections in the main urban area provide real-time traffic detection data.
Shanghai	On Yan'an Road, Bus Route 71 has priority in traffic volume along the entire route, providing traffic detection data. In some intersections in Pudong New Area, the SCATS system is used for optimized control, providing real-time data.	Wuhan	In the city area, 400 intersections provide real-time traffic detection data.
Jinan	In the urban area, 700 intersections operate with induction control, overflow control, variable lane control, tunnel control, ramp control, and bus priority, providing real-time traffic detection data.	Nanjing	The Qilin tram traffic signal control project.
Xi'an	All 1200 intersections across the city provide traffic detection data, operating with induction control, overflow control, variable lane control, etc.	Changsha	A demonstration project for the Internet of Vehicles in the high-tech development zone.
Shenzhen	Traffic flow data detection is conducted on major roads such as Beihuan Road, Binhe Road, Shennan Avenue, and Bao'an Avenue within the city.	Baoding	Over 50 intersections operate with overflow control and variable lane control.
Ordos	In the old city area, 200 intersections have been running induction control continuously for 9 years.	Huangshi	In the city area, over 200 intersections provide real-time traffic detection data.

Questions & Answers

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Thanks