TraffiClair

ClairSRS Presentation

Smart Road Studs

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Confidential

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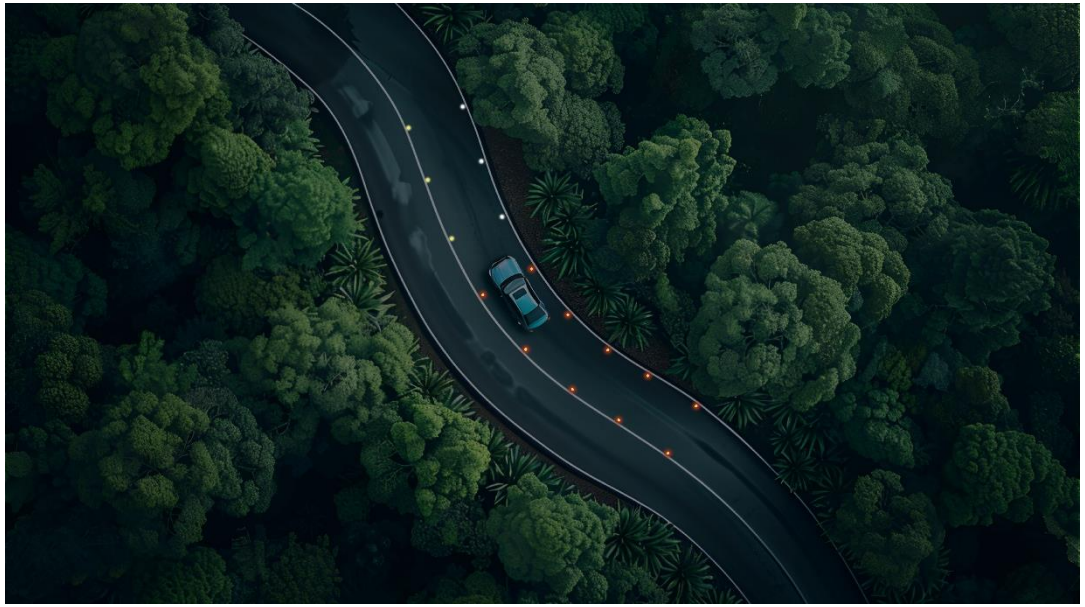
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ClairSRS Smart Road Studs

Solar-powered

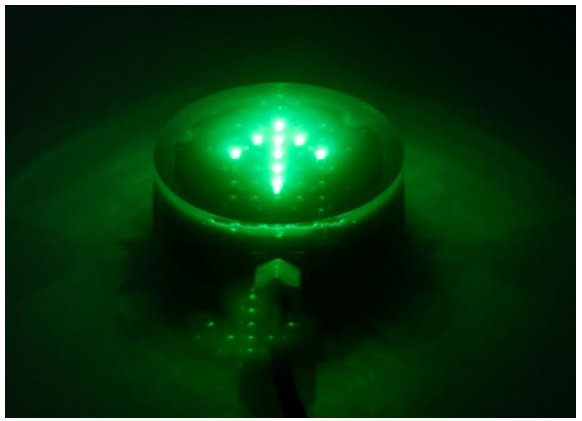






Wired-powered







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ClairSRS Key Features



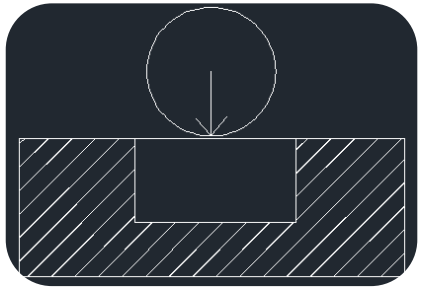
Solar-powered



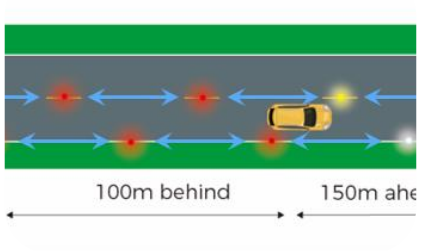
Geomagnetic Sensing



Ultra-bright LED Beads



Flush Ground Installation



Chain Communication



LED Control Mode

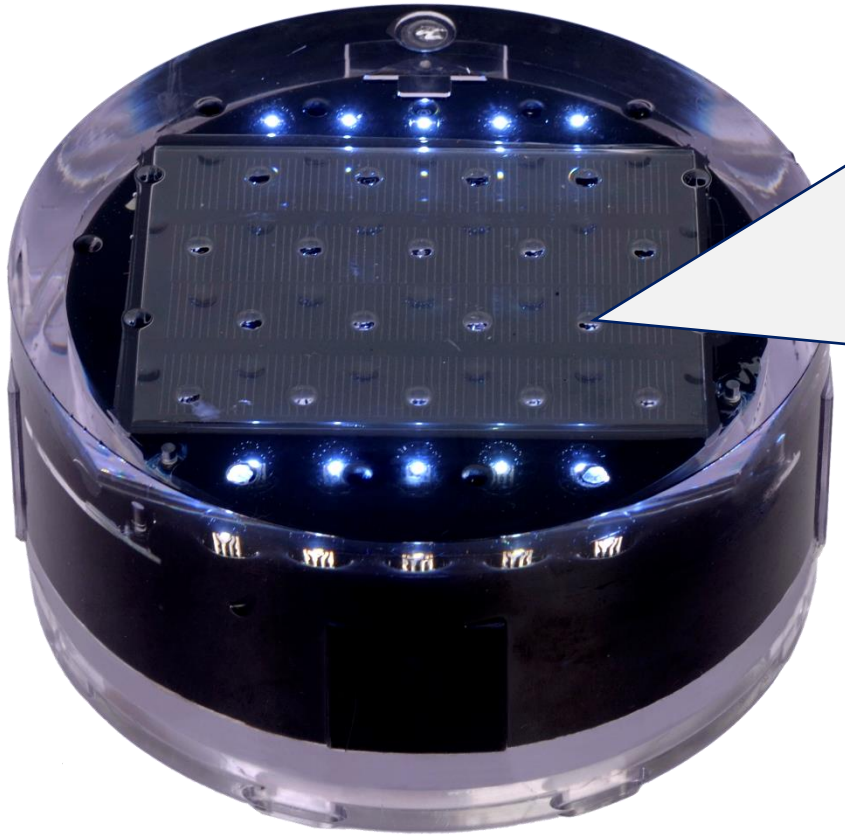


NFC Programming



Pressure Resistant Housing

Solar Power Supply



Solar-powered studs

- Solar-powered with a solar panel power of ≥1.1W.
- Battery: Lithium iron phosphate battery
- Battery Voltage: DC 3.2V
- Battery Capacity: 8000mAh
- Output – full charge: Up to 720 working hours with no solar input.
- Time to full charge: Time to full charge 69hrs @100klux (sunny day)



Solar-powered controller

Geomagnetic Sensing



The road stud is equipped with a built-in geomagnetic sensor that detects the approach and departure of vehicles. It collects various traffic parameters such as vehicle speed, queue length, and occupancy, and can detect vehicle stops or reverse movements. The system triggers corresponding responses using different light colors and flashing frequencies, enabling functions such as warnings, guidance, or traffic diversion.

- Detection Method: Multi-axis detection
- Sensitivity: Multi-level adjustable
- Data Types: Speed, queue length, occupancy, and detection of vehicle stops and reverse movements
- Wireless Power: Adjustable from 9 to 23 dBm
- Wireless Reception Sensitivity: -110 dBm

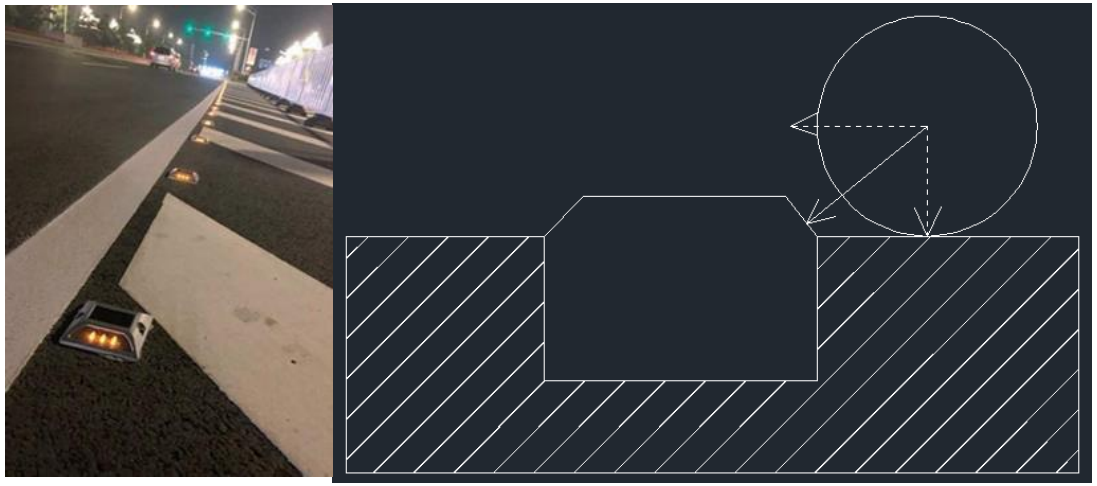
Ultra-bright LED Beads



- **LED Light Intensity:**
- **- Red: 12,000 to 15,000 mcd**
- **- White: 13,000 to 16,000 mcd**
- **- Yellow: 8,000 to 10,000 mcd**
- LED Emission Direction: Bi-directional
- LED Size: Diameter 8mm

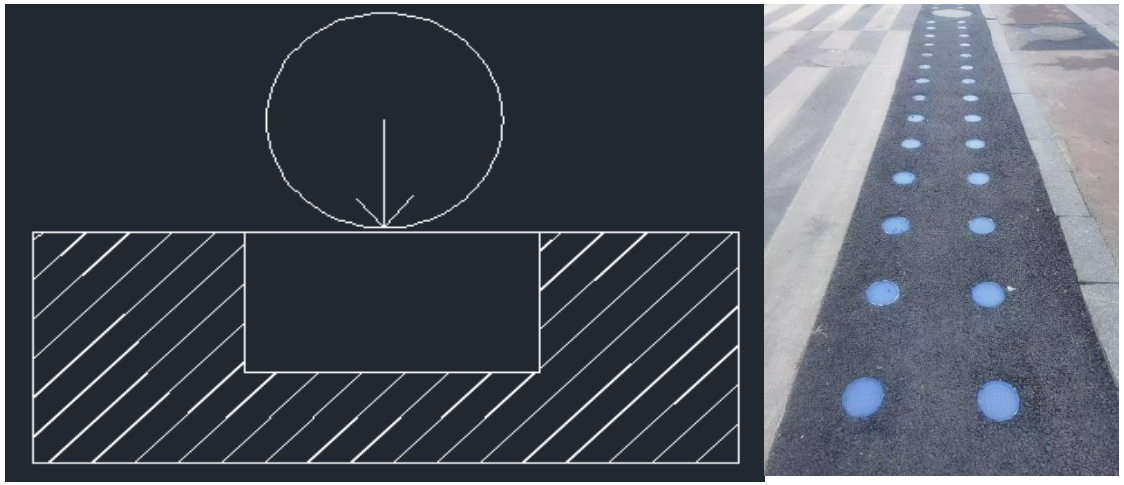
The device features ultra bright LED lights that can actively emit light in low visibility conditions or at night, enhancing road visibility and driving safety. Even during the day, the LEDs provide effective road guidance and information dissemination.

Flush Ground Installation



Other Studs: Raised Road Studs

- Impact to the studs, increased failure rate.
- Damage from cleaning vehicles such as snowplow.
- Raised legal disputes with damage to pedestrians and non-motorized vehicles.

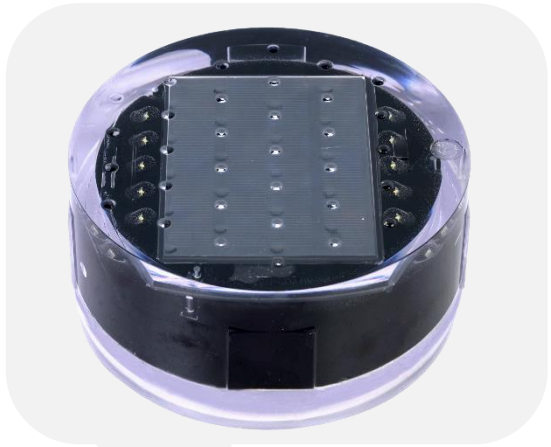


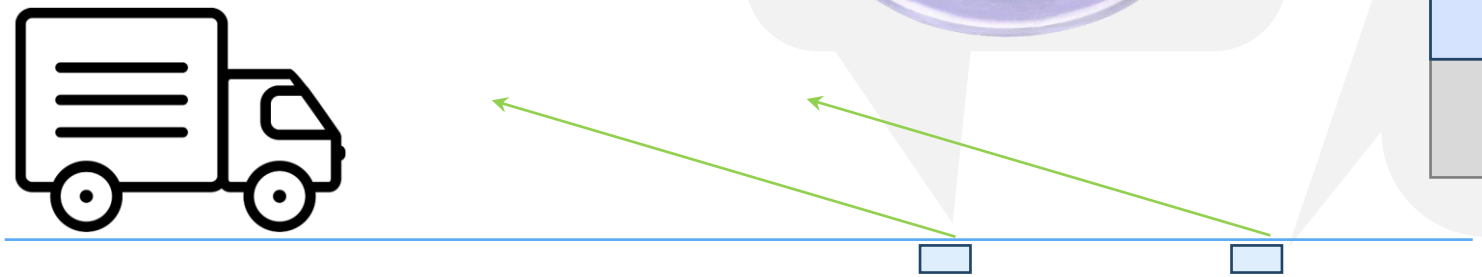
ClairSRS: Flush Ground Studs

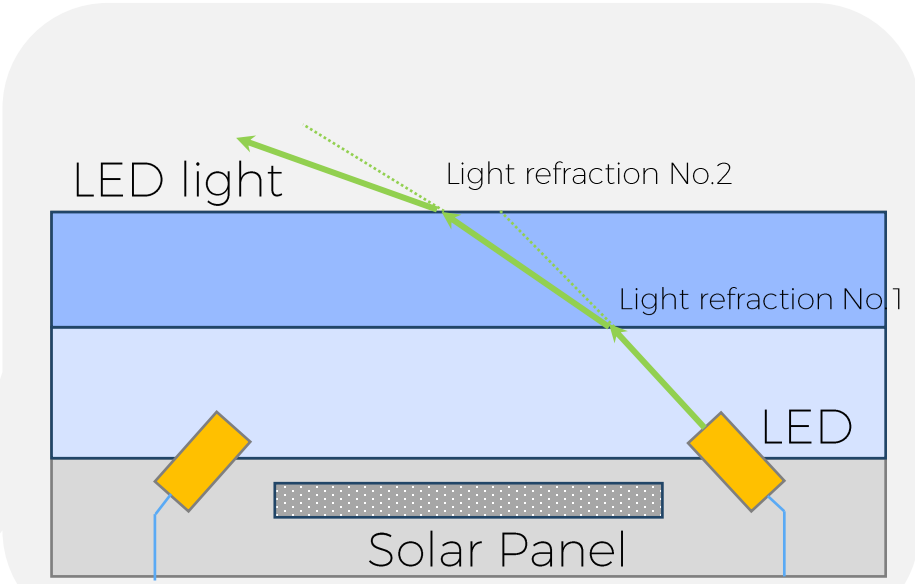
- No extra impact to the studs, enable a long-term life span.
- No damage from cleaning vehicles such as snowplow, and no damage to the cleaning vehicles as well.
- No damage to pedestrians and non-motorized vehicles.
- Patent two-stage light refraction design ensures good visuality for drivers without protrude above the surface of the road

Two-stage Light Refraction

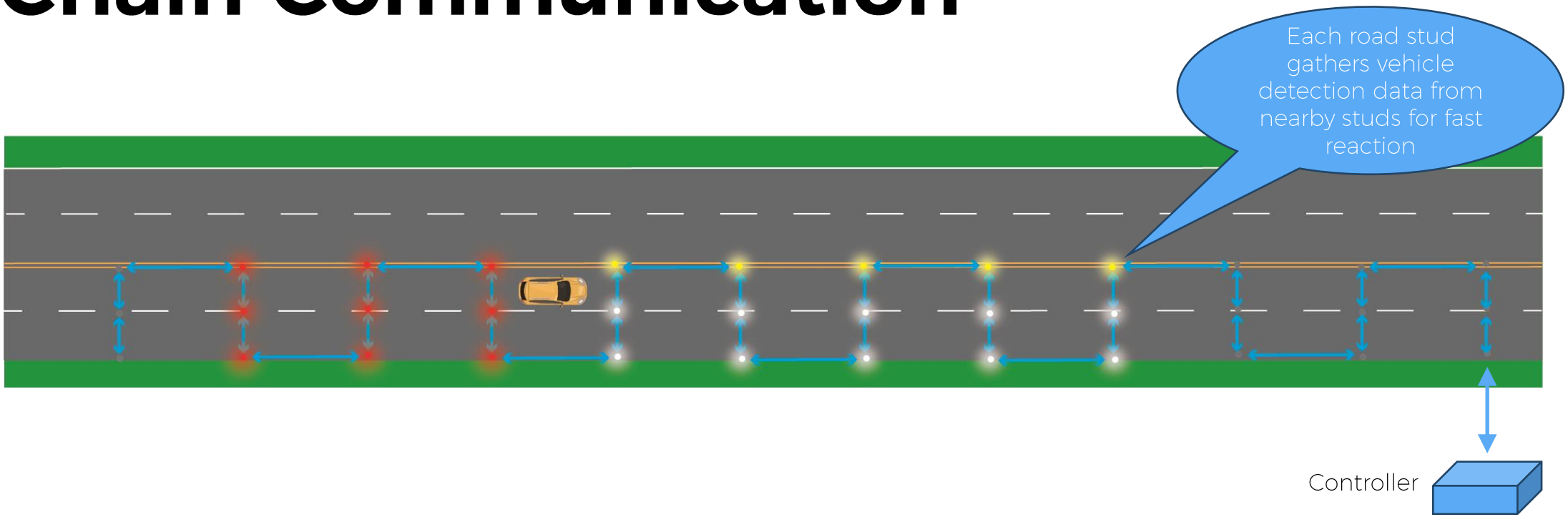
The patented design featuring a two-stage light refraction function allows the LED lamp beads of the road stud to not protrude above the road surface while still achieving excellent long-distance visibility. The surface of the road stud is flush with the ground, not affecting the normal operation of snowplows.







Chain Communication



- Based on 2.4GHz frequency wireless Communication.
- Each road stud gathers vehicle detection data from nearby studs and makes decisions on response strategies. **This distributed decision-making and low-latency communication system** eliminates network congestion issues typical of traditional communication methods, ensuring seamless light warning and vehicle-following effects even at high speeds

LED Control Mode

Brightness

Duty Cycle



Control over Position

Frequency

Fully Controllable
within the controller



All the illuminating strategy can be customized accordingly.

NFC Programming



NFC Programming and Remote Firmware Upgrades

- Configuration of location information, device reboot
- Firmware updates
- Parameter adjustments
- Mode switching
- Information retrieval

Pressure Resistant Housing

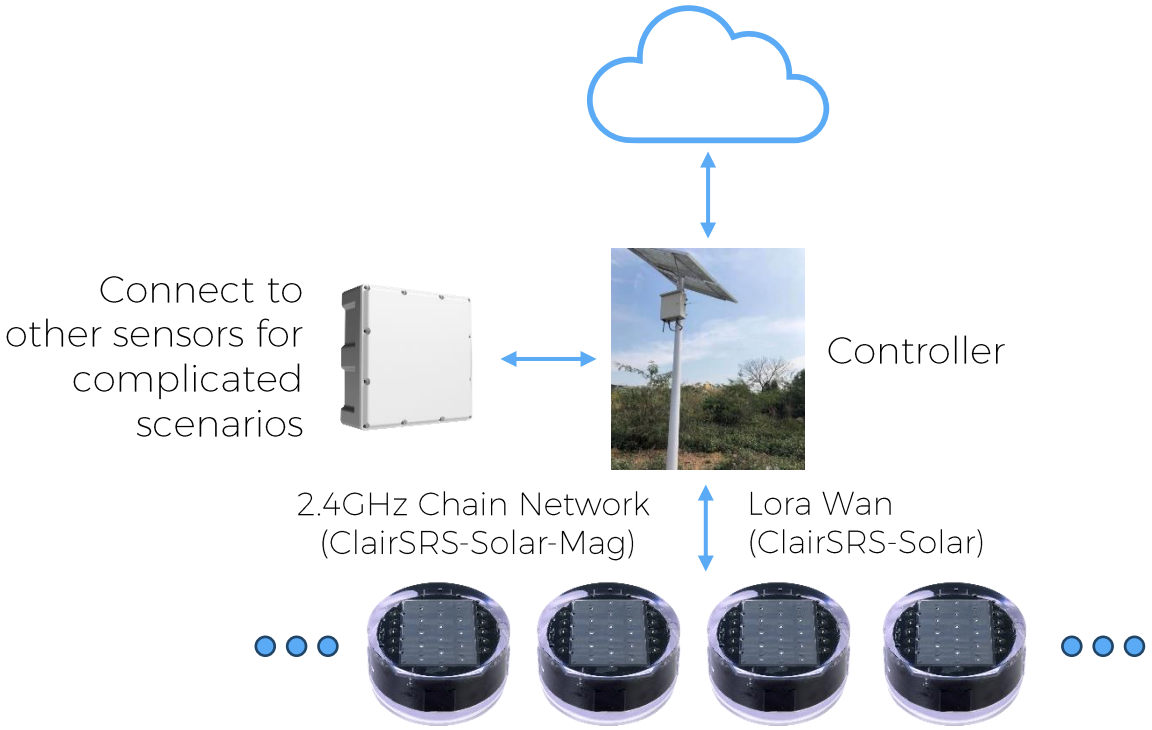


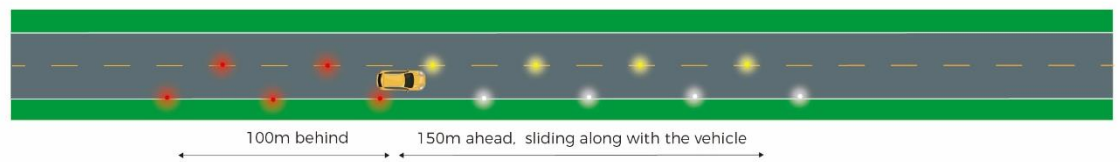
Overloaded vehicles are calculated at 160 tons. With 5 axles, there are a total of (4×4 + 2×1) 16 tires. Each tire can bear 10 tons. The tire width is greater than 30cm. The ground light diameter is 15cm, and the ground light can bear 5 tons.

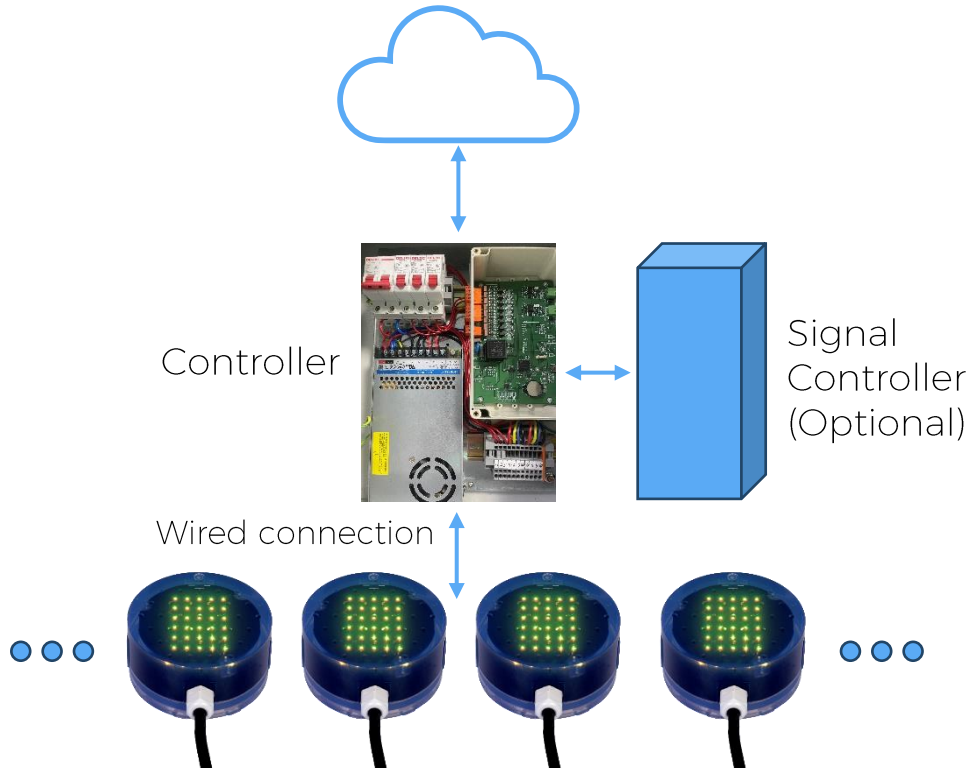
ClairSRS studs can withstand 26.5 tons >> 5 tons.

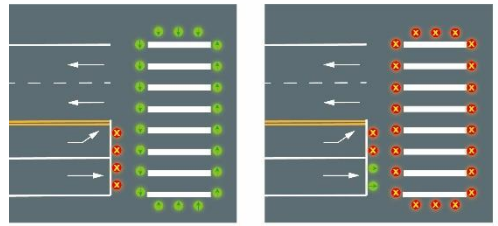
Made of reinforced PC material, the housing can withstand operating temperatures ranging from -45℃ to 85℃ and pressure up to 26.5 tons.

System Architecture

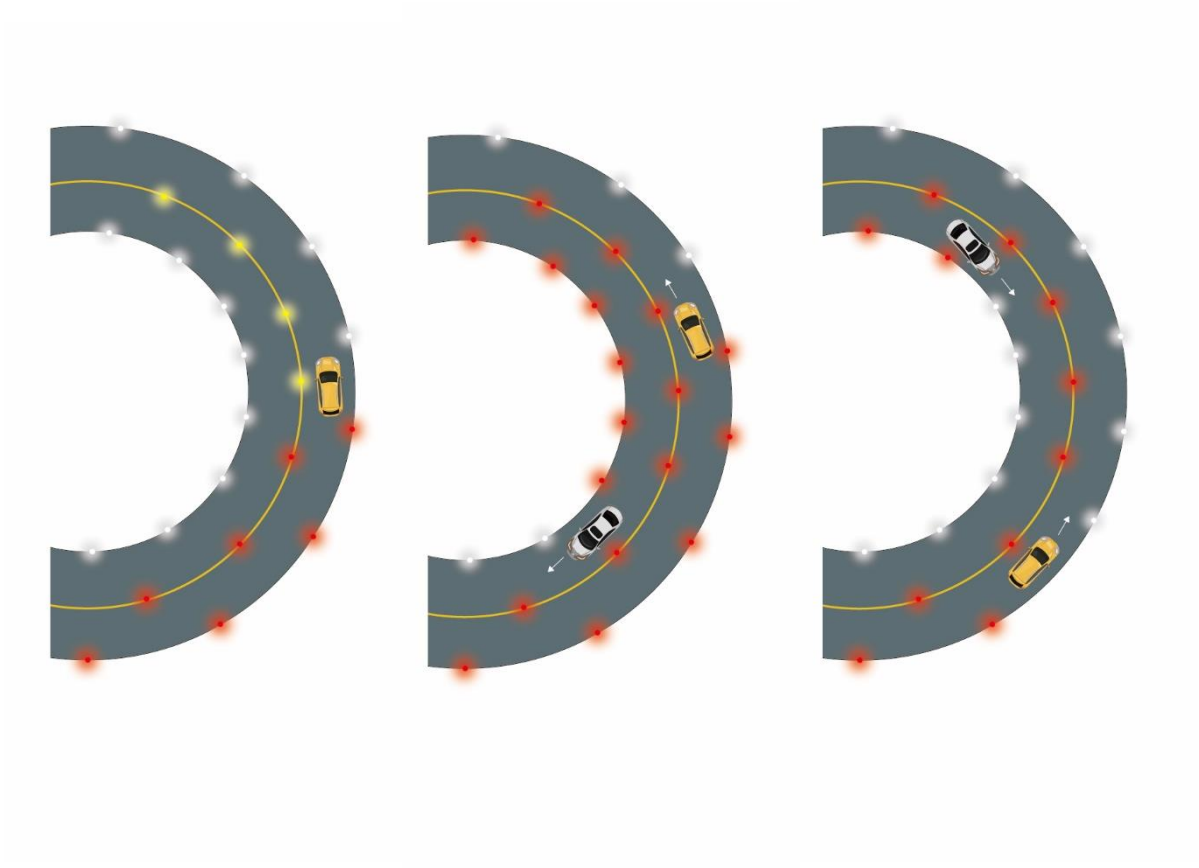








Application: Curve Warning



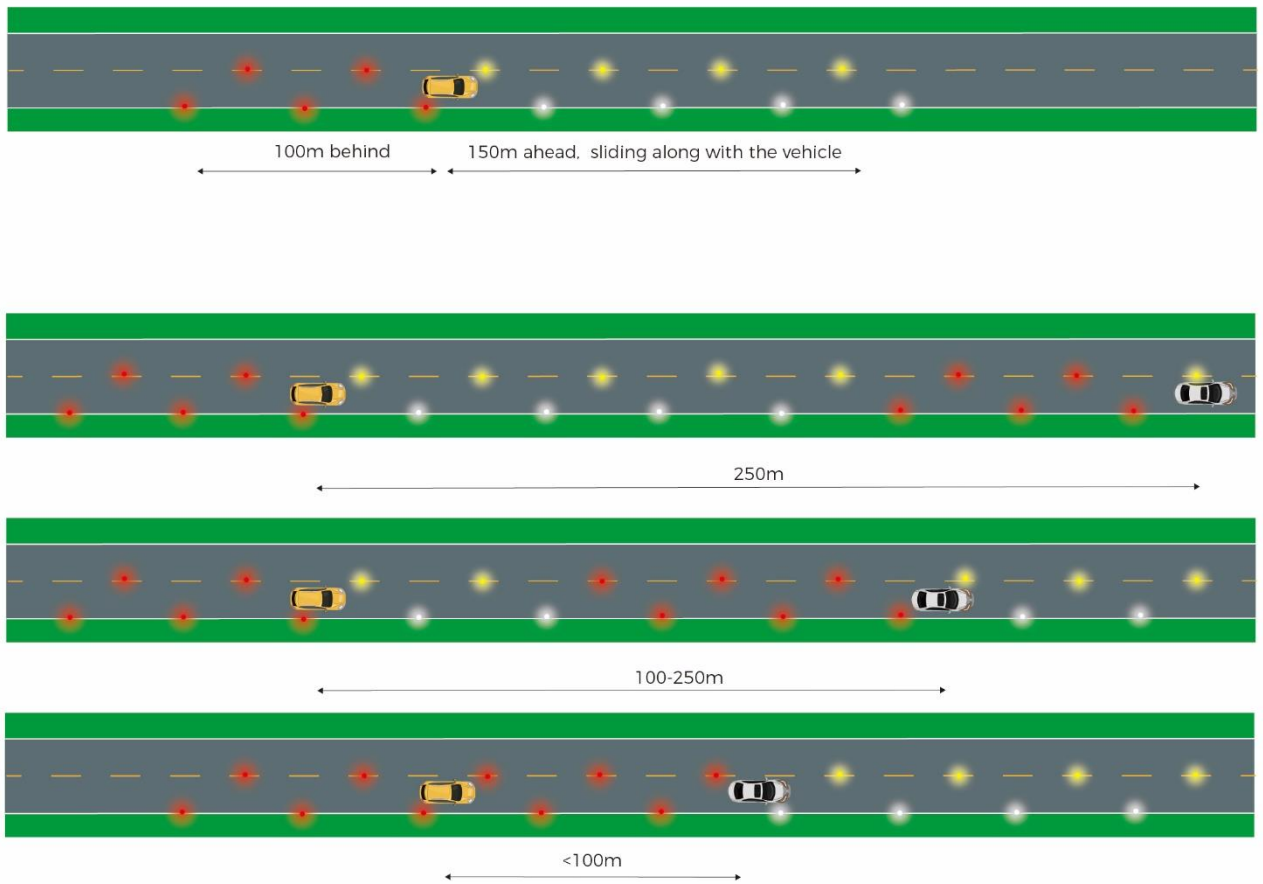
In situations such as small-radius curves or poor-visibility road sections, the system can manage scenarios like single-vehicle travel, oncoming traffic, and roadside parking.

Functionality:

- For Vehicles Ahead: Yellow (or white) lights illuminate in front of the vehicle.
- For Vehicles Behind: Red lights are displayed at the rear.
- For Oncoming or Rear Traffic: The centerline and edge lines also adjust accordingly to enhance visibility and safety.

Notice: All the illuminating strategy can be customized accordingly.

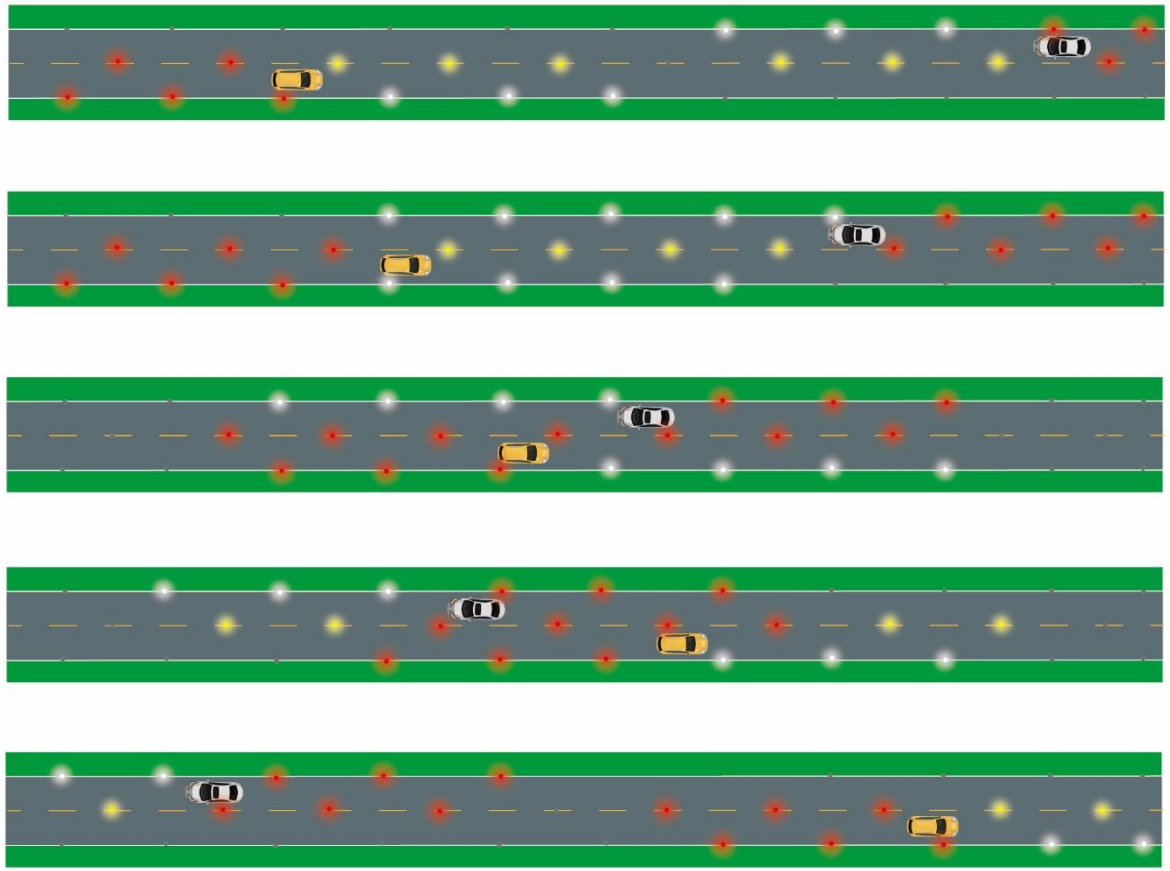
Application: Fog Zone Driving Alerts & Main Road Section Visibility Alerts



- For a certain distance ahead of the vehicle (e.g., 150 meters), the smart road studs in the center of the lane flash yellow, and the studs along the lane edges flash white, moving with the vehicle.
- For a certain distance behind the vehicle (e.g., 100 meters), the smart road studs on both the lane centerline and the edges flash red, also moving with the vehicle.
- During follow driving (scenario 2.1 combination overlay), similar to scenario 2.1, the system follows the principle of yellow (white) lights in the front and red lights in the rear, with red lights having higher priority.
- Taking two vehicles in follow driving as an example, the status can be divided into several stages depending on the distance between the vehicles, such as ① when the distance is far and does not constitute following, ② when the distance is closer, and ③ when the distance is within the red light zone behind the leading vehicle.
- ① When the distance between the vehicles is far, not constituting follow driving, each vehicle follows the single-vehicle driving status. There is a certain length of dormant road studs between the red light band behind the leading vehicle and the yellow (white) light band in front of the following vehicle (e.g., distance > 250 meters);
- ② When the distance between the vehicles becomes closer, the dormant road studs gradually reduce as the two vehicles approach, until all the lights are activated (e.g., distance = 250 meters). Furthermore, as the two vehicles continue to get closer (e.g., 100 meters < distance < 250 meters), the yellow (white) light band in front of the following vehicle gradually decreases;
- ③ When the distance between the vehicles is less than the length of the red light band behind the leading vehicle (e.g., distance < 100 meters), the entire space between the two vehicles will be covered by the red light band.

Notice: All the illuminating strategy can be customized accordingly.

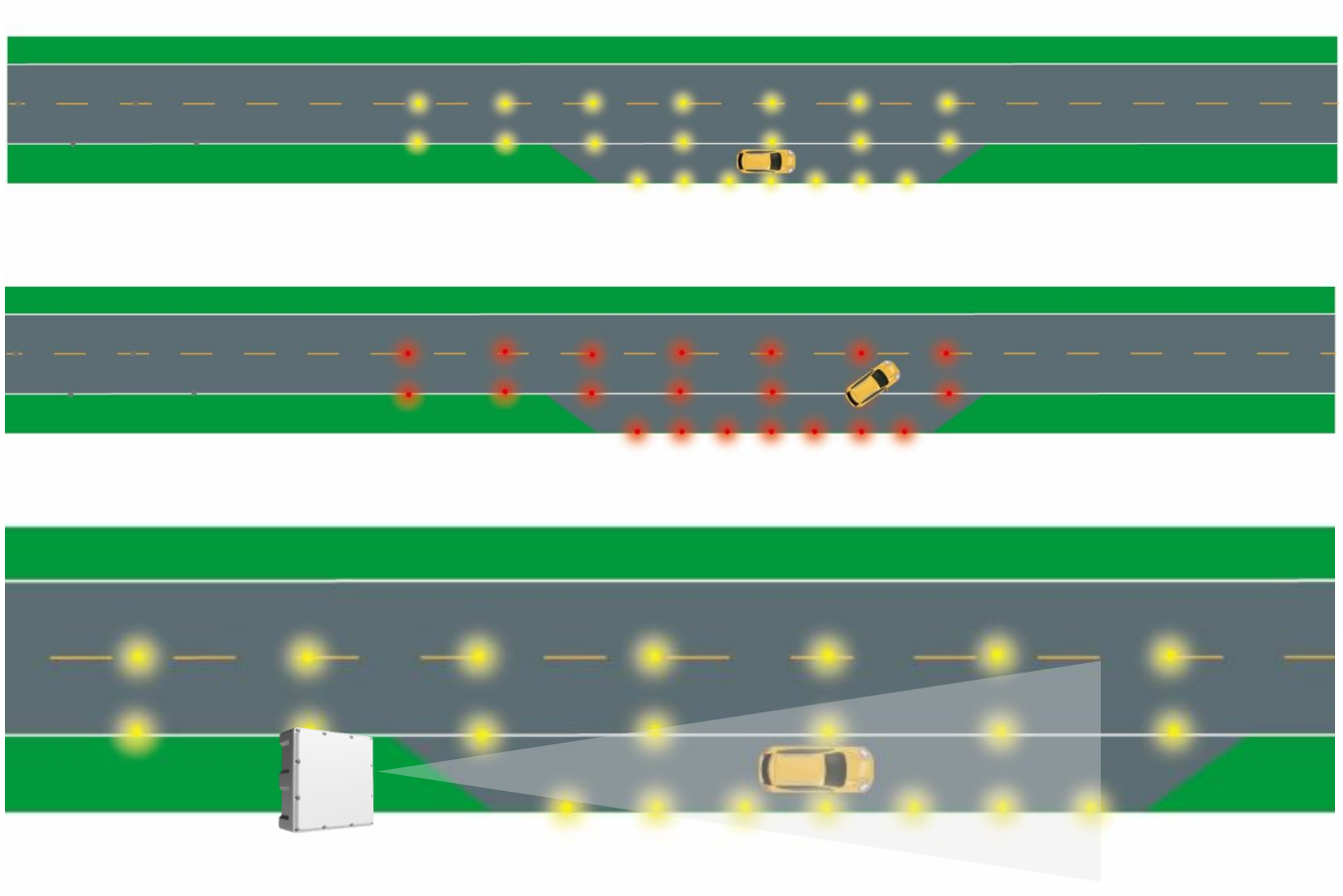
Application: Fog Zone Driving Alerts & Main Road Section Visibility Alerts



- During passing (oncoming) driving, the system follows the principle of yellow (white) lights in the front and red lights in the rear, with red lights having higher priority.
- Taking the example of one vehicle passing another (scenario 2.3.1), the situation can be divided into several stages: ① when the vehicles are far apart, ② as they gradually approach, ③ when they meet, ④ as they gradually move apart, and ⑤ when passing is complete.
- ① When the distance between the vehicles is far, each vehicle follows the single-vehicle driving status, and there is a certain length of dormant road studs between the two vehicles (e.g., distance > 300 meters);
- ② As the two vehicles gradually approach, the dormant road studs reduce until all the lights are activated (e.g., distance = 300 meters). Furthermore, as the vehicles continue to get closer (e.g., distance < 300 meters), the yellow (white) light band between them gradually decreases;
- ③ When the two vehicles meet, at the meeting point (distance = 0), there will be a red light band on both sides behind the vehicles and a white light band along the front edges;
- ④ As the two vehicles gradually move apart but are still within close range (e.g., distance < 200 meters), the space between them will be covered by the red light band;
- ⑤ After passing is complete (i.e., distance > 200 meters), both vehicles return to their single-vehicle driving status.

Notice: All the illuminating strategy can be customized accordingly.

Application: Emergency lane parking alerts on main road sections

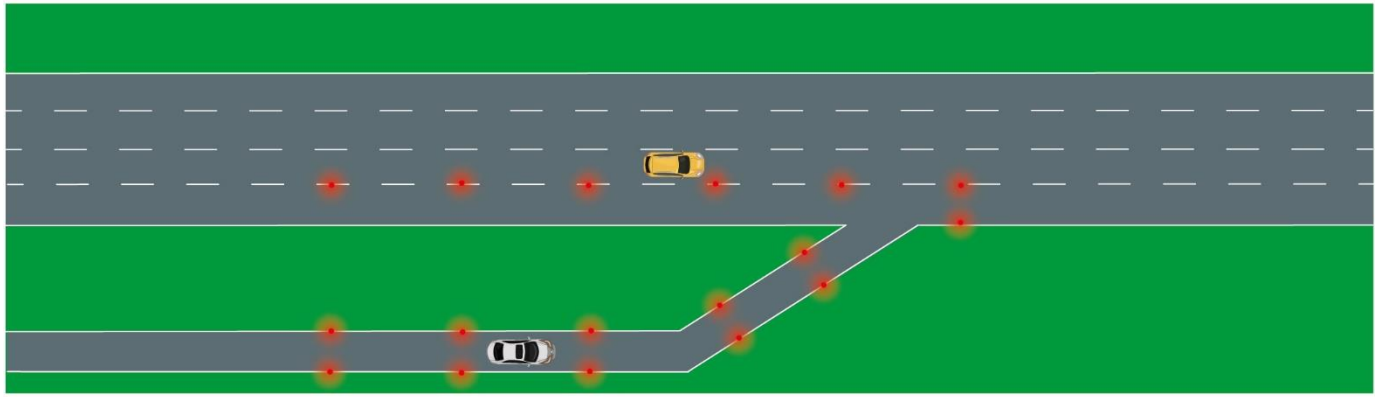


When a vehicle is parked in the emergency lane on a highway, the system activates emergency lane parking alerts. Red lights are turned on within a certain range behind the parked vehicle to warn following drivers.

For better performance, we can also use radar or infrared sensor for parking vehicle detection.

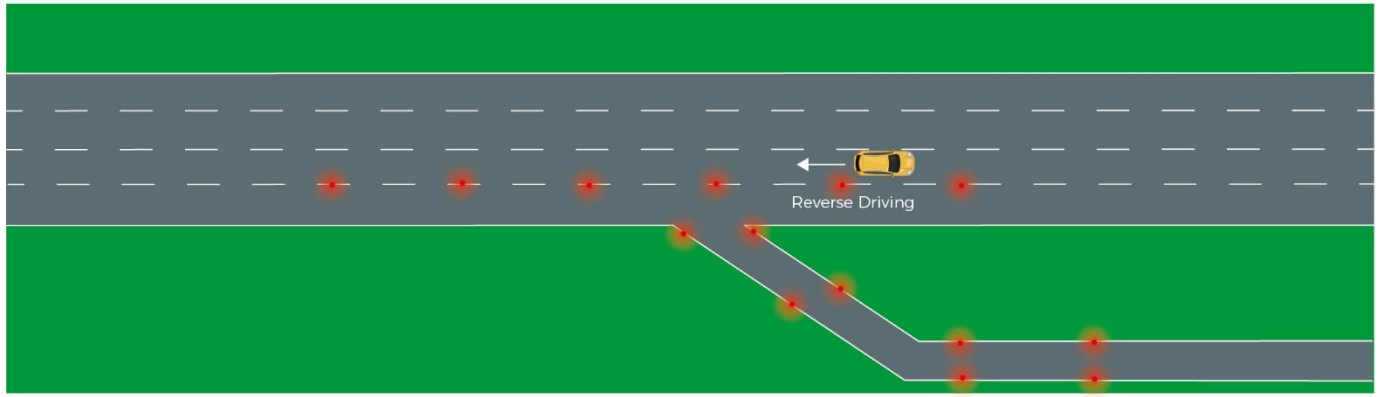
Notice: All the illuminating strategy can be customized accordingly.

Application: Merging zone & diverting zone



Merging zone collision alerts

Before a vehicle merges onto the main road from an on-ramp, if there are vehicles passing in the rightmost lane of the main road, yellow lights are activated in front of both the on-ramp and main road vehicles to provide real-time warnings. If there is a collision risk, red lights are turned on.

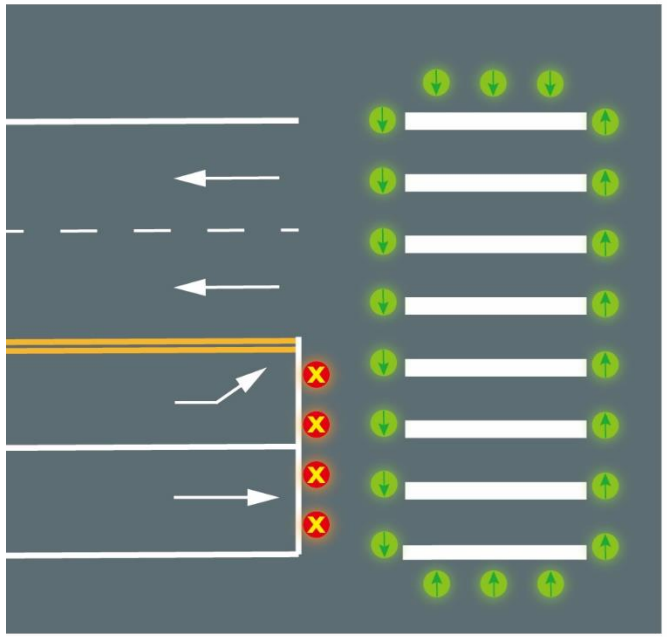


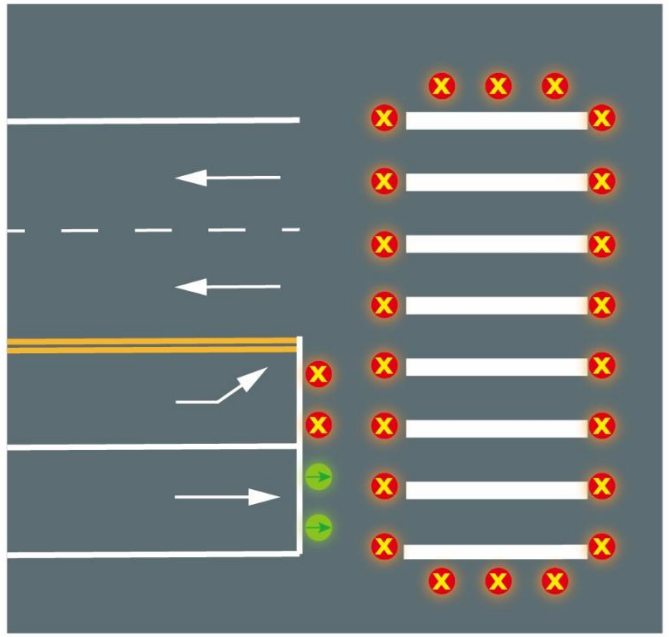
Diverting zone abnormal behavior alerts

When a vehicle exhibits abnormal behavior such as slowing down, stopping, or reversing due to missing a diversion ramp, the system provides alerts to following vehicles on the main road by turning on red lights within a certain range behind the vehicle.

Notice: All the illuminating strategy can be customized accordingly.

Application: Smart Crossing System





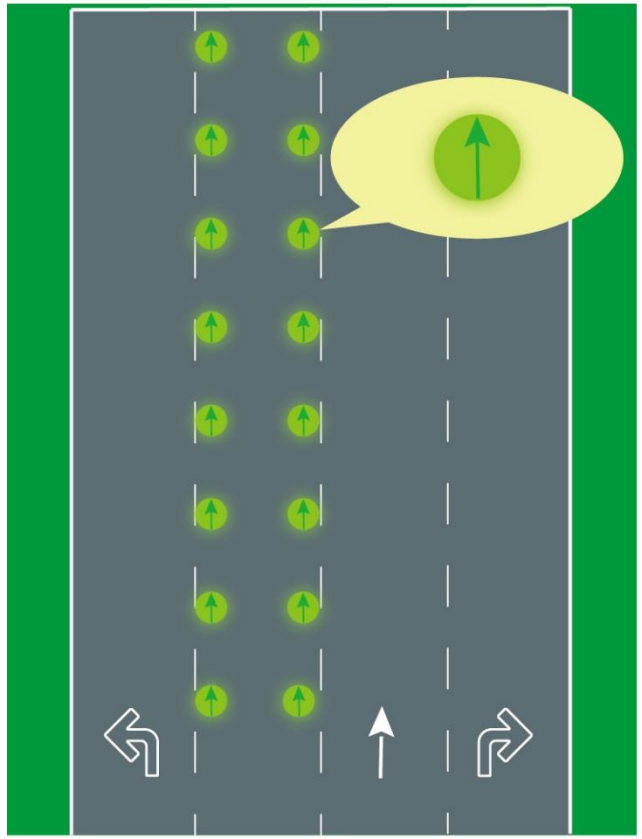
The Smart Crosswalk System is implemented in both signal-controlled and non-signal-controlled urban road sections and intersections to provide warnings for pedestrian crossings at intersections.

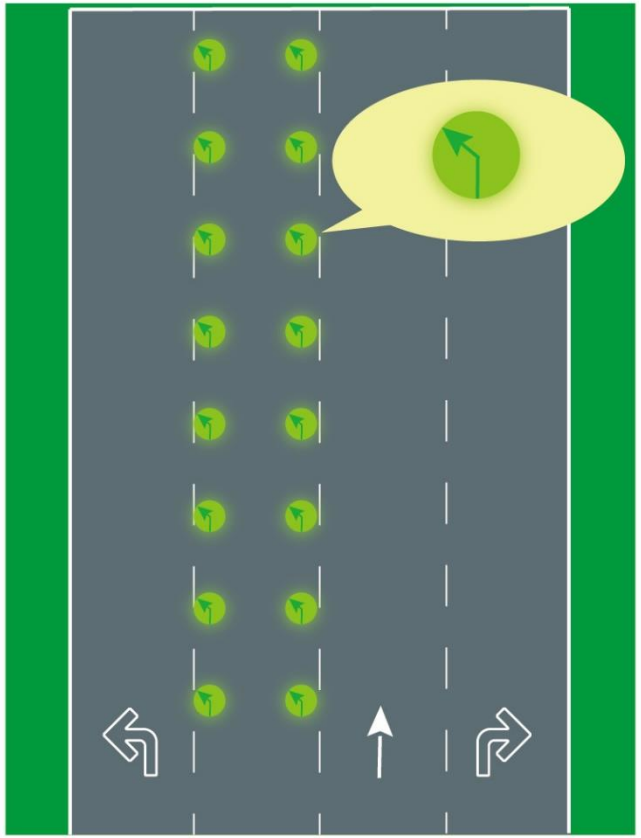
1. Pedestrian Detection (Optional): Video detectors monitor pedestrian crossing needs and red-light violations.

2. Vehicle Detection (Optional): Vehicle detectors assess traffic flow, speed, and real-time dynamics upstream and downstream of the crosswalk.

3. Warning Lights: Embedded crosswalk warning lights in the road surface provide alerts to both pedestrians and vehicles, ensuring safer passage and timely warnings.

Application: Variable Lane





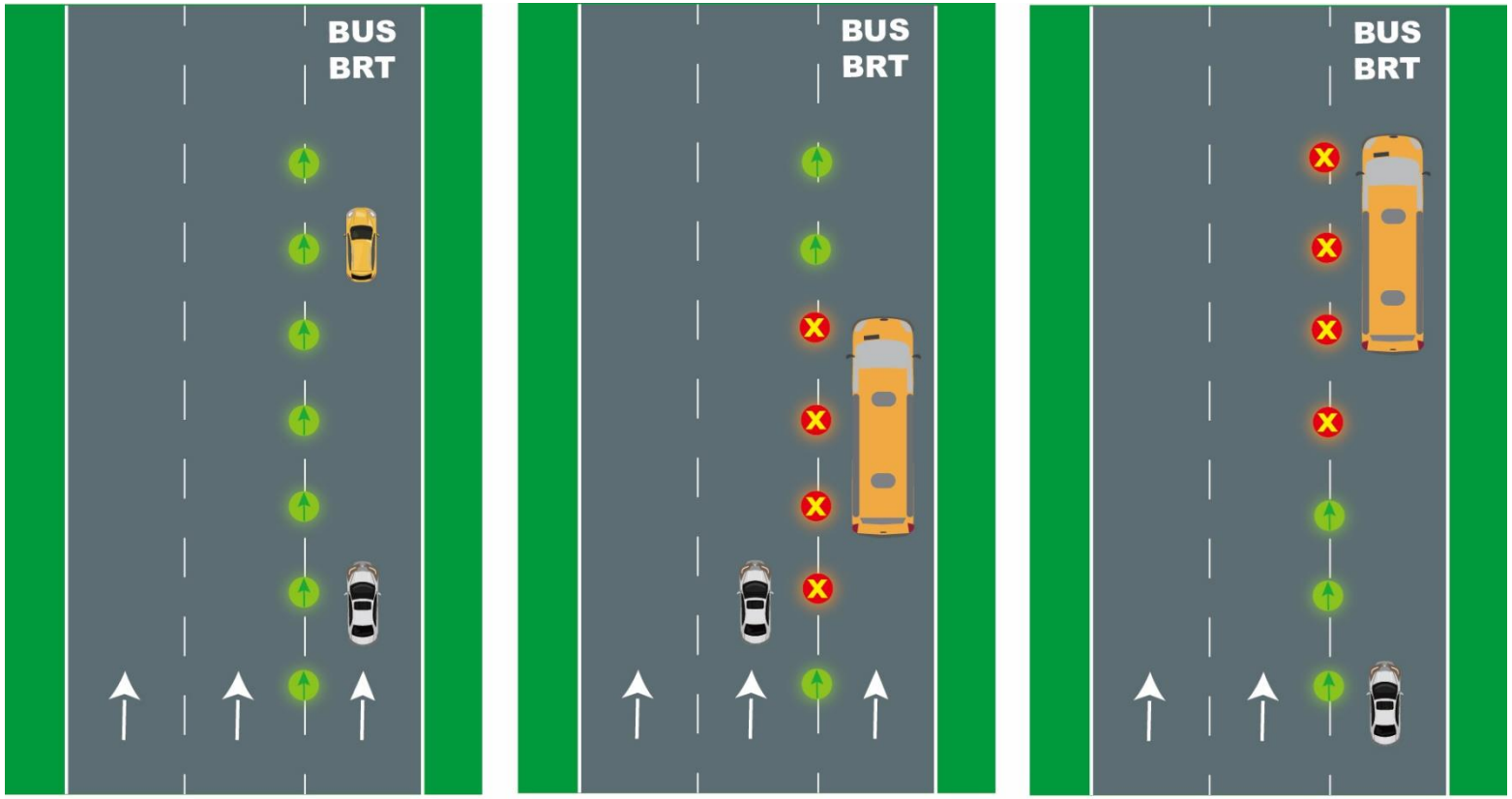
Lane Configuration: A row of smart road studs is installed on each side of the variable lane, supporting the switching between straight-through and left-turn signals. The shape and color (red, yellow, green) of the lights can be controlled by the signal control device.

- **When Defined as a Straight-Through Lane:**
  - Green Light: The road studs display a green straight-through arrow on the ground, which can flash or scroll.
  - Red Light: The road studs display a red straight-through arrow on the ground, which can flash or scroll.

- **When Defined as a Left-Turn Lane:**
  - Green Light: The road studs display a green left-turn arrow on the ground, which flashes synchronously.
  - Red Light: The road studs display a red left-turn arrow on the ground, which flashes synchronously.

- **Transition from Green to Red:**
  - When the light changes from green to red in any state, all road studs will flash yellow on the entire surface to maintain synchronization with the traffic signal light and timing

Application: Dynamic Road Rights Scheme for BRT Lanes and Bus Priority Lanes



Notice: ClairSRS-Wired-I is equipped with infrared detection module while buses are equipped with infrared emitting device.

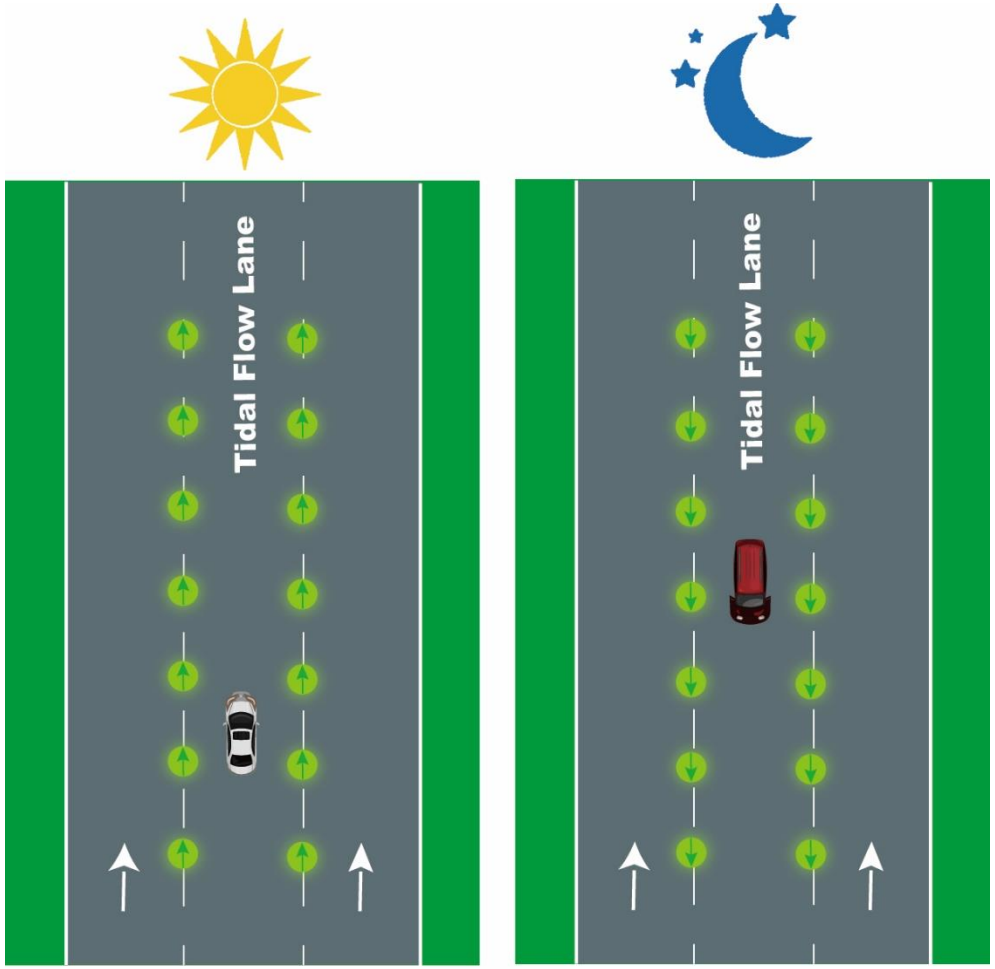
The smart road stud system for bus priority lanes allows general vehicles to use these lanes while ensuring that BRT/bus vehicles retain priority. This approach maximizes road resource utilization, alleviates traffic pressure, and enhances public transport reliability.

When No Special Vehicles are Present: The road stud displays a green arrow that scrolls from bottom to top, indicating that general vehicles are permitted to use the BRT lane.

When a Bus is Detected: The road stud activates a red "X" light within the detection range, prohibiting general vehicles from using the lane.

Detection Range: The detection range of the road stud can be adjusted. If no bus is detected, the road stud continues to display the green arrow, allowing general vehicles to use the lane, thereby improving traffic flow and reducing congestion.

Application: Tidal Lane



Morning Peak Period:
In the south-to-north direction, when the green light is activated for straight-through traffic, the road studs installed in the tidal lane will also turn green, displaying a green arrow for south-to-north straight-through traffic. The arrow can flash or scroll as needed.

Evening Peak Period:
The road studs will display a green straight-through arrow in the south-to-north direction, synchronized with the traffic signal lights, to implement the tidal lane scheme effectively.

Live Demo

Curve Warning



View Full Video on YouTube

Vehicle Following Effect



View Full Video on YouTube

Chain Network for Fast Response



View Full Video on YouTube

Live Demo

Emergency Parking Lane Alerts



[View Full Video on YouTube](#)

Smart Crosswalk System



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Dynamic Road Rights



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