



A leader in the global Lidar Industry

# Low Speed Vehicle SLAM Navigation Solution





## Index



|  |    |
|--|----|
| 1. Introduction .....                                      | 3  |
| 2. Function characteristics.....                           | 7  |
| 3. Work Principle .....                                    | 4  |
| 4. Development platform and language .....                 | 7  |
| 5. Control module performance parameters .....             | 8  |
| 6. Sensor Support .....                                    | 5  |
| 7. Functions of the System .....                           | 9  |
| 8. Hardware Configuration.....                             | 10 |
| 8.1 Indoor small scene hardware configuration list.....    | 10 |
| 8.2 Semi-outdoor/outdoor hardware configuration list ..... | 11 |
| 8.3 3D SLAM with GPS Navigation .....                      | 12 |



# 1. Introduction

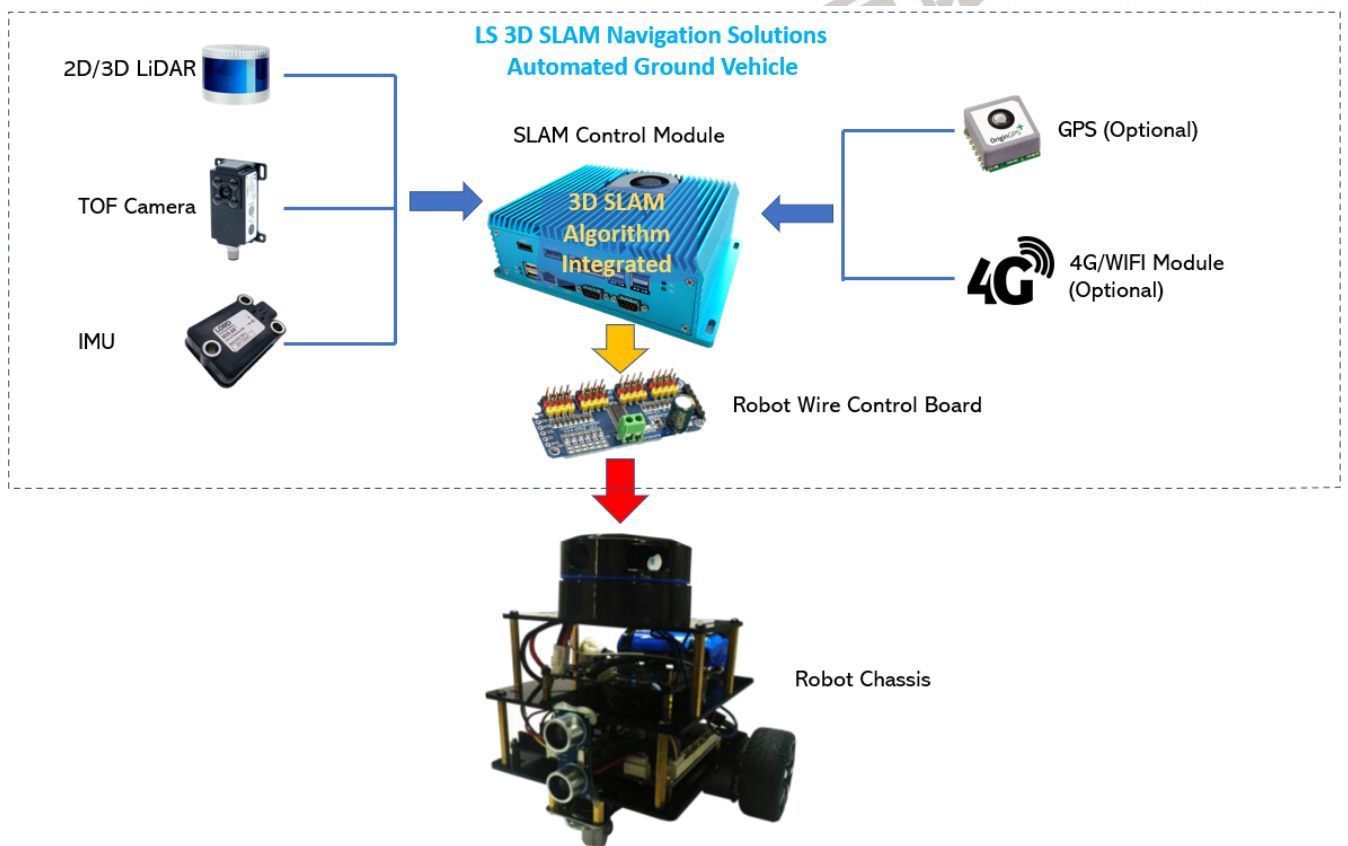
The AGV & Robots SLAM Navigation system offer the fast way to use the multi sensors fusion to realize the autonomous positioning and navigation by 2D / 3D lidar, TOF camera, GPS, ultrasonic, infrared, anti-drop, gyroscope, odometer and other sensors to evaluate the relevant concepts or project at early development. The solution has the excellent environmental perception, the high robustness and accurate positioning open platform and perfect documentation tools, which could have convenient, seamless, and quick access to various downstream terminals.

深圳市镭神智能系统有限公司

## 2. Work Principle

The core control module of LS AGV & Robots SLAM vehicle control system fuse into real-time 3D space navigation diagram to calculate its real time position coordinates communicates, by communicating with 2D or 3D Lidar via TCP to build a real-time 3D space navigation diagram and TOF camera via USB.

### System hardware structure:

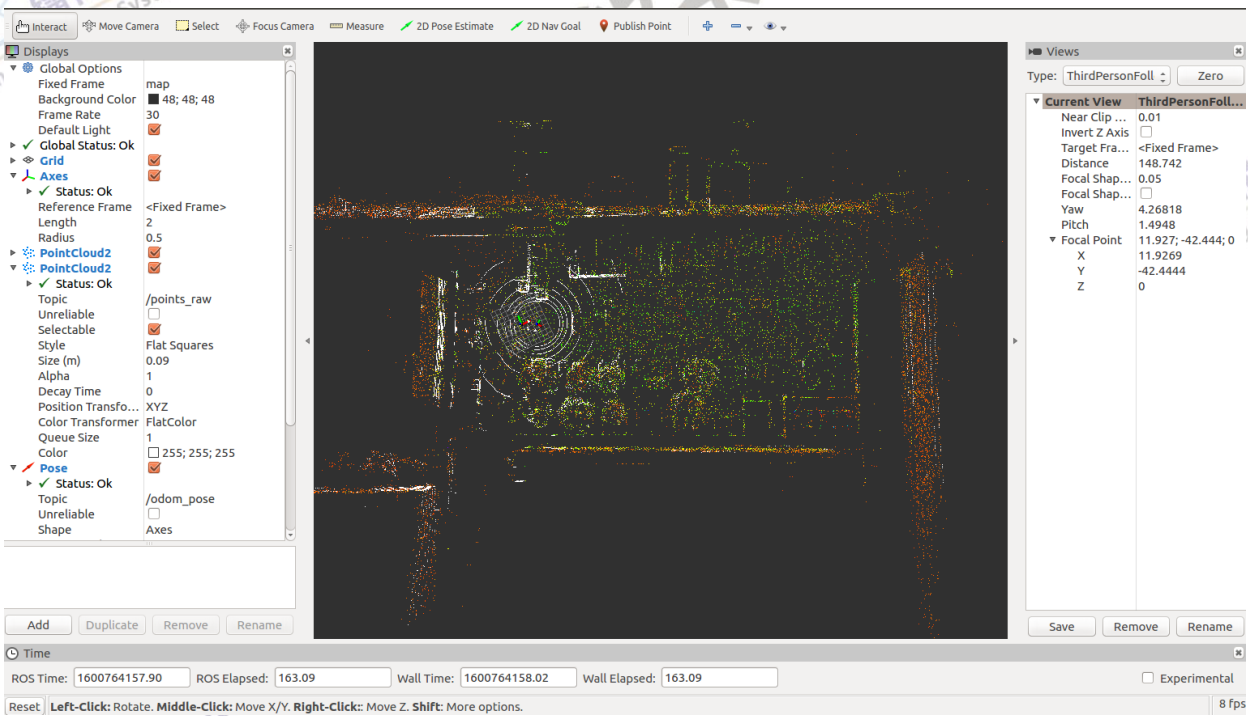
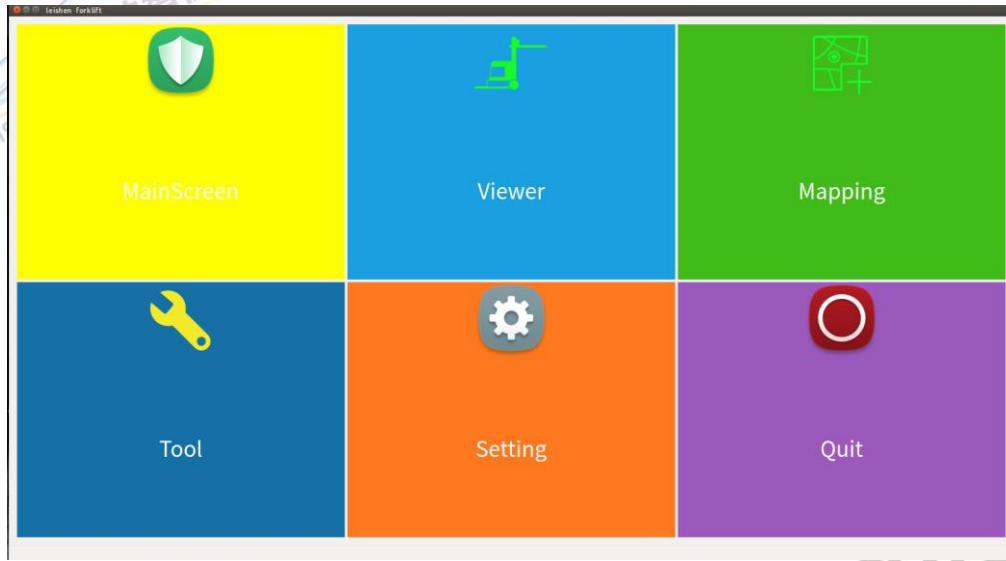


### Sensors Support:

| Item            | Description   |
|-----------------|---|
| 2D lidar        | Leishen N301 series Lidar   |
| 3D Lidar        | Leishen CX Series Lidar   |
| TOF Camera      | Support 5 loops maximum   |
| Array lidar     | Support 5 loops   |
| Ultrasonic      | Support peripheral arrangement  |
| Anti-drop       | Support laser ranging, infrared ranging, ultrasonic ranging and so on |
| GPS             | Support GPS-RTK positioning and navigation                            |
| Gyroscope       | Support high precision 9 axle   |
| Mile meter      | Support serial port/ USB interface                                    |
| Infrared sensor | Support multi-route IO input and output                               |
| Mini TOF Camera | Fusion Mini TOF Camera to be safe protection 360°                     |

The core navigation module can easily communicate with other sensors by interfaces, signal source end, such as IMU, lidar, camera & ultrasound etc., as well as signal output to AGV/Robots driving motor.

To help the project development, the system can be developed and debugged with WEB based platform supported by the background software, shown in screenshots below:





### 3. Function characteristics

- Combined ROS and Web
- High performance robot control service and response
- 3D positioning and mapping technology in large space
- Multi-sensor fusion and environment perception technology
- Intelligent path tracking technology
- Integration: electrical interface, USB, UART, Can, IO is integrated on all-in-one, conforming to international standards
- One station: map establishment, integrated completion of positioning and navigation
- Extensibility: provide a circuit package with customization to facilitate the expansion requirements of different navigation schemes (the size of the customized package depends on the detailed customized functional requirements)

### 4. Development platform and language

Development platform is : Ubuntu 16.04.6 LTS (Xenial Xerus)

Development language is: C++, JavaScript, Python

## 5. Control module performance parameters

| Item                     | Description            |
|--------------------------|------------------------|
| Input voltage            | 12 V                   |
| Basic dimension          | 200 x 120 x 100 mm     |
| Rated power              | 150W                   |
| Memory                   | 8G memory, CPU i5      |
| Lower computer           | STM series chip        |
| Map dimension            | 160,000 m <sup>2</sup> |
| Visible range            | 50-150m                |
| Navigation refresh rate  | 20Hz                   |
| Positioning refresh rate | 10Hz                   |
| Positioning precision    | ±5cm                   |
| Max. speed               | 1m/s                   |



## 6. Functions of the System

| Item                           | Description  |
|--------------------------------|--|
| Anti drop                      | Support instantaneous shutdown and alarm                                       |
| Virtual wall                   | Support random shape drawing   |
| Designated location navigation | Support multi-location and position repeat navigation                          |
| Point Location orientation     | Support for orientation in different directions after positioning              |
| Point Location Stop            | Support staying time setting   |
| Voice broadcast                | Support voice customization  |
| Map switch                     | Support map switching between different layers of map (for engineering design) |
| Map scanning control           | Support mobile control   |
| Calibration function           | Support map interface manual calibration                                       |
| Task configuration             | Support multi-task configuration   |
| Task activation                | Support activation of task instantaneously and at preset schedule              |
| Pathway monitoring             | Support real time positioning and status display                               |
| Task assignment                | Support progress percentage and remaining time estimation                      |
| Task start and stop            | Support task duly stop and restart   |
| Automatic charging             | Support laser infrared positioning cross checking                              |

## 7. Hardware Configuration

### 8.1 Indoor small scene hardware configuration list

| Product Model No. LS-SLAM-ID |   |          |
|------------------------------|---|----------|
| Item                         | Parameters  | Quantity |
| <b>SLAM Control Module</b>   | Four gigabytes of memory, 64 gigabytes of hard drive,<br>CPU 3955U, STM series chip,<br>Navigation refresh rate is 10Hz, dynamic positioning accuracy is $\pm 10\text{cm}$ ,<br>System: Ubuntu16.04   | 1        |
| <b>2D Lidar</b>              | Suitable for indoor and outdoor environment, reliable anti - Japanese light ability<br>Measuring radius: 10 m /15 m /20 m /25m<br>Sampling speed: 20,000 points/second<br>Typical value of scanning frequency: 10Hz<br>Measurement accuracy: $\pm 3\text{cm}$ | 1        |
| <b>IMU</b>                   | The maximum range of the three-axis gyroscope is $\pm 2000^\circ/\text{s}$<br>The maximum range of the triaxial accelerometer is $\pm 8\text{G}$  | 1        |
| <b>Ultrasonic</b>            | The minimum detection range is 1cm<br>The maximum detection distance is 6m<br>The beam width is 75 degrees<br>Range maximum detection accuracy 1mm<br>The shortest detection time is 1ms  | 1        |
| <b>Infrared box</b>          | I/O 6 loops<br>16 loops IIC<br>12V powered STM series chips   | 1        |

|               |   |   |
|---------------|---|---|
| <b>Router</b> | 4G+wifi/ base station positioning is optional | 1 |
|---------------|---|---|

## 8.2 Semi-outdoor/outdoor hardware configuration list

| Product Model No. LS-SLAM-OD |   |          |
|------------------------------|---|----------|
| Item                         | Parameters  | Quantity |
| <b>SLAM control module</b>   | Memory 4G, Hardware 64G,<br>CPU i5-6300u, STM series chips,<br>Navigation refresh rate is 10Hz, dynamic positioning accuracy is $\pm 15\text{cm}$ ,<br>System: Ubuntu16.04  | 1        |
| <b>3D Lidar</b>              | Suitable for indoor and outdoor environment, reliable sun light endurance ability<br>Measuring radius: 50m/70m/120m/150m<br>Ranging accuracy: $\pm 3\text{cm}$<br>Frequency: 10 Hz<br>Power supply range: +9V~+36V DC   | 1        |
| <b>IMU</b>                   | maximum range of the tri-axial gyroscope: $\pm 2000^\circ/\text{s}$<br>maximum range of the tri-axial accelerometer: $\pm 8\text{G}$  | 1        |
| <b>TOF Depth camera</b>      | The maximum range of the three-axis gyroscope is $\pm 2000^\circ/\text{s}$<br>The maximum range of the triaxial accelerometer is $\pm 8\text{G}$<br>TOF depth camera 640 x 480 pixels<br>The field of view Angle is $80^\circ \times 60^\circ$ , and the frame rate is up to 30fps<br>The detection range is 0.35~1.2m<br>Measurement accuracy 0.1% | 1        |
| <b>Ultrasonic box</b>        | I/O 6 loops<br>16 loops IIC<br>12V powered STM series chips   | 1        |

|               |   |   |
|---------------|---|---|
| <b>Router</b> | 4G+wifi/ base station positioning is optional | 1 |
|---------------|---|---|

### 8.3 3D SLAM with GPS Navigation

| Product Model No. : LS-SLAM-GPS |   |          |
|---------------------------------|---|----------|
| Item                            | Parameters  | Quantity |
| <b>SLAM Control module</b>      | Memory 8G CPU i7, STM series chips,<br>Navigation refresh rate 20Hz, positioning accuracy $\pm 5\text{cm}$ ,<br>System: Ubuntu16.04   | 1        |
| <b>3D Lidar</b>                 | 16 lines, standard distance 150m, ranging accuracy $\pm 3\text{cm}$   | 1        |
| <b>GPS</b>                      | RTK: horizontal 0.008+1ppm, vertical 0.015+1ppm<br>NMEA-0183, rtm2.x /3.x, CRM  | 1        |
| <b>IMU</b>                      | Maximum range of the three-axis gyroscope is $\pm 2000^\circ/\text{s}$<br>maximum range of the tri-axial accelerometer is $\pm 8\text{G}$   | 1        |
| <b>Depth camera</b>             | RGB camera is 5 megapixels, the field of view Angle is $74^\circ \times 56^\circ$ (default, 1080p is $63^\circ \times 37^\circ$ ), and the maximum frame rate is 30fps by default (1080p is 15fps).<br>Detection range is 0.35~1.2 or 0.5~3<br>Measurement accuracy 0.3%<br>precision of measurement < 1% | 1        |
| <b>Ultrasonic box</b>           | 6 loops of I/O<br>16 loops IIC<br>12V power STM series chips  | 1        |
| <b>Router</b>                   | 4G+wifi/ base station positioning is optional   | 1        |



# 深圳市镭神智能系统有限公司

