Rosbot User Manual

Prepared by: Wayne Liu & Tara Hercz
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Summary

Rosbot is designed for ROS (Robot Operating System) developer, educator and students. The heart of Rosbot is the fully programmable software framework and configurable hardware architecture based on the most popular robotic platform - ROS.

Rosbot comes with three categories:

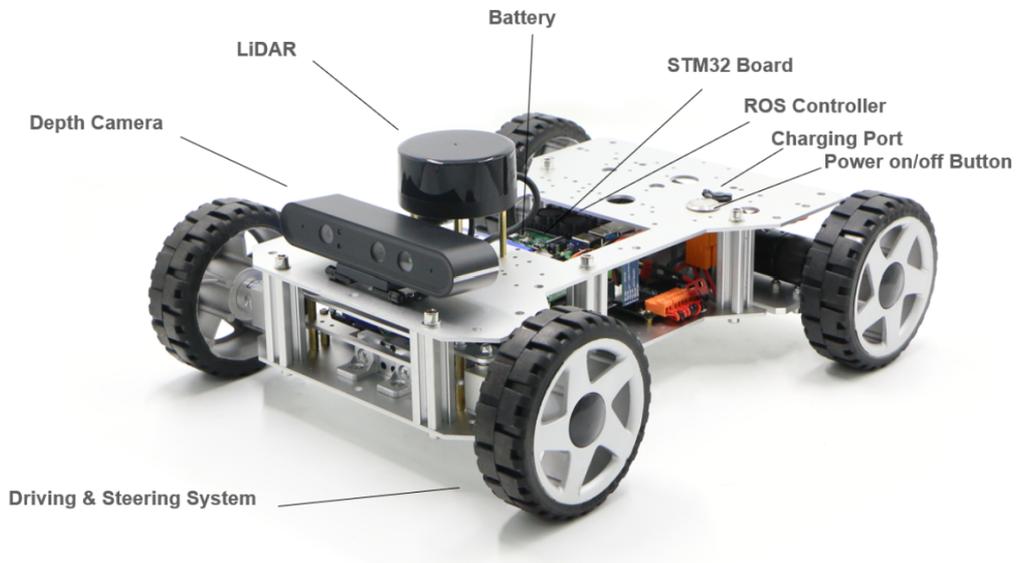**Rosbot Mini** - Suitable for ROS beginners and low budget projects.
Rosbot Pro - Suitable for ROS developers and educators who need a versatile system for rapid prototyping or teaching.
Rosbot Plus - This is the 4WD version of Rosbot with Independent Suspension Systems. This category is serious enough to be considered for industrial and commercial development.

Rosbot comes with popular ROS controllers such as:

- Jetson Nano
- Jetson TX
- Xavier
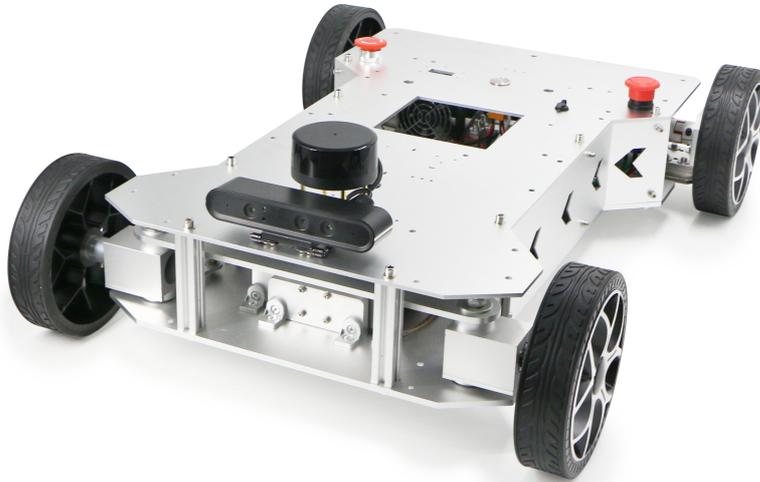- X86 Industrial PC (Built-to-Order Option)

1. Key Component

Labels: Depth Camera, LiDAR, Battery, STM32 Board, ROS Controller, Charging Port, Power on/off Button, Driving & Steering System

Variation	Image
Rosbot Mini	

Rosbot Pro	
Rosbot Plus	

2. Product Specifications

Product Matrix			

Product Name	Rosbot Mini	Rosbot Pro	Rosbot Plus
Motor Reduction Ratio	1:27	1:18	1:18
Max Speed	1.3m/s	1.65m/s	2.33m/s
Weight	5.92kg	19.54kg	35.16kg
Max Payload	10kg	35kg	22kg
Size	445*358*125mm	774*570*227mm	766*671*319mm
Minimal Turning Radius	0.77m	1.02m	1.29m
Battery Life	About 8 hours (no load), About 7 hours (fully load)	About 4 hours (no load), About 2.5 hours (fully load)	
Power Supply	22.2v 5000mah battery + 2A current smart charger		
Steering Gear	HWZ020 20kg torque digital servo	WH060 60kg torque digital servo	
Wheels	125mm diameters solid rubber wheels	150mm diameters solid rubber wheels	254 mm inflatable rubber wheels
Encoder	500 line AB phase high precision encoder		
Suspension System	Coaxial Pendulum Suspension System		4W Independent Suspension System
Control Interface	iOS & Android App via Bluetooth or Wifi, PS2, CAN, Serial Port, USB		

3. Introduction of ROS Controllers

There are 3 types of ROS Controllers available for use with the Rosbot based on Nvidia Jetson platform. Jetson nano is suited more towards research and development. Jetson TX is ideal for product prototyping. Jetson Xavier is used more often in research and commercial applications. X86 Industrial PC is designed for robust commercial applications and it is only available for Built-to-Order configurations.

The following table illustrates the main technical differences between the various controllers available from Roboworks. Both boards allow high level computation and are suited towards advanced robotic applications such as computer vision, deep learning and motion planning.

	Jetson Nano	Jetson TX1	Xavier Nx
Users	Edu/R&D	R&D/Commercial	R&D/Commercial
CPU	ARM Cortex-A57 64bit@1.43GHz Quad Core	ARM Cortex-A57 MPCore 64bit@1.73GHz Quad Core	6 Core Nvidia Camel ARM v8.2 64bit, 6MB L2 +4MB L3
GPU	128-core Nvidia Maxwell	256-core Nvidia Maxwell	384-core Nvidia Volta
RAM	4GB 64 bit LPDDR4	4GB 64 bit LPDDR4	8GB 128 bit LPDDR4
Storage	64G MicroSD	16G eMMC 5.1 +64G Hard Drive	16G eMMC 5.1 +64G Hard Drive
USB	USB3x4	USB3x1 +MicroUSBx1	USB3.1x4

4. Sensing System: LiDAR & Depth Camera

A Leishen LSLiDAR is installed on all Rosbot variations with either the N10 or M10 model being used. These LiDAR's offer a 360 degree scanning range and surroundings perception and boast a compact and light design. They have a high Signal Noise Ratio and excellent detection performance on high/low reflectivity objects and perform well in strong light conditions. They have a detection range of 30 metres and a scan frequency of 12Hz. This LiDAR integrates seamlessly into the Rosbots, ensuring all mapping and navigational uses can be easily achieved in your project.

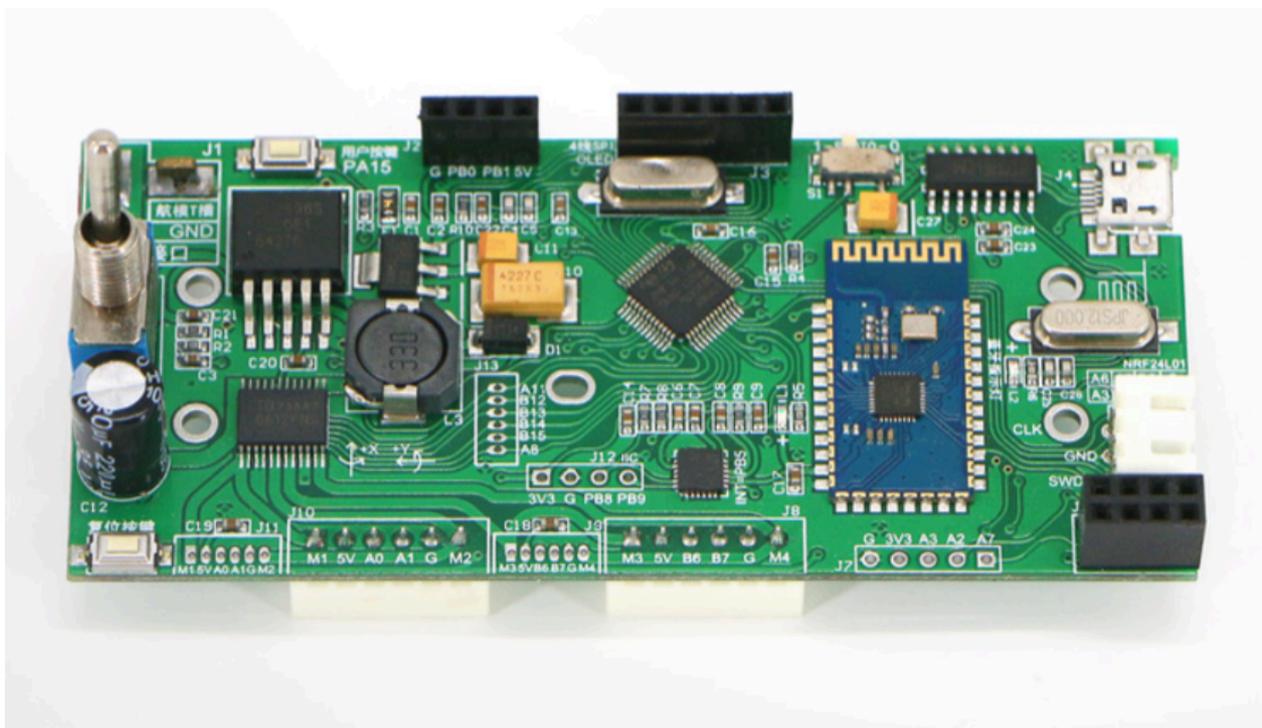The below table summaries the technical specifications of the LSLiDARs:

LS LiDAR	N10	M10	C16 (3D)
Detection Range	25m	30m	70/120/150 m
Scan Frequency	10Hz	12Hz	5/10/20Hz
Samples Frequency	4,500Hz	20,000Hz	240,000Hz
Output Contents	Angular, Distant and Light Intensity Data	Angular and Distant Data	Angular, Distant, Time Stamp and Light Intensity Data
Angular Resolution	0,8	0,22	1~2
Interface Type	Serial Port	Ethernet Port	Ethernet Port

Additionally, all Rosbots are equipped with an Orbbec Astra Depth Camera, which is an RGBD camera. This camera is optimized for a rage of uses including gesture control, skeleton tracking, 3D scanning and point cloud development. The following table summarizes the technical features of the depth camera.

Orbbec Astra Depth Camera	Specs
Depth Resolution	640x480
RBG Resolution	640x480
RGB Sensing Angle	63.1x49.4 degree
Depth Sensing Angle	58.4x45.5 degree
Monocular/Binocular Structural Light	Monocular Structural Light + Monocular RGB
Depth Frame per Second	640x480@30fps
RGB Frame per Second	640x480@30fps
Depth Range	0.6~4m
Data Transfer Interface	USB2.0 or above

5. STM32 Board (Motor Control, Power Management & IMU)

The STM32F103RC Board is the micro-controller used in all Rosbots. It has a high performance ARM Cortex - M3 32-bit RISC core operating at a 72MHz frequency along with high-speed embedded memories. It operates in -40°C to +105°C temperature range, suiting all robotic applications in worldwide climates. There are power-saving modes which allow the design of low-power applications. Some of the applications of this microcontroller include: motor drives, application control, robotic application, medical and handheld equipment, PC and gaming peripherals, GPS platforms, industrial applications, alarm system video intercom and scanners.

| STM32F103RC	Features
Core	ARM32-bit Cortex –M3 CPU Max speed of 72 MHz
Memories	512 KB of Flash memory 64kB of SRAM
Clock, Reset and Supply Management	2.0 to 3.6 V application supply and I/Os
Power	Sleep, Stop and Standby modes V_{BAT} supply for RTC and backup registers
DMA	12-channel DMA controller
Debug Mode	SWD and JTAG interfaces Cortex-M3 Embedded Trace Macrocell
I/O ports	51 I/O ports (mappable on 16 external interrupt vectors and 5V tolerant)
Timers	4x16-bit timers 2 x 16-bit motor control PWM timers (with emergency stop) 2 x watchdog timers (independent and Window) SysTick timer (24-bit downcounter) 2 x 16-bit basic timers to drive the DAC
Communication Interface	USB 2.0 full speed interface SDIO interface CAN interface (2.0B Active)

6. Steering & Driving System

The Steering and Driving system is integrated with the design and build of the Rosbot. Depending on the model purchased it will be either a 2 wheel or 4 wheel drive, with both options being suitable to a variety of research and development purposes. The wheels on all Rosbots are solid rubber with snow protection grade tires. There is a coaxial pendulum suspension system, and the top range Rosbots are equipped with shock absorbers with independent suspension systems, ensuring it is able to successfully navigate difficult terrain.

Steering and Driving Technical Specifications:

Steering and Driving Aspect	Features
Wheels	4 x 125mm diameter solid rubber wheels Snow protection grade tires
Motors	1 x HWZ020 20kg Torque Digital Servo 2 x MD36N 35W DC Brush Motors
Brackets	2 x Simple L-shaped Motor brackets
Chassis Material	Aluminium Alloy plates
Encoder	2 x 500 Line AB phase Photoelectric Encoders
Linear guide	1 x Mini linear guide
Suspension System	1 x Coaxial pendulum suspension system

Rosbot Chassis Design Diagram:

Unit:mm
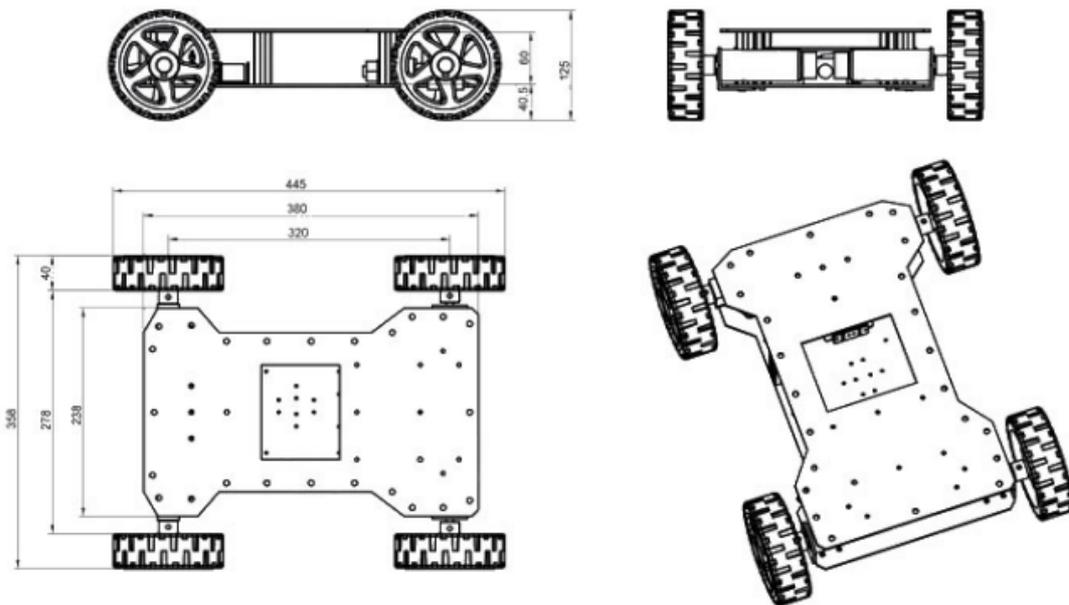
7. Battery Technical Specifications

All Rosbots come with a 5000 mAh battery and a Power Charger. Customers can upgrade the battery to 10000 mAh or 20000 mAh with additional cost. The 20000 mAh battery is too large to house within the enclosure of any Rosbots. It can only be installed on the top of the Robot chassis.

Battery parameter	Features		
	5000mAh	10000mAh	20000mAh
Battery Voltage	22.2V	22.2V	22.2V
Size	124*71*42mm	124*71*71mm	156*122*71mm
Power Charger	DC 5.5 Charging plug T-shaped discharge plug	DC 5.5 Charging plug T-shaped discharge plug	DC 5.5 Charging plug T-shaped discharge plug
Performance	15A continuous discharge	30A continuous discharge	60A continuous discharge
Weight	0.66kg	1.25kg	2.4kg