

Artificial Intelligence

LiDAR RoboEX



Learn the basics of AI (Artificial Intelligence) SLAM and Algorithm using TensorFlow for machine learning and deep learning. Experience high levels of image processing and machine learning LiDAR RoboEX provides various practical exercises for LiDAR which are applied to autonomous vehicles.

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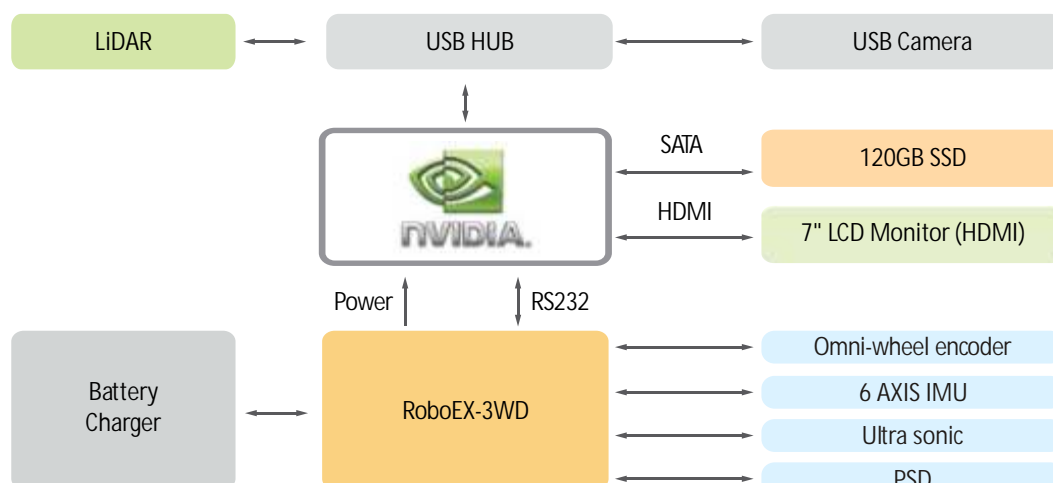
Product Overview

Learn basic theory of artificial intelligence and algorithms using TensorFlow which is used for machine learning in various fields. Experience high-performance services such as object and character recognition through deep learning, face recognition and edge detection through image processing. In addition, measure distance and angle using LiDAR and search the shortest path using algorithm.

Product Features

- Experience from basic theories for machine learning to algorithms for its implementation
- Deep learning training
- Machine learning and deep learning using Tensorflow for high performance numerical computation
- High speed of computation using high performance GPU
- Real-time image processing service using camera mounted on the product
- Training for controlling technology for DC motor and omnidirectional wheel
- Experience of Python language
- Learning ultrasonic sensor and infrared distance sensor (PSD) technology as well as object detection and obstacle awareness
- Robot driving body adopting Arduino enables learning motor controls and sensor status information acquisition
- Learn ROS and SLAM using LiDAR used for self-driving
- Distance & angle measurement using LiDAR, and path searching using algorithm
- Practical exercises for Neural Network

Block Diagram



Hardware Specifications

Module	Category	Specificaitons	Module	Category	Specificaitons
Nvidia Jetson TX2	CPU	HMP Dual Denver 2/2 MB L2 + Quad ARM A57/2 MB L2	RoboEX 3WD	EXT-Interface	0.8MM 2Raw 40Pin Connector 2EA
	GPU	NVIDIA Pascal, 256 CUDA cores		Program Interface	Micro-USB Type (DFU)
	Video	4K x 2K 60Hz Encode (HEVC) / 4K x 2K 60Hz Decode (12-bit Support)		User Interface	Character LCD(16x2), Buzzer 1EA, Function Button 5EA, Status LED 2EA, Power LED 1EA
	Memory	8GB 128bit LPDDR4 59.7 GB/s		Communication	- CAN 2.0 Part A & CAN 2.0 Part B - LIN 1.3 & 2.0
	Display	2x DSI, 2x DP 1.2 / HDMI 1.0 / eDP 1.4		Motor	RG35GM 11Type DC12V 1/50 with Encoder DC-Motor
	CSI	Up to 6 Cmeras (2 Lane) CSI2 D-PHY 1.2 (2.5 Gbps / Lane)		Motor Driver	L298P Dual Full Bridge Driver
	PCIE	Gen 2 1x4 + 1x1 OR 2x1 + 1x2		Sensor	- MPU-6050 3Axis Accelerometer
	Data Storage	32 GB eMMC, SDIO, SATA			- TMP36GT9 Low Voltage Temperature Sensor
	Other	CAN, UART, SPI, I ² C, I ² S, GPIOs			- Encoder with DC-Motor
	USB	USB 3.0 + USB 2.0			- MA40S4R / MA40S4S Ultrasonic Sensor
	Connectivity	1 Gigabit Ethernet, 802.11ac WLAN, Bluetooth		Wheel	Omni Wheel 60MM Active Type / 6MM Motor Shaft Hole
RoboEX 3WD	Contoroller	32bit ARM Cortex-M3 ATSAM38EA-AU MCU up to 84MHz	Battery	11.1V @ 5200mA 3EA	
	Flash Memory	512KB	Size	310mm x 310mm x 395mm	
	SRAM	64 + 32KB			
	DFU Controller	Low Power AVR 8bit Microcontroller Atmega16U2-AU(DFU)			

LiDAR Specifications

Item	Unit	Min	Typical	Max	Comments
Distance Range	Meter(m)	TBD	0.15~6	TBD	White objects
Angular Range	Degree	n/a	0-369	n/a	-
Distance Resolution	mm	n/a	< 0.5 < 1% of the distance	n/a	< 1.5 meters All distance range
Angular Resolution	Degree	n/a	1	n/a	5.5Hz scan rate
Sample Duration	Millisecond(ms)	n/a	0.5	n/a	-
Sample Frequency	Hz	n/a	2000	n/a	-

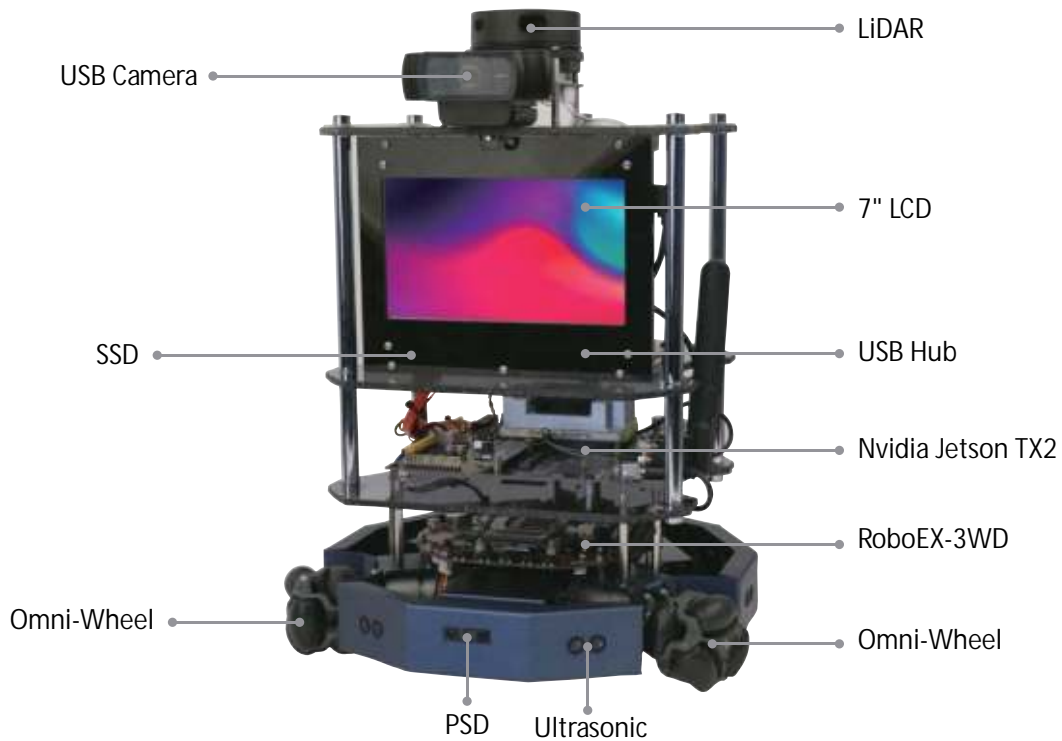
Software Specifications

Module	Category	Specificaitons	Module	Category	Specificaitons
AI	TensorFlow	TensorFlow 1.7.0	RoboEX 3WD	AndroX Studio TM	- Cygwin : 1.7.17
	Keras	Keras 1.2.2			- Make : GNU Make 3.82.90
Nvidia Jetson TX2	OS	Ubuntu 16.04			- Eclipse Platform : Kepler(4.3)
	CUDA	CUDA 9.0			- Arduino Platform : 1.0.5
	cuDNN	cuDNN 7.0.5			- Java SDK : Java SE Runtime Environment (build 1.6.0_26-b03)
	Multimedia	OpenCV 3.4.0			- Android NDK : Release R8E
	Others	- Python 3.5 - ROS Kinetic			- Android SDK : Android 4.2 (API 17)
RoboEX 3WD	AndroX Studio TM	- Launcher : 2.0			- ADT : 22.0.1
		- ARM Cross Toolchain : GCC 4.6.3 for Windows (Newly build the source code)			- Android SDK Tools : 22.0.1
		- Host Toolchain : GCC 4.5.3 (Built-in cygwin)			- Remote Explorer : 5.1.1
					- Remote Shell : 0.62
			- Remote Viewer : 2.7.1		
			- Serial Packet Monitor : 1.2		
			- Application Package : 1.2		
			- Installer : 1.4		

Training Contents

- | | | |
|--|---|--|
| <ol style="list-style-type: none"> 1. Deep Learning through RoboEX <ul style="list-style-type: none"> • AI / Machine Learning / Deep Learning • Deep Learning through TensorFlow • Image Processing | <ol style="list-style-type: none"> 2. Robot Control with RoboEX <ul style="list-style-type: none"> • RoboEX 3WD • Robot OS • Connecting Jetson board and RoboEX 3WD • Moving & Tracking | <ol style="list-style-type: none"> 3. LiDAR with RoboEX <ul style="list-style-type: none"> • Overview of LiDAR • Robot Operating System • Algorithm • Convolutional Neural Network |
|--|---|--|

Layout



Applications



Plant Diseases Detection



Handwriting Recognition



Face Recognition



Lane Recognition



Object Recognition



Path Searching



Room Mapping