AI at the Edge with NVIDIA Jetson

Challenge

> Develop a robust system for an autonomous delivery vehicle

> Implement a cost-effective and scalable platform

> Design a durable and power-efficient chassis

NVIDIA Solution

> Sensor fusion for multiple sensors and inputs and outputs

> Robust software tools and stack to enable AI across multiple modules

> Scalable Jetson platform that allows for rapid development

> Industrial-level components and capability

Results

> Advanced chassis design that enables high energy efficiency and agile movement

> Able to conduct daily operations in several indoor and outdoor locations

AN INNOVATIVE AND HOLISTIC SOLUTION FOR AUTONOMOUS DELIVERY

Meituan Autonomous Delivery Platform

Meituan provides an innovative and holistic solution for autonomous delivery, which incorporates an online order platform, dispatch system, and road network logistics with big data optimization. Their solution uses a variety of intelligent delivery devices, including unmanned aerial vehicles (UAVs), high-/low-speed autonomous delivery vehicles and robots, to meet the needs for on-demand delivery in diverse scenarios such as buildings, business campuses, and public roads. Their autonomous delivery vehicles adopt L4 level autonomous driving technology and use multi-sensor fusion schemes such as laser radar, ultrasonic wave, and cameras to autonomously drive at low speeds in urban environments. Accurate perception, high-precision localization, mapping, and planning ensure efficient and optimal shipping routes.

NVIDIA Platform

Meituan are using NVIDIA Jetson AGX Xavier™ as the computing unit for perception, localization, mapping, and planning tasks. They're using NVIDIA® TensorRT™ to optimize deep learning models for perception-related tasks and DeepStream SDK to fully utilize the NVIDIA Volta GPU and deep learning accelerators (DLAs). These software SDKs allowed them to improve the efficiency and performance of their autonomous delivery vehicles with Jetson.

Products Used
> NVIDIA Jetson® TX2
> NVIDIA Jetson AGX Xavier
> NVIDIA TITAN V
> NVIDIA GeForce® GTX 1080Ti

Processing Engines Used
> Detection, segmentation, and tracking on GPU and DLAs
> Mapping, localization, control, and planning on ARM processors
> Gigabit Multimedia Serial Links (GMSL) cameras and vision processor pipeline

Software Used
> OpenCV for the vision system
> NVIDIA CUDA® for GPU acceleration
> Caffe, TensorFlow, ONNX, and NVIDIA TensorRT for GPU and DLAs

Meituan Results

Currently, Meituan autonomous delivery vehicles have been tested and deployed in three major locations: Joy City Mall in Beijing's Chaoyang District, Lenovo's offices in Shenzhen, and Songjiang University Town in Shanghai. In the Joy City Mall, the vehicles pick up orders from restaurants and bring them to a collection point where the delivery drivers then take them to their final destination. In Lenovo's office, the vehicles collect orders and distribute them across offices, and they're linked to the elevator systems to service multiple stories in the buildings. In SongJiang University Town, Meituan delivers meals directly from merchants to consumers and they're delivering over 1,000 meals a day.

Meituan is also collaborating with Tsinghua University, University of California Berkeley, China Fortune Land Development, Beijing Innovation Center for Mobility Intelligent, Segway, and DeepBlue Technology to expand their locations and capabilities. Meituan believes that the future lack of workers will force traditional logistics to transform, and they're hoping to "deliver everything for everyone everywhere."

About Meituan

Meituan Dianping (HKSE: 3690.HK) is a leading Chinese O2O local life service platform, connecting over 240 million consumers and five million local merchants via a comprehensive array of e-commerce services and products. As of today, Meituan Dianping is already the largest on-demand food delivery player in China. With the mission of "We help people eat better, live better," the company is now aiming at using self-driving technologies to build the world's largest interactive platform for intelligent delivery and speeding up the development of unmanned delivery technology.

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Learn more: **www.nvidia.com/robotics**
Learn more about Meituan at: **https://about.meituan.com/en.html**