Robot Controller Based on 11th Generation Intel® Core™ Processor

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PART 1

Service Robot Challenges
There has been an explosive growth of service robots in the commercial sector as evidenced by the many different use cases for them. It is mainly used in large public places like airports, restaurants, banks, shopping malls, etc. For instance, service robots can be used as mobile signs and self-service kiosks. Such usage requires the support of various kinds of workloads associated with those functions. It necessitates the deployment of a capable compute module reference design that can meet the expanded and varied workloads. The challenges, therefore, can be listed as follows:
**Challenges**

- **Support for advanced navigation and analytics:**
  Currently, modern service robots use computer vision and depth sensors/cameras to complement LiDAR for object recognition and collision avoidance. With the expansion in the kind of usage, the compute module not only needs to provide the computation power for complex navigation and maneuvering, it also needs the headroom to support AI workloads, media processing, and such other operations.

- **Scalability and time to market**
  Service robots belong to a very fragmented industry. Robots are available in a range of sizes and capabilities depending on the application. The design and validation cycles required for each use case are extensive and can hamper the product’s time to market. Such delays add to the cost and may not be feasible for small scale deployment.
A scalable compute module design is one that can accommodate the different workloads that a service robot is expected to execute. Such a design eliminates the need for constant redesigning and reduces the product’s time to market.

- **Main compute board** that provides a cost-optimized base platform to enable the navigation module
- **I/O expansion board** that can be easily customized to support the I/O connectivity required by application modules to provide services
PART 2

Service Robot Controller Introduction
Features

★ Based on 11th Generation Intel® Core™ Processor
★ AI specific enhancements (Intel® DL Boost)
★ Multi-Function：2*LAN/5*COM/8*USB/1*CAN
★ MSK EXT：USB3.0/PCIe-X4/DDI
★ 9~36V DC-IN
★ 3.5 inch motherboard
High-performance processor

Built on Intel® 10nm SuperFin-based micro architecture 11th Generation Intel® Core™ processor. High-performance, responsive CPU/GPU compute combined with AI capabilities in a low power platform.

We comprehensively compared the CPU and GPU test results of multiple benchmark software.

CPU multi-threaded running scores include CINEBENCH_20 and Geekbench5 and Fritz Chess.

The GPU running score uses 3DMark 11 and Geekbench5 OpenCL.

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High-performance processor

We tested multiple mainstream machine learning algorithms and recorded the running time of the same model on the two platforms.

The running time of each processor platform CPU and GPU is calculated separately, and finally we processed the data to intuitively reflect the increase in computing power.

The actual increase depends on the specific implementation of your project.

Among them, squeezenet1.1 runs in the Intel® Distribution of OpenVINO™ toolkit.

resnet-50, googlenetV4 and yolo V3 run in tensorflow environment.

"AI capacity" graph is about the generation-to-generation comparison between 11th Generation Intel® Core™ processor and 8th Generation Intel® Core™ Processor. The AI capacity of 11th Generation Intel® Core™ processor is increased at least 1.8 times than the 8th Generation Intel® Core™ processor.

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The improvement of AI can at least make existing applications run stably, which can reduce heat generation and power consumption, and reduce the complexity of structural design.

The improvement of GPU can increase the frame rate of photo processing in vision applications, which is more suitable for robots with high real-time requirements.

Finally, all performance improvements will help improve the development efficiency of terminal manufacturers.
Advantages-2

**Interface**  2*LAN/4*USB3.0&4*USB2.0/5*COM/1*CAN/8*GPIO/HDMI&eDP
The following two diagrams show the interfaces of the controller front panel and side panel.

There are kinds of user interfaces that are provided by robot controller, such as power interface, display interfaces, Ethernet, USB 3.0, and so on.

**Figure 1. Front panel interface**

**Figure 2. Side panel interface**
MSKEXT

The controller provides two Mini-SAS extension ports. These two interfaces can provide many extended functions, such as 1*PCIe-X4, 1*DDI, 1*USB3.0&1*USB2.0, support display output, AI accelerator card, graphics card, etc.

Extended functions

(Shows the mini SAS interconnection between the main compute board and I/O expansion board.)
The controller is equipped with two high-performance RJ45 networking interfaces, using Intel® Ethernet Connection I219-LM. It can support the Intel vPro® platform with Intel® Active Management Technology, which brings modern remote manageability, maintenance, and hardware-enhanced security features.
Moreover, the speed and scalability of the CAN module allows more choices in the selection of downstream sensing modules. With the increasing number of CAN modules at present, this function is more and more valued by system manufacturers.
The core module of the controller can be configured with different CPUs to achieve different capabilities. It can meet the requirement of basic applications such as positioning, navigation and maneuverability on an AGV. With the addition of the IO extension board, user can connect graphic card, AI accelerator card and motion control card to meet high-end requirements like visual recognition, AI processing, and motion control. Moreover, the speed and scalability of the CAN module allows more choices in the selection of downstream sensing modules. With the increasing number of CAN modules at present, this function is more and more valued by system manufacturers!

Here is a compute module that can meet the requirements from entry-level to the most high-end service robot applications. It can meet a variety of different use cases and requirements. One size fits all! One solution that meets all the industry’s asks!
PART 3

Company Profile
Shenzhen Comstar Technology Co., Ltd was founded in 2009. We're committed to the R&D of embedded industrial motherboards and computers. It has developed into a national high-tech enterprise which covers R&D, production, sales, and OEM&ODM service all-in-one mode.

Comstar is standing on self-innovation and self-research. Our products are widely used in industrial automation, machine vision, robotics, AGV, automated driving, financial terminals, and other advanced intelligent industries.

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