MYiR 米尔电子
Make Your Idea Real

FZ5 EdgeBoard AI Box
Overview

- ✓ Xilinx Zynq UltraScale+ ZU5EV MPSoC based on 1.5 GHz Quad Arm Cortex-A53 and 600MHz Dual Cortex-R5 Cores
- ✓ 8GB DDR4 SDRAM (64-bit, 2400MHz), 32GB eMMC Flash, 64MB QSPI Flash, 32KB EEPROM
- ✓ 4 x USB 3.0, Gigabit Ethernet, RS232, RS485, CAN, Micro-SD, Mini DP, HDMI-IN, Debug (USB-UART) …
- ✓ Computing Power up to 2.4TOPS, Runs at 55 FPS for ResNet-50
- ✓ Supports 8- to 16-channel Video Decoding and 4- to 8-channel Intelligent Analysis
- ✓ Supports Running PetaLinux,
- ✓ Supports Baidu Baidu's PaddlePaddle AI Framework

The FZ5 EdgeBoard AI Box is a rugged and fanless AI edge computing box. With flexibility and stability, algorithms and models, it is designed for data computing at the edge. The computing of data takes place near the 'edge' of a network, where the data is being developed, instead of in a centralized data-processing center. On-device processing results in faster performance and response time, lower latency, power efficiency, improved security by retaining data on the device, and cost savings by minimizing data center transports. With a passive cooling enclosure design, the FZ5 EdgeBoard AI Box is capable of operating quietly in temperature ranging from -40°C to +70°C.
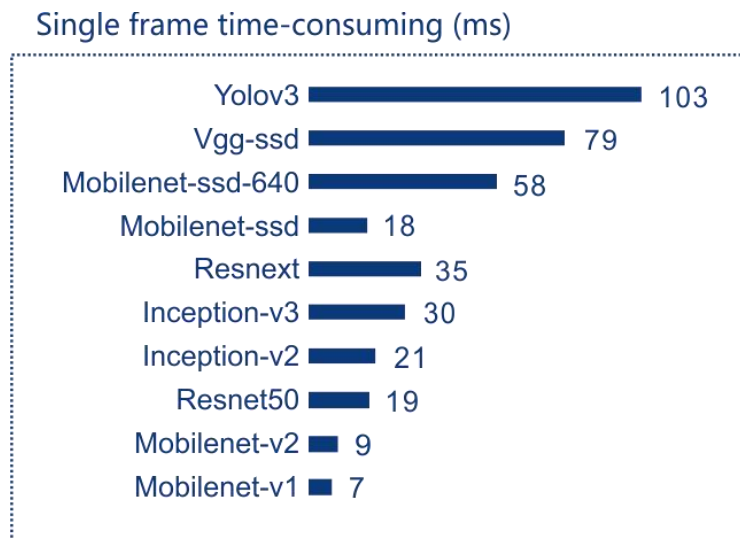
*Front View*

Rear View
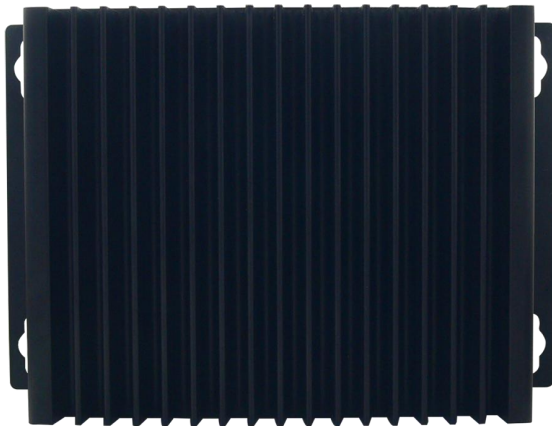
Top View

Bottom View

It has Computing Power up to 2.4TOPS and can run at 55 FPS for ResNet-50 in actual measurement. Power consumption is within 10W to 20W under typical working conditions. Measured data for some models are shown as below:

Single frame time-consuming (ms)

| Model	Time (ms)
Yolov3	103
Vgg-ssd	79
Mobilenet-ssd-640	58
Mobilenet-ssd	18
Resnext	35
Inception-v3	30
Inception-v2	21
Resnet50	19
Mobilenet-v2	9
Mobilenet-v1	7

Measured Data for Reference

The FZ5 EdgeBoard AI Box is using **Xilinx Zynq UltraScale+ ZU5EV MPSoC** solution. The ZU5EV device features a 1.5 GHz quad-core ARM Cortex-A53 64-bit application processor, a 600MHz dual-core real-time ARM Cortex-R5 processor, a Mali400 embedded GPU, a H.264/H.265 Video Codec Unit (VCU) and rich FPGA fabric. The Box has a mainboard **FZ5 Card** inside with memory and storage capacities of **8GB DDR4, 32GB eMMC, 64MB QSPI Flash and 32KB EEPROM** as well as a **32GB Micro SD card slot** for extension. It has exposed rich peripheral interfaces to the Box enclosure including **4 x USB 3.0, Gigabit Ethernet, RS232, RS485, CAN, Debug, HDMI Input and Mini DisplayPort (DP)**.

FZ5 Card Top View

FZ5 Card Bottom View
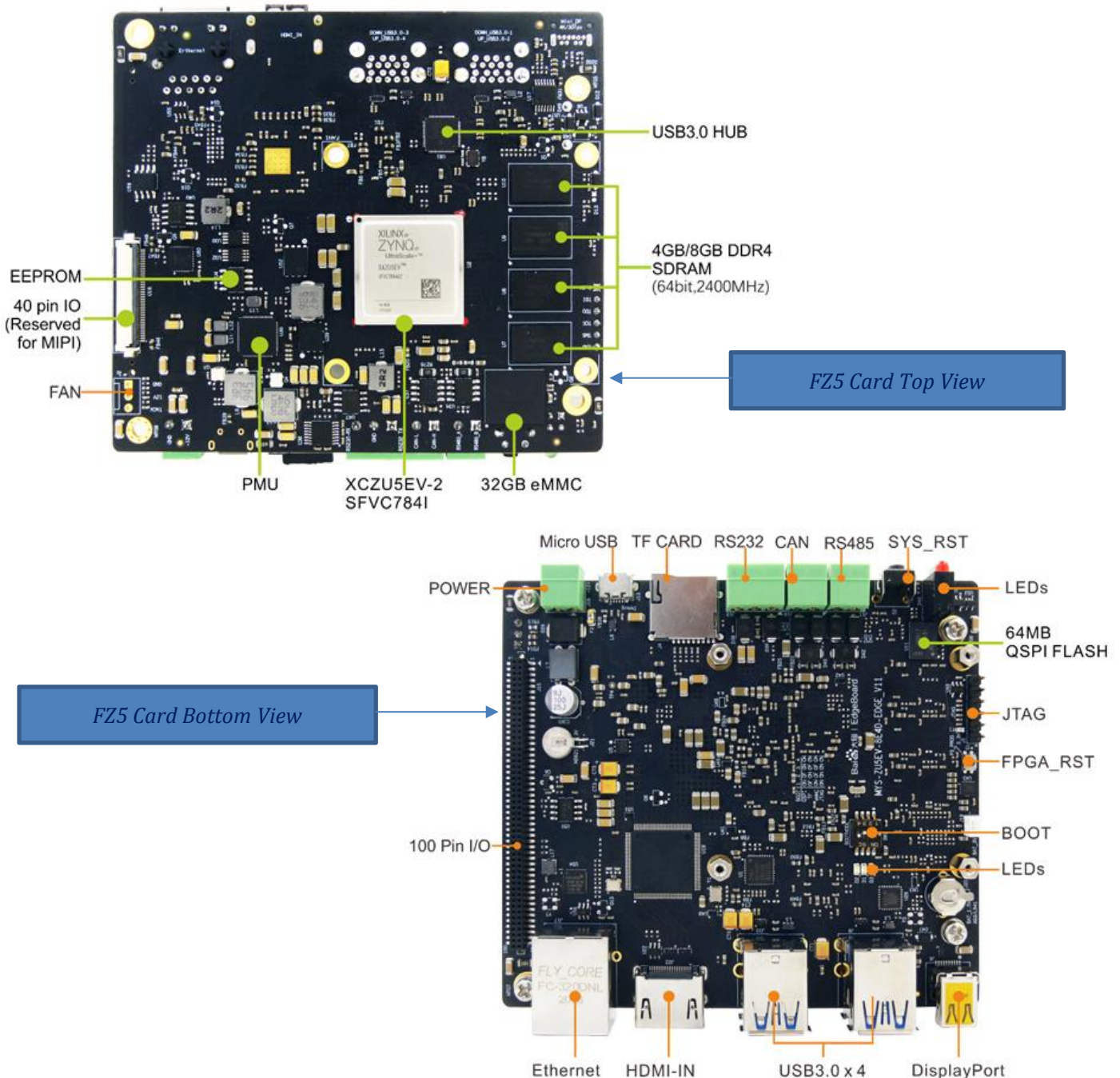
The **FZ5 EdgeBoard AI Box** is able to run **PetaLinux** and supports **PaddlePaddle** **AI framework** which is fully compatible to use **Baidu Brain's AI development tools like EasyDL, AI Studio and EasyEdge** to enable developers and engineers to quickly leverage Baidu-proven technology or deploy self-defined models, enabling faster deployment. It can support 8- to 16-channel video decoding and 4- to 8-channel intelligent analysis and can be used directly in many fields such as multimedia, automotive ADAS, surveillance, industrial quality inspection, medical diagnosis and more others with creation of customers' own applications. Its life cycle is as long as 10 years.
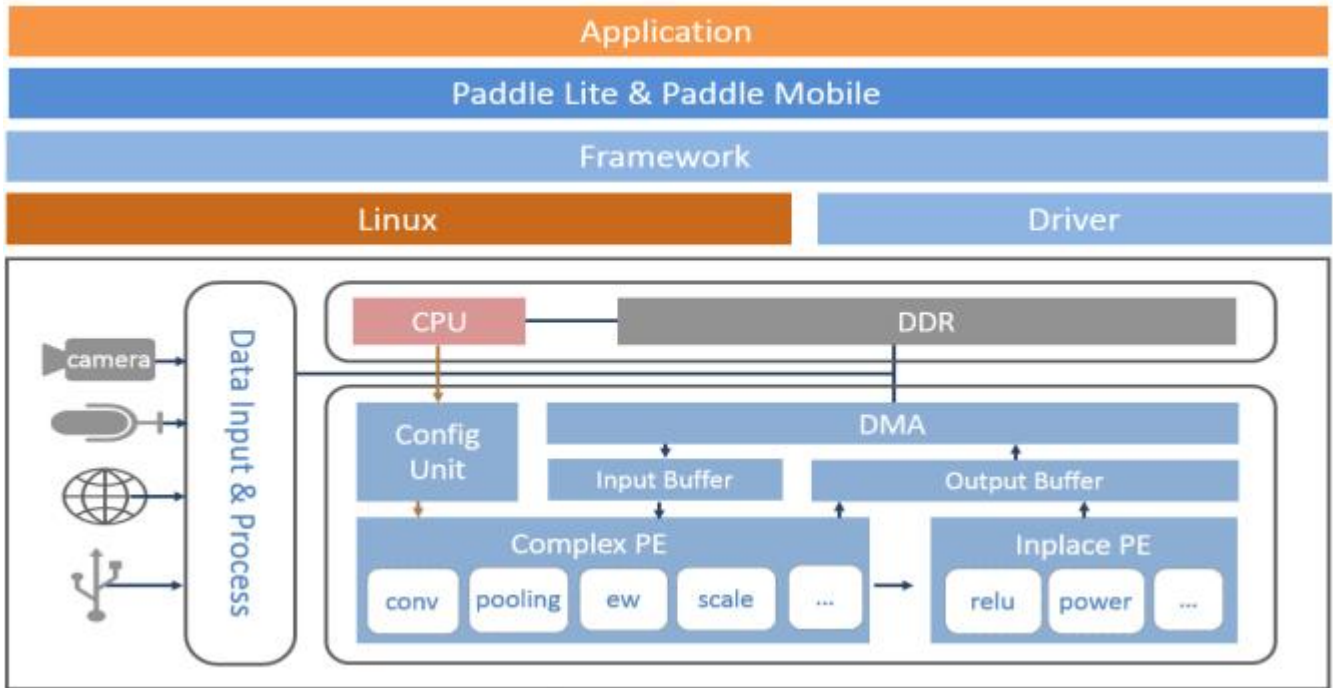
Software Architecture of FZ5 EdgeBoard AI Box

Hardware Specification

Zynq® UltraScale+™ MPSoC devices provide 64-bit processor scalability while combining real-time control with soft and hard engines for graphics, video, waveform, and packet processing. Built on a common real-time processor and programmable logic equipped platform, three distinct variants include dual application processor (CG) devices, quad application processor and GPU (EG) devices, and video codec (EV) devices.

	CG Devices	EG Devices	EV Devices
Application Processor	Dual-core ARM® Cortex™-A53 MPCore™ up to 1.3GHz	Quad-core ARM Cortex-A53 MPCore up to 1.5GHz	Quad-core ARM Cortex-A53 MPCore up to 1.5GHz
Real-Time Processor	Dual-core ARM Cortex-R5 MPCore up to 533MHz	Dual-core ARM Cortex-R5 MPCore up to 600MHz	Dual-core ARM Cortex-R5 MPCore up to 600MHz
Graphics Processor		Mali™-400 MP2	Mali™-400 MP2
Video Codec			H.264 / H.265
Programmable Logic	103K–600K System Logic Cells	103K–1143K System Logic Cells	192K–504K System Logic Cells
Applications	• Sensor Processing & Fusion • Motor Control • Low-cost Ultrasound • Traffic Engineering	• Flight Navigation • Missile & Munitions • Military Construction • Secure Solutions • Networking • Cloud Computing Security • Data Center • Machine Vision • Medical Endoscopy	• Situational Awareness • Surveillance/Reconnaissance • Smart Vision • Image Manipulation • Graphic Overlay • Human Machine Interface • Automotive ADAS • Video Processing • Interactive Display

Zynq UltraScale+ MPSoCs

The Zynq UltraScale+ family provides footprint compatibility to enable users to migrate designs from one device to another. Any two packages with the same footprint identifier code (last letter and number sequence) are footprint compatible. MYIR is using the **XCZU5EV-2SFVC784I** MPSoC for **FZ5 EdgeBoard AI Box** by default, the C784 package covers the widest footprint compatibilities that enable users to select devices among CG, EG and EV.

Zynq® UltraScale+™ MPSoC Device Migration Table

The main features for the XCZU2CG, XCZU3CG, XCZU3EG, XCZU4EV and XCZU5EV MPSoC devices are summarized as below.

| Device	XCZU2CG	XCZU3CG	XCZU3EG	XCZU4EV	XCZU5EV
Logic cells (k)	103	154	154	192	256
CLB Flip-Flops (K)	94	141	141	176	234
CLB LUTs (K)	47	71	71	88	117
Block RAM (Mb)	5.3	7.6	7.6	4.5	5.1
UltraRAM (Mb)	-	-	-	13.5	18.0
DSP Slices	240	360	360	728	1,248
GTX transceivers	PS-GTR4x (6Gb/s)	PS-GTR4x (6Gb/s)	PS-GTR4x (6Gb/s)	PS-GTR4x (6Gb/s), GTH4x (16.3Gb/s)	PS-GTR4x (6Gb/s), GTH4x (16.3Gb/s)
Processor Units					
Application Processor Unit	Dual-core ARM® Cortex™-A53 MPCore™ up to 1.3GHz	Quad-core ARM® Cortex™-A53 MPCore™ up to 1.5GHz			
Memory w/ECC	L1 Cache 32KB I / D per core, L2 Cache 1MB, on-chip Memory 256KB				
Real-Time Processor Unit	Dual-core ARM Cortex-R5 MPCore™ up to 600MHz				
Memory w/ECC	L1 Cache 32KB I / D per core, Tightly Coupled Memory 128KB per core				
Graphics Processing Unit	-	-	Mali™-400 MP2 up to 667MHz		
Video Codec	-	-	-	H.264 / H.265	
Memory L2 Cache	64KB				
External Memory, Connectivity, Integrated Block Functionality					
Dynamic Memory Interface	x32/x64: DDR4, LPDDR4, DDR3, DDR3L, LPDDR3 with ECC				
Static Memory Interfaces	NAND, 2x Quad-SPI				
High-Speed Connectivity	PCIe® Gen2 x4, 2x USB3.0, SATA 3.1, DisplayPort, 4x Tri-mode Gigabit Ethernet				
General Connectivity	2 x USB 2.0, 2 x SD/SDIO, 2 x UART, 2 x CAN 2.0B, 2 x I2C, 2 x SPI, 4 x 32b GPIO				
Power Management	Full / Low / PL / Battery Power Domains				
Security	RSA, AES, and SHA				
AMS - System Monitor	10-bit, 1MSPS – Temperature and Voltage Monitor				

MPSoC device selection guide

The **FZ5 EdgeBoard AI Box** takes full advantages of the Xilinx Zynq UltraScale+ ZU5EV MPSoC. The main features are listed in below table.

Item	Features
SoC	Xilinx Zynq UltraScale+ XCZU5EV-1SFVC784 (ZU5EV, 784 Pin Package) MPSoC - 1.5 GHz 64 bit Quad-core ARM® Cortex™-A53 - 600MHz Dual-core ARM® Cortex™-R5 processor - ARM Mali™-400MP2 Graphics Processor - H.264/H.265 Video Codec Unit (VCU) - 16nm FinFET+ FPGA fabric
Memory	8GB DDR4 SDRAM (64bit, 2400MHz)
Storage	32GB eMMC 64MB QSPI Flash 32KB EEPROM Micro SD card slot
Communications	1 x 10/100/1000Mbps Ethernet Interface 4 x USB 3.0 Host Ports 1 x USB-UART Debug Interface 1 x RS232, 1 x RS485, 1 x CAN
Display	1 x HDMI Input Interface 1 x Mini DisplayPort (DP) Output Interface, 4K/30fps
Others	1 x System Reset Button 2 x LEDs (1 x Red Power LED, 1 x Green System Status LED)
Power supply	DC 12V/3A
Dimensions	Body: 120mm x 100mm x 50mm Hanger: 148mm x 100mm
Working Temp.	-40°C ~+70°C
Working humidity	20% ~ 90%, non-condensing
RTC	*If RTC function is needed, you may need to open the enclosure and add the battery to the main board of the FZ5 EdgeBoard AI Box.* - 1 x 1.5V Non-Rechargeable RTC Battery Holder (battery is not provided by default, Model AG3/LR41 is recommended, pluggable) - 1 x 3V Rechargeable RTC Battery Interface (battery is not soldered by default, Model MS621T is recommended, needs to be soldered)
Software	Supports Running PetaLinux Supports Baidu's PaddlePaddle AI framework

Features of FZ5 EdgeBoard AI Box

Dimension Chart
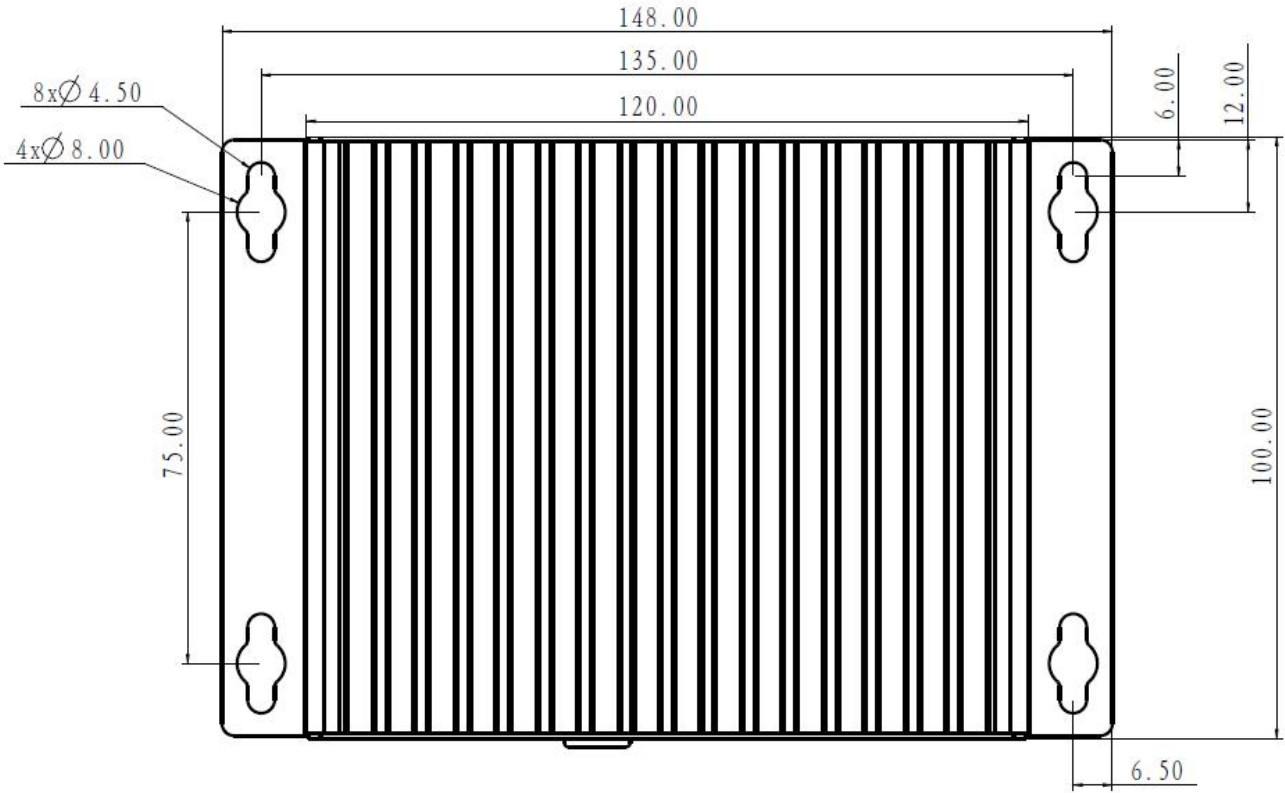
Dimension Chart of FZ5 EDGE AI BOX (Unit: mm)

Software Features

The FZ5 EdgeBoard AI Box is able to run **PetaLinux 2019.1** and provided with complete Linux BSP. The features are as below:

| Item	Features	Description	Source code provided
Tool chains	gcc8.2.0	gcc version 8.2.0	
	gcc 5.2.1	gcc version 5.2.1 (Linaro GCC 5.2)	
Bootloader	boot.bin	First boot program including FSBL and u-boot2019.01	Yes
Linux Kernel	Linux 4.19.0	Customized kernel for FZ5 Card	Yes
	USB2.0/3.0 Host	USB2.0/3.0 Host driver	Yes
	Ethernet	Gigabit Ethernet driver	Yes
	MMC/SD/TF	MMC/SD/TF card driver	Yes
	Qspi flash	Qspi flash driver	Yes
	CAN	CAN driver	Yes
	DP	DP driver	Yes
	I2C	I2C driver	Yes
	UART	UART driver	Yes
	Watchdog	Watchdog driver	Yes
	GPIO	GPIO driver	Yes
	LED	LED driver	Yes
	Button	Button driver	Yes
	RTC	RTC driver	Yes
	HDMI	HDMI IN driver	Yes
Application	HDMI	HDMI IN example	Yes
	CAN	CAN example	Yes
	Net	Socket example	Yes
File system	Ramdisk	Ramdisk System Image	
	Rootfs	Buildroot making including Qt	Yes
Petalinux	Petalinux2019.1	Supports Xilinx Petalinux2019.1 development tools. MYIR provides complete BSP for the FZ5 card.	

Features of Linux BSP

The FZ5 Edge AI Box supports **PaddlePaddle AI framework** which is fully compatible to use **Baidu Brain's AI development tools like EasyDL, AI Studio and EasyEdge** to enable developers and engineers to quickly leverage Baidu-proven technology or deploy self-defined models, enabling faster deployment.

Baidu Brain's AI Development Tools
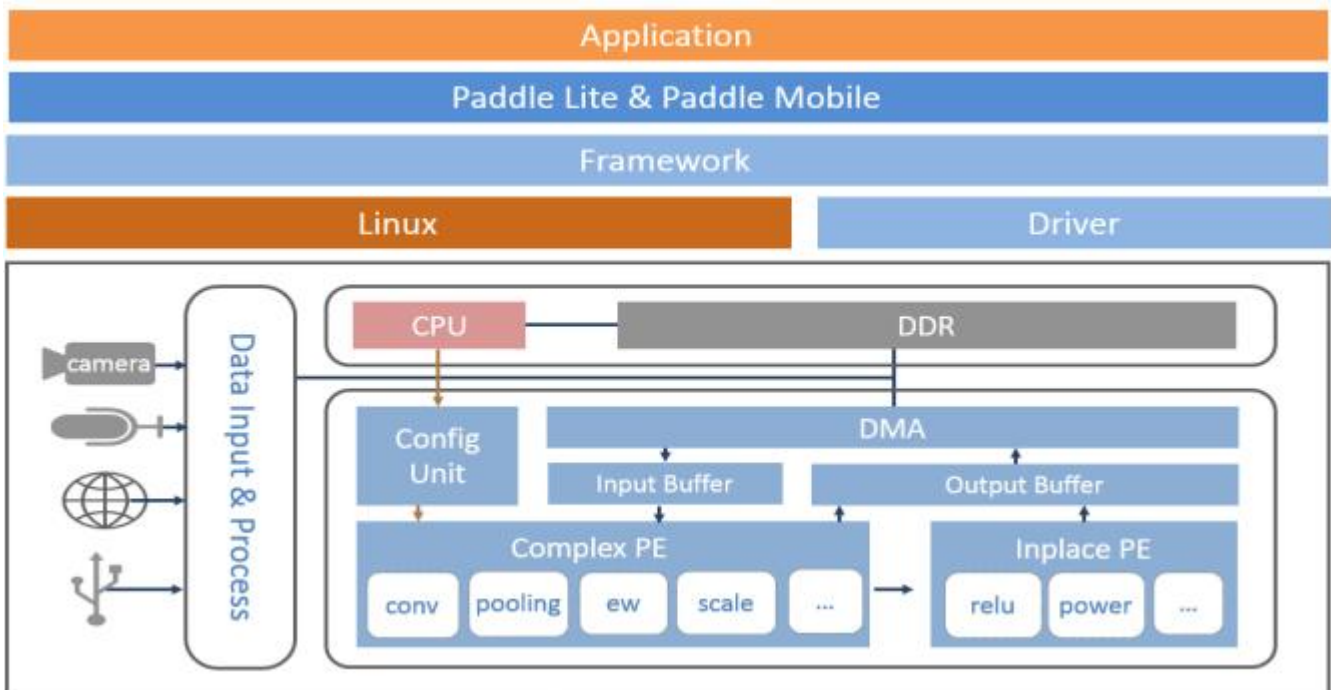
Software Architecture of FZ5 Card

Order Information

Item	Packing List
FZ5 EdgeBoard AI Box (Part No.: MYS-ZU5EV-32E8D-EDGE-BOX)	✓ One **FZ5 EdgeBoard AI BOX** ✓ One 12V/3A Power Adapter ✓ DC Power Adapter Cable ✓ One Mini USB Cable ✓ One 32GB TF Card

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