Overview of Real-time Operating Systems for embedded devices

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Introduction

Real-time operating systems can be used for embedded devices management,smart home automation, for civil or military aviation – for optical devices and weapon controls management. Real-time operating system manages devices with that has:

→ limited resources

→ limited time to complete task

→ sensors for communication

Target of the paper is to explore and describe features of well-known RTOS such as: FreeRTOS, Zephyr and Armbian GNU/Linux. Paper performs the Overview task of PhD thesis.

Materials and Methods

Programming languages for real-time os development are C or Assembly language. Usage of assembly language gives more control of current task execution. For every RTOS will be analyzed:

→ Short description

→ Supported virtualizators

→ Supported Instruction set architectures

→ Embedded device whitch is supported by the os

FreeRTOS

Short Description	Supported Virtualizators	Supported ISA	Supported microcontroller modules
Written in C,modular libraries, supports AWS	QEMU,Virtualbox	X86,ARM-RISC,PIC	PIC24-RISC based, SIFive board-RISCV based

FreeRTOS Docs (2023).

Zephyr OS

Short Description	Supported Virtualizators	Supported ISA	Supported microcontroller modules
Written in C,multi-thread OS	QEMU	ARM64,x86	NEORV32-RISCV based Adafruit KB2040- RISC based

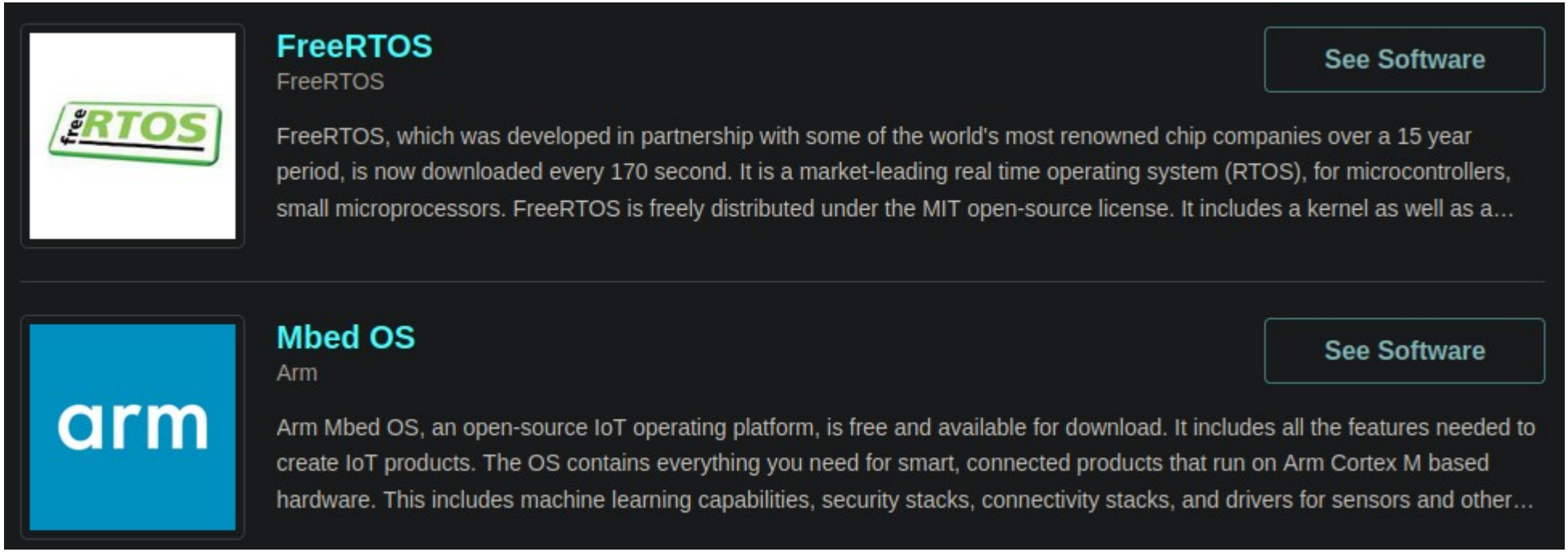
Zephyr Docs (2023).

Armbian

Short Description	Supported Virtualizators	Supported ISA	Supported microcontroller modules
Debian – ported OS for microcontroller modules; SD card can be used for storage	QEMU	X86_64, RISC	OrangePi,BananaPi

Armbian Docs (2023).

Best RTOS 2023



Results

→ FreeRTOS, Zephyr and Armbian OS are analyzed and compared.

→ Virtualizators for x86 simulation are shown.

→ For every OS is shown supported device

Conclusions and future work

Analyzed operating systems are written in C and they support RISC-V architecture because of C. But when requirements for the RTOS are OS to be much faster and more useful for RISC-V projects then exists need to develop truly RISC-V assembly-based OS. That is main target of my PhD thesis.

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PhD thesis theme -> Methods and Tools to develop a assembly-based operating system for embedded devices

References

1. A practical introduction to real-time systems for undergraduate engineering
2. FreeRTOS Documentation, 2023
3. Zephyr Documentation,2023
4. Armbian Documentation,2023