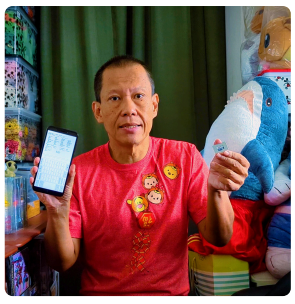
Lup Yuen LEE



IoT Techie and Educator

Singapore SG
Born in 1969

https://lupyuen.org luppy@appkaki.com
lupyuen lupyuen MisterTechBlog Download PDF JSON

Hands-on IoT advisor and educator. Passionate about helping everyone create IoT products that will make a difference.

SKILLS

Internet of Things (IoT)
Master

lorawan | nb-iot | sigfox | apache nuttx | apache mynewt | embedded zig | embedded rust | embedded c | bl602 | nrf52 | stm32 | aws iot | google cloud iot

Cloud Computing
Master

aws | google cloud | azure | s3 | sagemaker | rds | dynamodb | lambda | api gateway | cloud functions | appengine | tensorflow | bigquery | node.js | go

Mobile Application Development
Master

ios | android | swift | react native | xcode | responsive mobile web | bootstrap

WORK EXPERIENCE

Apache NuttX PMC (Project Management Committee) at Apache NuttX RTOS **September 2022- Current**
https://nuttx.apache.org/

Promoting IoT Education with Apache NuttX RTOS (Real-Time Operating System). Ported Apache NuttX RTOS to:

- PINE64 PinePhone (Allwinner A64 SoC / Arm Cortex-A53)
- PINE64 Star64 64-bit RISC-V Single-Board Computer (StarFive JH7110 SoC)
- PINE64 Ox64 64-bit RISC-V Single-Board Computer (BouffaloLab BL808 SoC)
- PINE64 Oz64 SG2000 64-bit RISC-V Single-Board Computer (Sophgo SG2000 SoC)
- PINE64 StarPro64 64-bit RISC-V Single-Board Computer (ESWIN EIC7700X SoC)
- PINE64 Yuzuki Avaota-A1 Arm64 Single-Board Computer (Allwinner A527 SoC / Arm Cortex-A55)

Adjunct Lecturer at Temasek Polytechnic **April 2015- February 2019**
(SG) Singapore http://www.tp.edu.sg

Responsible for teaching and mentoring the next generation of professionals in IoT technologies. He taught the following courses:

- IoT Application Development: He prepared and presented lessons and labs for training working adults with IoT programming skills, based on AWS IoT, Sigfox, Ubidots and Arduino. He created the training platform with various AWS services: AWS IoT, Lambda, API Gateway, S3, DynamoDB, SNS, Elasticsearch, Kibana. His students included IT professionals from Agility, IBM, SAP, Ericsson, Canon and ITE.
- IoT Project: He supervised the students in creating innovative IoT products (based on AWS IoT and Sigfox) that solve real-world problems like dementia patient tracking, elderly home monitoring, food safety, campus security, AED management, realtime asset tracking.

Chief Technology Officer at UnaBiz **August 2016- April 2018**
(SG) Singapore https://unabiz.com

As former CTO of UnaBiz, he was responsible for creating new tools and systems to help people get onboard with Sigfox the quickest way possible.

- (1) UnaLocation - Enhanced Sigfox Geolocation with Machine Learning; (2) UnaRadar - Sigfox Network Finder mobile web app; (3) UnaMap - Sigfox Coverage Web Map; (4) UnaShield - Sigfox Shield for Arduino; (5) UnaBell - Smart Button on Sigfox; (6) sigfox-gcloud - Open Source Sigfox Server for Google Cloud; (7) sigfox-aws - Open Source Sigfox Server for Amazon Web Services

Principal Consultant at Konica Minolta Business Innovation Centre **November 2014- September 2016**
(SG) Singapore https://bic.konicaminolta.asia

He heads the software development/engineering team that architects, develops and executes proof-of-concept (POC) projects for incubating new businesses for Konica Minolta. He was also consulted for technical due diligence in investment projects and acquisitions.

- (1) Straight-Through Food & Beverage Ordering System with iOS and Android mobile apps and Kitchen Display System; (2) Bluetooth Beacon Location Analytics for Android and iOS

Chief Technology Officer at SingTel L!feLabs **June 2009- November 2014**
(SG) Singapore https://singtel.com

Reports directly to CEO Group Digital L!fe, Mr Allen Lew. Responsible for scanning of innovative ICT technologies worldwide and executing proof-of-concept (POC) projects for the SingTel Group. He was also consulted for technical due diligence in SingTel Innov8 investment projects and SingTel Group Strategy acquisitions.

- (1) Internet of Things (IoT); (2) Indoor Positioning; (3) Smart Retail; (4) Social Recommendation based on Facebook profiling; (5) Speech Recognition for Singapore English; (6) Image Recognition for Retail; (7) Motion Gesture User Experience; (8) Augmented Reality; (9) Cloud Gaming; (10) Virtual Reality; (11) Video Streaming and Distribution; (12) Home Automation

Principal Consultant at NCS Pte Ltd **September 1994- September 2012**
(SG) Singapore https://www.ncs.com.sg

Lead Enterprise Architect for Microsoft .NET technologies in Singapore's largest system integrator

- (1) IRAS Inland Revenue Integrated System; (2) Singapore Health Services Outpatient Administrative System; (3) Digital library systems for National Library Board, Singapore Polytechnic, Temasek Polytechnic, Singapore Airlines Engineering, SASCO; (4) Web portals for IDA MyeCitizen Portal, MINDEF NS Portal, MediaCorp MOBTV Portal; (5) YW8, Singapore’s first mobile payment system by NETS, DBS, SingTel, M1, StarHub

EDUCATION

Master of Science, Computer Science at University of Illinois at Urbana-Champaign

1991 - 1992

(US) USA

Research Assistant for CHOICES Object-Oriented Operating System

Bachelor of Science, Computer Science at University of Toronto - University College

1988 - 1990

(CA) Canada

PUBLICATIONS

Creating the Unicorn Emulator for Avaota-A1 SBC (Apache NuttX RTOS) in lupyuen.org

13 April 2025

Avaota-A1 Arm64 SBC is officially supported by Apache NuttX RTOS (Allwinner A527 SoC). Let's take Unicorn Emulator and create a Software Emulator for Avaota SBC.

Inside Arm64 MMU: Unicorn Emulator vs Apache NuttX RTOS in lupyuen.org

30 March 2025

Spotted in Unicorn Emulator: A Demo of Arm64 Memory Management Unit (MMU)... in 18 Lines of Arm64 Assembly! Today we decipher the code inside the Arm64 MMU Demo, figure out how it works. Which turns out to be surprisingly helpful for emulating Apache NuttX RTOS, compiled for Arm64 SBCs.

Porting Apache NuttX RTOS to Avaota-A1 SBC (Allwinner A527 SoC) in lupyuen.org

16 March 2025

This article explains how we ported NuttX from QEMU Arm64 Kernel Build to PINE64 Yuzuki Avaota-A1 SBC based on Allwinner A527 SoC ... Completed within 24 Hours!

PR Test Bot for PinePhone (Apache NuttX RTOS) in lupyuen.org

9 March 2025

Earlier we created a PR Test Bot that will Build and Test the Pull Requests for Apache NuttX RTOS. Today we extend our Test Bot to Build and Test the Pull Requests for PINE64 PinePhone. Yep on the Real Arm64 PinePhone Hardware!

StarPro64 EIC7700X RISC-V SBC: Maybe LLM on NPU on NuttX? in lupyuen.org

2 March 2025

StarPro64 EIC7700X is the (literally) Hot New RISC-V SBC by PINE64. Let's chat about ESWIN EIC7700X, the RISC-V SoC inside, how its Neural Processing Unit supports Large Language Models. And how we port Apache NuttX RTOS to StarPro64.

QEMU Test Bot for Pull Requests: Beware of Semihosting Breakout (Apache NuttX RTOS) in lupyuen.org

23 February 2025

Last week we saw our new Test Bot for NuttX Pull Requests, that will test on Real Hardware: Oz64 SG2000 RISC-V SBC. Today we extend our Test Bot to QEMU Emulators: Arm64 QEMU and RISC-V QEMU.

Test Bot for Pull Requests ... Tested on Real Hardware (Apache NuttX RTOS / Oz64 SG2000 RISC-V SBC) in lupyuen.org

16 February 2025

We're always Making Things Better (and making better things) with Apache NuttX RTOS. Our new Test Bot shall watch for Comments on Pull Requests and start a NuttX Build and Test on Real Hardware: PINE64 Oz64 SG2000 RISC-V SBC.

Auto-Rewind for Daily Test (Apache NuttX RTOS) in lupyuen.org

9 February 2025

If the Daily Test fails for Apache NuttX RTOS... Can we Auto-Rewind and discover the Breaking Commit? Let's do it with Prometheus Time-Series Database and Mastodon Server

Rust Standard Library on Apache NuttX RTOS in lupyuen.org

26 January 2025

Rust Standard Library is now available on Apache NuttX RTOS, thanks to awesome work by Huang Qi! In this article we explain (1) How to build NuttX + Rust Standard Library (2) Handling JSON with the Serde Crate (3) Async Functions with the Tokio Crate (4) Blinking LEDs with the Nix Crate

Fixing a uname bug (Apache NuttX RTOS) in lupyuen.org

19 January 2025

Earlier This Week: uname became unusually quieter on Apache NuttX RTOS... The Commit Hash is missing! Watch as we stomp the seemingly simple bug, that turns out to be something seriously sinister! (Spoiler: Static Vars are broken)

Forgejo Git Forge for Apache NuttX RTOS (Experimental) in lupyuen.org

12 January 2025

Life Without GitHub: What's it like? Today we talk about Forgejo Git Forge, and whether Apache NuttX RTOS could possibly switch from GitHub to our own Git Forge.

Git Bisecting a Bug (Apache NuttX RTOS) in lupyuen.org

5 January 2025

Suppose we hit a Runtime Bug in Apache NuttX RTOS. We think that the Breaking Commit (causing the bug) is somewhere inside these hundreds of NuttX Commits. But which one? In this article: We run Git Bisect to discover the Breaking Commit.

Mastodon Server for Continuous Integration (Apache NuttX RTOS) in lupyuen.org

29 December 2024

We're out for a 50 km overnight hike. Our Build Farm for Apache NuttX RTOS runs non-stop all day, all night. Continuously compiling over 1,000 NuttX Targets. Can we be 100% sure that NuttX is OK? Without getting spammed by alert emails all night? In this article: We talk about Mastodon as a fun new way to broadcast NuttX Alerts in real

time.

Buy a Coffee for Lup Yuen Lee in lupyuen.org

28 December 2024

Please sponsor my open-source writing and projects. Thank you so much!

Failing a Continuous Integration Test for Apache NuttX RTOS (QEMU RISC-V) in lupyuen.org

22 December 2024

Every Day: Apache NuttX RTOS on QEMU RISC-V Emulator fails our Continuous Integration Test. The Bug Stops Here! In this article, we study the internals of a NuttX CI Test (Continuous Integration) as we fix the bug.

Rewinding a Build for Apache NuttX RTOS (Docker) in lupyuen.org

15 December 2024

When something breaks the Daily Build for Apache NuttX RTOS: Our NuttX Maintainers will scramble to identify the Breaking Commit. Not any more! Now we can go back in time and Rewind The Build.

macOS Build Farm for Apache NuttX RTOS (Apple Silicon) in lupyuen.org

8 December 2024

Folks on macOS: Compiling Apache NuttX RTOS used to be so tiresome. Not any more! In this article, we explain how to build anything on macOS, by patching the NuttX CI Script. Which also becomes our macOS Build Farm.

Continuous Integration Dashboard for Apache NuttX RTOS (Prometheus and Grafana) in lupyuen.org

24 November 2024

Last article we spoke about the (Twice) Daily Builds for Apache NuttX RTOS. Today we talk about Monitoring the Daily Builds (also the NuttX Build Farm) with our new NuttX Dashboard.

Optimising the Continuous Integration for Apache NuttX RTOS (GitHub Actions) in lupyuen.org

10 November 2024

Within Two Weeks: We squashed our GitHub Actions spending from $4,900 (weekly) down to $890. Previously: Our developers waited 2.5 Hours for a Pull Request to be checked. Now we wait at most 1.5 Hours! This article explains everything we did in the (Semi-Chaotic) Two Weeks for Apache NuttX RTOS.

Your very own Build Farm for Apache NuttX RTOS in lupyuen.org

27 October 2024

Refurbished Ubuntu PCs have become quite affordable. Let's turn them into a (Low-Cost) Build Farm for Apache NuttX RTOS, thanks to the Docker Image provided by NuttX.

LLM Bot that reviews Pull Requests for Apache NuttX RTOS in lupyuen.org

29 September 2024

We’re experimenting with an LLM Bot (Large Language Model) that will review Pull Requests for Apache NuttX RTOS. This article explains how we created the Bot in One Week... By sheer accident!

Continuous Integration for Apache NuttX RTOS in lupyuen.org

11 September 2024

This article explains how Apache NuttX RTOS is running Continuous Integration with GitHub Actions. Every NuttX Pull Request will trigger 1,594 NuttX Builds!

Early Days of Rust Apps on Apache NuttX RTOS in lupyuen.org

19 August 2024

My student Rushabh Gala has just completed his project for Google Summer of Code, on creating Safer Rust Apps for Apache NuttX RTOS. In this article we walk through Rushabh’s contributions, and understand how we’re evolving Rust Apps for NuttX.

RISC-V Emulator for Sophgo SG2000 SoC (Pine64 Oz64 / Milk-V Duo S) in lupyuen.org

7 July 2024

Earlier this year we made a RISC-V Emulator for Ox64 BL808 SBC, thanks to our customised TinyEMU RISC-V Emulator. (Not the small flightless bird) Now that NuttX supports Sophgo SG2000 SoC: Let's create a similar emulator for Pine64 Oz64 SBC and Milk-V Duo S!

Daily Automated Testing for Milk-V Duo S RISC-V SBC (IKEA TRETAKT / Apache NuttX RTOS) in lupyuen.org

23 June 2024

Last week we upstreamed Milk-V Duo S SBC to Apache NuttX RTOS. (Based on Sophgo SG2000 RISC-V SoC) But NuttX Mainline changes every day. Will Milk-V Duo S suffer “Software Bit Rot”? And fail to boot NuttX someday? Let’s do Daily Automated Testing for NuttX on a Milk-V Duo S SBC, controlled by an IKEA Smart Power Plug with Home Assistant API.

(Slides) TinyEMU RISC-V Emulator for Apache NuttX RTOS in NuttX International Workshop 2024

13 June 2023

What if we could boot and test Apache NuttX RTOS inside a Web Browser? This presentation explains how we created a NuttX Emulator in WebAssembly, based on TinyEMU RISC-V Emulator.

(Video) TinyEMU RISC-V Emulator for Apache NuttX RTOS in NuttX International Workshop 2024

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What if we could boot and test Apache NuttX RTOS inside a Web Browser? This presentation explains how we created a NuttX Emulator in WebAssembly, based on TinyEMU RISC-V Emulator.

(Slides) Adventures of Ox64 BL808 RISC-V SBC with Apache NuttX RTOS in NuttX International Workshop 2024

13 June 2023

We ported Apache NuttX RTOS to PINE64's Ox64 BL808 64-bit Single-Board Computer. And we created an Emulator for Ox64 SBC that runs in the Web Browser, thanks to TinyEMU RISC-V Emulator. Today we run Daily Automated Testing of NuttX on the Ox64 Emulator. In this presentation we explain how we used the Ox64 Emulator in our experiments with WebAssembly and NuttX: (1) Testing the TCC RISC-V Compiler in WebAssembly (2) Porting the QuickJS JavaScript Engine to NuttX (3) Creating a Drag-n-Drop App Builder for NuttX

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(Slides) Analysis of Real-Time Logs for Apache NuttX RTOS with PureScript in NuttX International Workshop 2024

13 June 2023

Today we can get Real-Time NuttX Logs from our RISC-V Devices: Ox64 SBC (Web Serial API) and Ox64 Emulator (Term.js). What if we could analyse the RISC-V Logs in Real-Time? And show the results in the Web Browser? Let's do it with PureScript, the Functional Language that compiles to JavaScript. We'll also support Online Scripting of PureScript for Log Parsing. Can we enhance the NuttX Developer Experience with Functional Programming Tools like PureScript? Or newer hardware like PINE64 Ox64 SBC and Sophgo SG2000 / Milk-V Duo S? Let's chat about this.

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13 June 2023

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Apache NuttX RTOS on Sophgo SG2000 RISC-V SoC (Milk-V Duo S / Oz64 SBC) in lupyuen.org

19 May 2024

Soon we'll see many new 64-bit RISC-V SBCs based on the Sophgo SG2000 RISC-V SoC. Will they work with Apache NuttX RTOS? Let's find out!

Rust Apps on Ox64 BL808 RISC-V SBC and Apache NuttX RTOS in lupyuen.org

5 May 2024

Will Rust Apps run on a 64-bit RISC-V SBC? Like Ox64 BL808 SBC? Let's find out with Apache NuttX RTOS!

Rust Custom Target for QEMU RISC-V on Apache NuttX RTOS in lupyuen.org

21 April 2024

Our Rust App compiles for Software Floating-Point, but Apache NuttX RTOS expects Hardware Floating-Point... Let's fix this with a Rust Custom Target for QEMU RISC-V

Rust Apps on Apache NuttX RTOS and QEMU RISC-V in lupyuen.org

7 April 2024

Here's how we run Rust Apps on Apache NuttX RTOS and QEMU RISC-V Emulator.

Too many Embedded Logs? PureScript might help (Ox64 BL808 SBC / Apache NuttX RTOS) in lupyuen.org

3 March 2024

Troubleshooting Crash Dumps for Apache NuttX RTOS will become a little less painful... Thanks to our new NuttX Log Parser! This is how we created with PureScript, a Real-Time Parser and Explainer for RISC-V Exceptions and Stack Dumps.

(Homage to MakeCode) Coding Ox64 BL808 SBC the Drag-n-Drop Way in lupyuen.org

25 February 2024

Remember Makecode? BBC micro:bit and its Drag-n-Drop App Builder? Let's give MakeCode a wholesome wholesale makeover... With Blockly, QuickJS JavaScript Engine, Apache NuttX RTOS and Ox64 BL808 64-bit RISC-V SBC

QuickJS JavaScript Engine on a Real-Time Operating System (Apache NuttX RTOS) in lupyuen.org

18 February 2024

Can we run QuickJS JavaScript Engine on Apache NuttX RTOS? And Blink the LED on Ox64 BL808 RISC-V SBC... In 4 lines of JavaScript? Let's do it!

Zig runs ROM FS Filesystem in the Web Browser (thanks to Apache NuttX RTOS) in lupyuen.org

11 February 2024

We solve a hefty headache in our port of TCC Compiler to WebAssembly: Missing C Header Files... Thanks to the ROM FS Filesystem and the ROM FS Driver from Apache NuttX RTOS

TCC RISC-V Compiler runs in the Web Browser (thanks to Zig Compiler) in lupyuen.org

4 February 2024

Today we're running Apache NuttX RTOS inside a Web Browser. What if we could compile and test NuttX Apps in the Web Browser? Let's explore with TCC 64-bit RISC-V Compiler, compiled to WebAssembly with Zig Compiler.

Automated Testing with Ox64 BL808 Emulator (Apache NuttX RTOS) in lupyuen.org

28 January 2024

Every day we're auto-building Apache NuttX RTOS for Ox64 BL808 SBC... Can we test NuttX on Ox64 Emulator automatically after building? Let's find out!

Emulate Ox64 BL808 in the Web Browser: Experiments with TinyEMU RISC-V Emulator and Apache NuttX RTOS in lupyuen.org
21 January 2024

Let's create a barebones Ox64 BL808 Emulator that runs in the Web Browser... By tweaking TinyEMU RISC-V Emulator and booting Apache NuttX RTOS without any modification

Apache NuttX RTOS in a Web Browser? Adventures with TinyEMU and VirtIO in lupyuen.org
14 January 2024

Here's how we boot and run Apache NuttX RTOS in the Web Browser... Thanks to TinyEMU RISC-V Emulator, VirtIO Virtual Devices and OpenAMP Library

Nim on a Real-Time Operating System: Apache NuttX RTOS + Ox64 BL808 SBC in lupyuen.org
1 January 2024

Let's blink an LED on Pine64 Ox64 BL808 64-bit RISC-V Single-Board Computer... With Nim Programming Language and Apache NuttX Real-Time Operating System

$8 RISC-V SBC on a Real-Time Operating System: Ox64 + NuttX in hackster.io
17 December 2023

Bare Metal Experiments with Apache NuttX RTOS (Real-Time Operating System) on the affordable Pine64 Ox64 BL808 64-bit RISC-V SBC

Fixed the UART Interrupt and Platform-Level Interrupt Controller (Ox64 BL808) in lupyuen.org
10 December 2023

Weak Ordering in the Ox64 BL808 Memory Management Unit (T-Head C906)... Causes problems with UART Interrupts and the Platform-Level Interrupt Controller

RISC-V Ox64 BL808 SBC: UART Interrupt and Platform-Level Interrupt Controller (PLIC) in lupyuen.org
3 December 2023

We dive into the Platform-Level Interrupt Controller (PLIC) for the tiny adorable Pine64 Ox64 BL808 64-bit Single-Board Computer... Using Apache NuttX Real-Time Operating System to explain the inner workings of PLIC

RISC-V Ox64 BL808 SBC: NuttX Apps and Initial RAM Disk in lupyuen.org
26 November 2023

(1) What's inside an Application for Apache NuttX RTOS (2) How it calls the NuttX Kernel (3) How NuttX Apps are bundled into the Initial RAM Disk for Pine64 Ox64 BL808 RISC-V SBC

RISC-V Ox64 BL808 SBC: Sv39 Memory Management Unit in lupyuen.org
19 November 2023

Let's boot Apache NuttX RTOS on Pine64 Ox64 64-bit RISC-V SBC... And figure out how the Sv39 Memory Management Unit works

RISC-V Ox64 BL808 SBC: Starting Apache NuttX Real-Time Operating System in lupyuen.org
12 November 2023

Let's boot a tiny bit of Apache NuttX Real-Time Operating System... On Pine64 Ox64 BL808 RISC-V SBC

Ox64 BL808 RISC-V SBC: Booting Linux and (maybe) Apache NuttX RTOS in lupyuen.org
5 November 2023

Let's boot Linux on Pine64 Ox64 BL808 RISC-V SBC... As we figure out how Apache NuttX RTOS might run on Ox64

Star64 JH7110 RISC-V SBC: Experiments with OpenSBI (Supervisor Binary Interface) in lupyuen.org
29 October 2023

Let's boot Apache NuttX RTOS on the Star64 JH7110 RISC-V SBC (VisionFive5 too)... And experiment with the OpenSBI Supervisor Binary Interface

Strange Workaround for TFTP Timeout in U-Boot Bootloader (Star64 JH7110 RISC-V SBC) in lupyuen.org
6 October 2023

Here's how we fixed TFTP Timeouts in the Star64 JH7110 U-Boot Bootloader... By sending every TFTP Data Packet twice

(Slides) Apache NuttX RTOS for PINE64 PinePhone in NuttX International Workshop 2023
29 September 2023

Smartphones are incredibly complex gadgets. What if we could learn the internals of smartphones... By booting Apache NuttX RTOS on our phone? Over the past year, we have ported NuttX to PINE64 PinePhone as an Educational Experiment. Today we can run NuttX Touchscreen Apps on PinePhone, based on Allwinner A64 SoC with Arm64 CPUs. NuttX on PinePhone will soon support Phone Calls and Text Messages on the 4G LTE Network. We hope NuttX will become a valuable tool for teaching the inner workings of modern smartphones.

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(Slides) PinePhone Touchscreen on NuttX: Handling MIPI DSI, Display Engine and I2C Touch Input in NuttX International Workshop 2023
29 September 2023

This presentation explains how we built the NuttX Drivers to support Touchscreen Apps on PINE64 PinePhone: (1) MIPI DSI on Allwinner A64 SoC (2) Allwinner Display Engine (3) Goodix I2C Touch Panel (4) Integration with LVGL Graphics Library. To derisk the development, we prototyped the NuttX Drivers in the Zig Programming Language, before rewriting to C.

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(Slides) LVGL in WebAssembly: Building NuttX Touchscreen Apps with Zig and testing them in the Web Browser in NuttX International Workshop 2023
29 September 2023

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RISC-V Star64 JH7110: Power Up the Display Controller with U-Boot Bootloader in lupyuen.org
2 September 2023

Let's power up the DC8200 Display Controller inside Star64 JH7110 RISC-V Single-Board Computer... By running simple commands in the U-Boot Bootloader

RISC-V Star64 JH7110: Inside the Display Controller in lupyuen.org
23 August 2023

Let's take a walk inside the Display Controller for Pine64's Star64 JH7110 RISC-V SBC... And find out how we'll create the Display Driver for Apache NuttX RTOS

(Slides) What's inside a Smartphone? Exploring the internals with Apache NuttX Real-Time Operating System in Apache Conference Asia 2023
19 August 2023

Smartphones are incredibly complex gadgets. What if we could learn the internals of smartphones... By booting Apache NuttX RTOS (Real-Time Operating System) on our phone? Over the past year, we have written a series of 24 articles explaining the inner workings of PINE64 PinePhone, and how we implemented the smartphone features with Apache NuttX RTOS. The articles cover the essential (and esoteric) topics on smartphone technology: MIPI DSI LCD Display, I2C Touch Panel, USB Controller, LTE Modem, Accelerometer / Gyroscope, Arm64 Interrupts and many more. We are also experimenting with newer, easier ways to create Smartphone Apps, with LVGL Graphics Library, Zig Programming Language, WebAssembly Simulation and Arm64 Emulation.

(Video) What's inside a Smartphone? Exploring the internals with Apache NuttX Real-Time Operating System in Apache Conference Asia 2023
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RTOS on a RISC-V SBC: Star64 JH7110 + Apache NuttX in hackster.io
8 August 2023

Here's how we boot a Real-Time Operating System (Apache NuttX) on the Star64 JH7110 64-bit RISC-V Single-Board Computer

Star64 JH7110 + NuttX RTOS: Creating the First Release for the RISC-V SBC in lupyuen.org
7 August 2023

Pine64's Star64 JH7110 RISC-V SBC is now supported in Apache NuttX RTOS Mainline! Let's review how we created the first release of NuttX for Star64

Star64 JH7110 + NuttX RTOS: RISC-V PLIC Interrupts and Serial I/O in lupyuen.org
2 August 2023

Apache NuttX RTOS on Pine64's Star64 JH7110 RISC-V SBC has a problem with Serial I/O Interrupts and the RISC-V Platform-Level Interrupt Controller (PLIC)... Let's fix this!

Star64 JH7110 + NuttX RTOS: RISC-V Semihosting and Initial RAM Disk in lupyuen.org
28 July 2023

Apache NuttX RTOS crashes on Pine64's Star64 JH7110 RISC-V SBC because there's no Semihosting. But no worries! We modified NuttX to boot with an Initial RAM Disk instead (initrd).

Star64 JH7110 + NuttX RTOS: RISC-V Privilege Levels and UART Registers in lupyuen.org
19 July 2023

We're porting Apache NuttX RTOS to Pine64's Star64 JH7110 RISC-V SBC... And we see interesting issues with RISC-V Privilege Levels and 16550 UART Registers

Star64 JH7110 RISC-V SBC: Boot from Network with U-Boot and TFTP in lupyuen.org
13 July 2023

Let's boot Apache NuttX RTOS (or Linux) over the Network with U-Boot Bootloader and TFTP... On Pine64's Star64 JH7110 RISC-V Single-Board Computer

Apache NuttX RTOS on RISC-V: Star64 JH7110 SBC in lupyuen.org
9 July 2023

(Partially) Booting Apache NuttX Real-Time Operating System on Pine64's Star64 64-bit RISC-V Single-Board Computer, based on StarFive JH7110 SoC

Booting RISC-V Linux on Star64 JH7110 SBC in lupyuen.org
4 July 2023

Watch what happens when we boot Yocto and Armbian Linux on Pine64's Star64 64-bit RISC-V Single-Board Computer, based on StarFive JH7110 SoC

Inspecting the RISC-V Linux Images for Star64 SBC in lupyuen.org
30 June 2023

Let's look inside the Linux Images for Pine64's Star64 64-bit RISC-V Single-Board Computer: Armbian and Yocto

64-bit RISC-V with Apache NuttX Real-Time Operating System in lupyuen.org
25 June 2023

Let's boot Apache NuttX Real-Time Operating System on a 64-bit RISC-V Device (QEMU Emulator) and explore the Boot Code inside NuttX

NuttX RTOS for PinePhone: The First Year in lupyuen.org
21 June 2023

2023 has been an awesome year for Apache NuttX RTOS on Pine64 PinePhone! Let's review the features that we've implemented... And what we'll do next

NuttX RTOS for PinePhone: Feature Phone UI in LVGL, Zig and WebAssembly in lupyuen.org
10 June 2023

How we created the LVGL Feature Phone UI for Pine64 PinePhone on Apache NuttX RTOS... By tweaking and testing in a Web Browser!

(Possibly) LVGL in WebAssembly with Zig Compiler in lupyuen.org
31 May 2023

Can we preview an LVGL App in the Web Browser... With WebAssembly and Zig Compiler? Let's find out!

Recipe for Wholemeal Sourdough with Bread Machine in lupyuen.org
22 May 2023

Yep it's a Sourdough Recipe

Inside a Smartphone Accelerometer: PinePhone with NuttX RTOS in hackster.io
17 May 2023

When we tilt our Smartphone from Portrait to Landscape... How does it know that we're tilting our phone? Watch what happens when we snoop the MPU-6050 Accelerometer Data from PinePhone with Apache NuttX RTOS

NuttX RTOS for PinePhone: Phone Calls and Text Messages in lupyuen.org
4 May 2023

Making Phone Calls and Sending SMS Text Messages with PinePhone's Quectel EG25-G 4G LTE Modem... How we'll do it with Apache NuttX RTOS

NuttX RTOS for PinePhone: 4G LTE Modem in lupyuen.org
12 April 2023

All about the Quectel EG25-G 4G LTE Modem inside Pine64 PinePhone... And how we'll control it with Apache NuttX RTOS

NuttX RTOS for PinePhone: Simpler USB with EHCI (Enhanced Host Controller Interface) in lupyuen.org
24 March 2023

Porting the Enhanced Host Controller Interface (EHCI) USB Driver... From Apache NuttX RTOS to Pine64 PinePhone

(Clickable) Call Graph for Apache NuttX Real-Time Operating System in lupyuen.org
5 March 2023

Here's how Apache NuttX RTOS boots on Pine64 PinePhone... Visualised as a Call Graph with Unicorn Emulator and Rust

(Possibly) Emulate PinePhone with Unicorn Emulator in lupyuen.org
24 February 2023

To make PinePhone testing easier... Can we emulate Arm64 PinePhone with Unicorn Emulator? Let's find out! We'll call the Unicorn Emulator in Rust

NuttX RTOS for PinePhone: Exploring USB in lupyuen.org
20 February 2023

What's inside the USB Controller of Pine64 PinePhone... And how we'll create a USB Driver for Apache NuttX RTOS

NuttX RTOS for PinePhone: LVGL Terminal for NSH Shell in lupyuen.org
3 February 2023

Let's build a Terminal App for PinePhone... With LVGL and Apache NuttX RTOS

Apache NuttX RTOS trips ChatGPT in lupyuen.org
29 January 2023

ChatGPT (the AI chatbot) will gladly answer questions about Apache NuttX RTOS! But the answers aren't always correct. Let's turn this into a learning opportunity, and understand why ChatGPT's answers are incorrect

NuttX RTOS for PinePhone: Boot to LVGL in lupyuen.org
22 January 2023

How we configure Apache NuttX RTOS to boot an LVGL Touchscreen App on Pine64 PinePhone

NuttX RTOS for PinePhone: Touch Panel in lupyuen.org
12 January 2023

All about the Capacitive Touch Panel inside Pine64 PinePhone... And how we created the PinePhone Touch Panel Driver for Apache NuttX RTOS

NuttX RTOS for PinePhone: What is it? in lupyuen.org
3 January 2023

Let's talk about Apache NuttX RTOS for Pine64 PinePhone: What is it? Why are we doing this? How will we use it?

NuttX RTOS for PinePhone: Framebuffer in lupyuen.org
1 January 2023

How NuttX Apps call the NuttX Framebuffer Interface to render graphics... And what's inside the Framebuffer Driver for Pine64 PinePhone

NuttX RTOS for PinePhone: LCD Panel in lupyuen.org
28 December 2022

Apache NuttX RTOS now boots with a Test Pattern on Pine64 PinePhone! Let's find out what's inside our new NuttX Driver for PinePhone's LCD Panel.

NuttX RTOS for PinePhone: Display Engine in lupyuen.org
23 December 2022

Apache NuttX Kernel now supports Allwinner A64 Display Engine on Pine64 PinePhone! Here's how we call it to render graphics on PinePhone's LCD Display

NuttX RTOS for PinePhone: MIPI Display Serial Interface in lupyuen.org
15 December 2022

Apache NuttX Kernel has a driver for MIPI Display Serial Interface... Here's how it will be called for rendering PinePhone's LCD Display

Preparing a Pull Request for Apache NuttX RTOS in lupyuen.org
28 November 2022

Here are the steps to prepare a Pull Request for Apache NuttX RTOS

NuttX RTOS for PinePhone: Render Graphics in Zig in lupyuen.org
15 November 2022

How we render graphics directly to PinePhone's Display Hardware... With the Zig Programming Language and Apache NuttX RTOS

Rendering PinePhone's Display (DE and TCON0) in lupyuen.org
30 October 2022

How does Pine64 PinePhone render graphics on its LCD Display? Let's find out about the Allwinner A64 SoC's Display Engine (DE) and Timing Controller (TCON0).

NuttX RTOS for PinePhone: Display Driver in Zig in lupyuen.org
18 October 2022

Let's build a PinePhone Display Driver in Zig... That will run on Apache NuttX RTOS

Understanding PinePhone's Display (MIPI DSI) in lupyuen.org
2 October 2022

How does Pine64 PinePhone control its LCD Display over MIPI Display Serial Interface? Let's find out!

NuttX on a RISC-V IoT Gadget: PineDio Stack BL604 in NuttX Online Workshop 2022
25 September 2022

Pine64's PineDio Stack BL604 is a RISC-V board that's packed with IoT features: Touchscreen, LoRa, WiFi, BLE, GPS and more. In this presentation we'll talk about the porting of NuttX to PineDio Stack, how we simplified the developer onboarding, and our plans to support LoRaWAN and LVGL Apps in Zig.

Visual Programming with Zig and NuttX Sensors in NuttX Online Workshop 2022
24 September 2022

What if we could drag-and-drop NuttX Sensors to create IoT Apps? In this presentation we'll explore Blockly, the web-based toolkit for Visual Programming, and how we might customise Blockly to create NuttX Sensor Apps. We'll also discuss the Zig Programming Language, and why Blockly will generate NuttX Sensor Apps as Zig programs.

Simpler, safer LVGL Touchscreen Apps with Zig and NuttX in NuttX Online Workshop 2022
24 September 2022

Is there a simpler and safer way to code Touchscreen Apps with the LVGL Graphics Library? In this presentation we'll talk about migrating a NuttX LVGL App from C to Zig, and the benefits that it brings.

NuttX RTOS for PinePhone: Blinking the LEDs in lupyuen.org
22 September 2022

Let's experiment with the GPIO Hardware on Pine64 PinePhone... With a little help from Apache NuttX RTOS

NuttX RTOS for PinePhone: UART Driver in lupyuen.org
9 September 2022

Our PinePhone Operating System will be awfully quiet if we don't implement UART Input and Output... Here's how we implemented the UART Driver for Apache NuttX RTOS

NuttX RTOS for PinePhone: Fixing the Interrupts in lupyuen.org
1 September 2022

How Pine64 PinePhone handles Arm64 Interrupts with the Generic Interrupt Controller... And how we implemented PinePhone Interrupt Handling in Apache NuttX RTOS

PinePhone boots Apache NuttX RTOS in lupyuen.org
28 August 2022

How we ported Apache NuttX RTOS to PinePhone... And what's inside the U-Boot Bootloader

Apache NuttX RTOS on Arm Cortex-A53: How it might run on PinePhone in lupyuen.org
25 August 2022

Apache NuttX RTOS now runs on 64-bit Arm Cortex-A53 with Multi-Core Symmetric Multi-Processing... Will it run on PinePhone? Let's find out!

Visual Programming with Zig and NuttX Sensors in lupyuen.org
19 August 2022

What if we could drag-and-drop NuttX Sensors... To create IoT Sensor Apps in Zig? Let's find out!

Zig Visual Programming with Blockly in lupyuen.org
7 August 2022

How we create a Zig program visually with Blockly, the drag-n-drop way... And how we might use it to build Sensor IoT Apps for Apache NuttX RTOS

Read NuttX Sensor Data with Zig in lupyuen.org
29 July 2022

Using Zig to read Sensor Data on Apache NuttX RTOS... With Bosch BME280 Temperature / Humidity / Air Pressure Sensor

Build an LVGL Touchscreen App with Zig in lupyuen.org
12 July 2022

Can we use Zig to build an LVGL Touchscreen App for Apache NuttX RTOS? Also wrap the LVGL API in Zig to build simpler, safer LVGL Apps? Let's find out!

Build a PinePhone App with Zig and zgt in lupyuen.org
25 June 2022

Can we use Zig to code PinePhone Apps? Maybe make them simpler and safer? Let's find out!

Build an IoT App with Zig and LoRaWAN in lupyuen.org
15 June 2022

Let's build a complex IoT App with Zig and LoRaWAN... And run it on RISC-V BL602 with Apache NuttX RTOS

Zig on RISC-V BL602: Quick Peek with Apache NuttX RTOS in lupyuen.org
2 June 2022

How we run Zig on the BL602 RISC-V SoC... With Apache NuttX RTOS

(Mostly) Automated Testing of Apache NuttX RTOS on PineDio Stack BL604 RISC-V Board in lupyuen.org
22 May 2022

Pine64 is about to launch the PineDio Stack BL604 RISC-V Board with LoRa and Touch Screen... Here's how we automatically flash and test every new release of Apache NuttX RTOS for PineDio Stack

NuttX GPIO Expander for PineDio Stack BL604 in lupyuen.org
3 May 2022

PineDio Stack BL604 RISC-V Board has an interesting problem on Apache NuttX RTOS... Too many GPIOs! Let's fix this with a GPIO Expander

NuttX Touch Panel Driver for PineDio Stack BL604 in lupyuen.org
21 April 2022

How we created the Apache NuttX RTOS Driver for Hynitron CST816S I2C Touch Panel... For PineDio Stack BL604 RISC-V Board

PineDio Stack BL604 runs Apache NuttX RTOS in lupyuen.org
12 April 2022

Running Apache NuttX RTOS on PineDio Stack BL604 RISC-V board... With ST7789 Display, LVGL Graphics and LoRaWAN

ST7789 Display with LVGL Graphics on Apache NuttX RTOS in lupyuen.org
2 April 2022

RISC-V BL602 SoC with ST7789 SPI Display and LVGL Graphics Library... Let's make it work on Apache NuttX RTOS!

Rust talks I2C on Apache NuttX RTOS in lupyuen.org
22 March 2022

Reading the Bosch BME280 I2C Sensor with Rust Embedded HAL... On BL602 RISC-V SoC and Apache NuttX RTOS

Apache NuttX Driver for BME280 Sensor: Ported from Zephyr OS in lupyuen.org
10 March 2022

Apache NuttX OS talks I2C with Bosch BME280 Sensor on BL602 RISC-V SoC... Thanks to the BME280 Driver ported from Zephyr OS

Connect IKEA Air Quality Sensor to Apache NuttX OS in lupyuen.org
12 February 2022

How we expose the UART Port on IKEA VINDRIKTNING Air Quality Sensor... And read the PM 2.5 data with PineDio Stack BL604 RISC-V Board

BL602 EFlash Loader: Reverse Engineered with Ghidra in lupyuen.org
2 February 2022

What's inside the EFlash Loader that flashes all firmware to the BL602 RISC-V SoC

Auto Flash and Test NuttX on RISC-V BL602 in lupyuen.org
26 January 2022

How we automagically flash and test the daily build of Apache NuttX OS on BL602 RISC-V SoC

Rust on Apache NuttX OS in lupyuen.org
12 January 2022

How we run Rust programs on Apache NuttX OS... And transmit a LoRa Message with Rust

Encode Sensor Data with CBOR on Apache NuttX OS in lupyuen.org
10 January 2022

Compressing Sensor Data with CBOR on Apache NuttX OS... By calling TinyCBOR Library

LoRaWAN on Apache NuttX OS in lupyuen.org
3 January 2022

Porting Semtech's LoRaWAN Stack to Apache NuttX OS... And testing it on PineDio Stack BL604 RISC-V Board

LoRa SX1262 on Apache NuttX OS in lupyuen.org
22 December 2021

Porting the LoRa Driver for Semtech SX1262 from Linux to Apache NuttX OS... And testing it on PineDio Stack BL604 RISC-V Board

SPI on Apache NuttX OS in lupyuen.org
13 December 2021

How we transmit and receive data over SPI on Apache NuttX OS... By coding a NuttX Device Driver

Apache NuttX OS on RISC-V BL602 and BL604 in lupyuen.org
24 November 2021

How we build, flash and test the Apache NuttX operating system on BL602 and BL604 RISC-V SoCs

PineDio LoRa Gateway: Testing The Prototype in lupyuen.org
11 November 2021

How we test the pre-production PineDio LoRa Gateway by Pine64... And connect it to The Things Network

Build a Linux Driver for PineDio LoRa SX1262 USB Adapter in lupyuen.org
28 October 2021

How we build a LoRa SX1262 Driver for PineDio USB Adapter... And test it on Pinebook Pro

Monitor IoT Devices in The Things Network with Prometheus and Grafana in lupyuen.org
21 October 2021

How we monitor our IoT Sensor Devices connected to The Things Network... With Prometheus Time Series Database and Grafana Dashboards

CBOR Payload Formatter for The Things Network in lupyuen.org
18 October 2021

How we decode CBOR Sensor Data inside The Things Network... With a CBOR Payload Formatter

Internal Temperature Sensor on BL602 in lupyuen.org
14 October 2021

How we read the Internal Temperature Sensor on the BL602 and BL604 RISC-V SoCs... And transmit to The Things Network

IoT Digital Twin with Roblox and The Things Network in lupyuen.org
8 October 2021

Can we use Roblox to monitor and control an IoT Device... Through LoRaWAN and The Things Network?

Encode Sensor Data with CBOR on BL602 in lupyuen.org
5 October 2021

How we compress Sensor Data with CBOR... And transmit over LoRaWAN on the BL602 / BL604 RISC-V SoC

Grafana Data Source for The Things Network in lupyuen.org
27 September 2021

How we visualise Sensor Data from The Things Network... With a Custom MQTT Data Source in Grafana

The Things Network on PineDio Stack BL604 RISC-V Board in lupyuen.org
21 September 2021

How we join The Things Network and send data to the cloud on the new PineDio Stack BL604 RISC-V Board

LoRaWAN on PineDio Stack BL604 RISC-V Board in lupyuen.org
16 September 2021

How we test LoRaWAN on the new PineDio Stack BL604 RISC-V Board

Rust on RISC-V BL602: Rhai Scripting in lupyuen.org
4 September 2021

Can we drag-and-drop Rhai Scripts... And run them on WebAssembly and BL602 RISC-V SoC?

PineDio Stack BL604 RISC-V Board: Testing The Prototype in lupyuen.org
29 August 2021

What's it like to create Open Source Software for brand new prototype hardware? Read on to find out!

Rust on RISC-V BL602: Simulated with WebAssembly in lupyuen.org
16 August 2021

Can we run Rust Firmware for BL602 RISC-V SoC in a Web Browser... Simulated with WebAssembly?

Rust on RISC-V BL602: Is It Sunny? in lupyuen.org
3 August 2021

How we create Rust Firmware that reads Analog Inputs... With the Analog-to-Digital Converter on RISC-V BL602

RISC-V BL706 Audio Video Board in lupyuen.org
14 July 2021

What's inside the Bouffalo Lab RISC-V BL706 Audio Video Board... And how it differs from BL602

Reverse Engineering WiFi on RISC-V BL602 in lupyuen.org
7 July 2021

What happens inside the WiFi Driver on RISC-V BL602... And how we found the incomplete source code for the driver

Machine Learning on RISC-V BL602 with TensorFlow Lite in lupyuen.org
22 June 2021

How we run TensorFlow Lite on RISC-V BL602... To create a Glowing LED

BL602 Bootloader in lupyuen.org
9 June 2021

All about the BL602 RISC-V Bootloader... And how it loads the Application Firmware into XIP Flash Memory

Simulate RISC-V BL602 with WebAssembly, uLisp and Blockly in lupyuen.org
27 May 2021

How we simulate the BL602 RISC-V SoC with uLisp in WebAssembly... And preview Blockly uLisp Apps in the Web Browser

uLisp and Blockly on PineCone BL602 RISC-V Board in lupyuen.org
14 May 2021

Porting the uLisp Interpreter to PineCone BL602 RISC-V Board... And writing graphical programs with Blockly (Scratch)

PineCone BL602 Talks LoRaWAN in lupyuen.org
11 May 2021

How we connect PineCone BL602 RISC-V Board to LoRaWAN... With the Pine64 RFM90 LoRa Module

Build a LoRaWAN Network with RAKwireless WisGate Developer Gateway in lupyuen.org
30 April 2021

How we set up our own LoRaWAN Network with RAKwireless RAK7248 WisGate Developer D4H Gateway... And test it with RAKwireless WisBlock in Arduino

Run Rust RISC-V Firmware with BL602 IoT SDK in lupyuen.org
21 April 2021

How we build, flash and run Rust firmware on BL602 RISC-V SoC... With the BL602 IoT SDK

PineCone BL602 RISC-V Board Receives LoRa Packets in lupyuen.org
4 April 2021

How PineCone BL602 RISC-V Board with SX1276 receives LoRa packets... Transmitted by RAKwireless WisBlock

RAKwireless WisBlock talks LoRa with PineCone BL602 RISC-V Board in lupyuen.org
11 March 2021

How we receive LoRa packets transmitted by PineCone BL602 RISC-V Board ... With RAKwireless WisBlock in Arduino

Connect PineCone BL602 to LoRa Transceiver in lupyuen.org
7 March 2021

How we transmit LoRa packets on PineCone BL602 RISC-V Board ... With Semtech 1276 or Hope RF96

The RISC-V BL602 Book in lupyuen.org
20 February 2021

Your free open-source resource for learning RISC-V BL602 SoC

PineCone BL602 Talks UART to Grove E-Ink Display in lupyuen.org
19 February 2021

How we render an image with PineCone BL602 RISC-V Board ... On Grove Triple Colour E-Ink Display with UART Interface

PineCone BL602 Blasting Pixels to ST7789 Display with LVGL Library in lupyuen.org
16 February 2021

How we render text and graphics on PineCone BL602 RISC-V Board ... With ST7789 SPI Display and LVGL Graphics Library

PineCone BL602 talks SPI too! in lupyuen.org
7 February 2021

PineCone BL602 RISC-V Board talks to BME280 Sensor over SPI... Let's find out how

PineCone BL602 talks to I2C Sensors in lupyuen.org
29 January 2021

How we call the BL602 RISC-V Hardware Abstraction Layer to access the BME280 I2C Sensor

Mynewt GPIO ported to PineCone BL602 RISC-V Board in lupyuen.org
15 January 2021

How we ported the BL602 RISC-V Hardware Abstraction Layer to Apache Mynewt ... Starting with GPIO

Control PineCone BL602 RGB LED with GPIO and PWM in lupyuen.org
6 January 2021

Explore the BL602 GPIO and PWM Demo Firmware... And how they call the GPIO and PWM Hardware Abstraction Layer

Flashing Firmware to PineCone BL602 in lupyuen.org
1 January 2021

What happens when we flash RISC-V firmware to PineCone BL602 Board... And what's inside the BL602 Boot Image, Partition Table, Device Tree and EFuse Configuration

Porting Mynewt to PineCone BL602 in lupyuen.org
21 December 2020

How we port Apache Mynewt embedded operating system to the PineCone BL602 RISC-V Board

Better Open Source Advocate in lupyuen.org
15 December 2020

I made mistakes in 2020... Here's how I'll do better in 2021

Debug Rust on PineCone BL602 with VSCode and GDB in lupyuen.org
14 December 2020

How we build and debug Embedded Rust Firmware for PineCone BL602... With VSCode and GDB

Connect PineCone BL602 to OpenOCD in lupyuen.org
11 December 2020

How we connect PineCone BL602 Evaluation Board to OpenOCD... For flashing and debugging RISC-V firmware

Quick Peek of PineCone BL602 RISC-V Evaluation Board in lupyuen.org
29 November 2020

What's inside the PineCone BL602 Evaluation Board... And how we're using it to contribute to the RISC-V Open Source Ecosystem

(UNFINISHED) Draw your own PineTime Watch Face... From WebAssembly to Embedded Rust in lupyuen.org

18 November 2020

How we build a hand-drawn Watch Face for PineTime Smart Watch... Starting from WebAssembly to Embedded Rust

Create Your Own PineTime Watch Face in Rust... And Publish on crates.io in lupyuen.org
17 October 2020

How we build PineTime Watch Faces with Rust and LVGL... And publish them on crates.io

Bluetooth Time Sync and LVGL on PineTime Mynewt in lupyuen.org
16 October 2020

How PineTime syncs the time over Bluetooth LE with Mynewt and NimBLE... And how we create Watch Faces with LVGL

Porting PineTime Watch Face from C to Rust On RIOT with LVGL in lupyuen.org
13 September 2020

Converting Embedded C to Rust is not that hard... Here's how we convert a PineTime Watch Face with LVGL from C to Rust on RIOT

Safer, Simpler Embedded Programs with Rust on RIOT (Presentation) in RIOT Summit
11 September 2020

Tired of pointer problems on Embedded C? It’s time to switch over to a safer, simpler way of coding: Embedded Rust. We’ll look at Rust hosted on RIOT and how it’s used to create LVGL watch apps for PineTime Smart Watch.

Safer, Simpler Embedded Programs with Rust on RIOT (Video) in RIOT Summit
11 September 2020

Tired of pointer problems on Embedded C? It’s time to switch over to a safer, simpler way of coding: Embedded Rust. We’ll look at Rust hosted on RIOT and how it’s used to create LVGL watch apps for PineTime Smart Watch.

Preview PineTime Watch Faces in your Web Browser with WebAssembly in lupyuen.org
19 August 2020

How we build and preview PineTime Watch Faces with only a web browser... No computer needed!

Build PineTime Firmware in the Cloud with GitHub Actions in lupyuen.org
27 July 2020

Learn to build PineTime Smart Watch Firmware in the Cloud... No computer needed!

Wayland and LVGL on PinePhone with Ubuntu Touch in lupyuen.org
25 July 2020

Learn about Wayland and Ubuntu Touch on PinePhone... And how we build PinePhone Apps with LVGL

(UNFINISHED) Auto Convert Go to Dart with an Abstract Syntax Tree in lupyuen.org
9 July 2020

How we convert Go code to Dart and Flutter automatically with an Abstract Syntax Tree

Flutter State Management with Bloc for PineTime Companion App in lupyuen.org
27 June 2020

How we manage state with the Bloc Library in the Flutter Companion App (Android and iOS) for PineTime Smart Watch

PineTime doesn't run Linux... But that's OK! in lupyuen.org
19 June 2020

Getting started with PineTime Smart Watch

Your First GTK App with Go and VSCodium in lupyuen.org
18 June 2020

Creating desktop apps on Linux doesn't have to be hard... Let's build GTK+ 3 apps in Go with the gotk3 library!

Convert Go to Flutter and Dart for PineTime Companion App in lupyuen.org
17 June 2020

How we build the Flutter Companion App (Android and iOS) for PineTime Smart Watch by converting Go to Dart

Your First Bluetooth Low Energy App with Flutter in lupyuen.org
4 June 2020

Bluetooth Low Energy apps are ridiculously easy to code with Flutter and Dart, let me show you how!

Porting MicroPython and wasp-os to Mynewt on PineTime Smart Watch (nRF52) in lupyuen.org
2 June 2020

Making wasp-os truly awesome with full multitasking, interoperable firmware updates and a common companion app

Wireless Firmware Update In Action on PineTime Smart Watch (nRF52) in lupyuen.org
20 May 2020

Observe step-by-step the Wireless Firmware Update running on PineTime Smart Watch (nRF52) with MCUBoot Bootloader, NimBLE Bluetooth LE Stack and Apache Mynewt

MCUBoot Bootloader for PineTime Smart Watch (nRF52) in lupyuen.org
18 May 2020

Wireless Firmware Updates done right on PineTime Smart Watch... With the open source MCUBoot Bootloader from Apache Mynewt and Zephyr

Configure Mynewt for SPI Flash on PineTime Smart Watch (nRF52) in lupyuen.org
15 May 2020

Configure Mynewt OS to enable access to SPI Flash Memory on PineTime Smart Watch

Firmware Update over Bluetooth Low Energy on PineTime Smart Watch in lupyuen.org
11 May 2020

Flash any firmware to PineTime from our mobile phone... Without opening the watch!

CHIP-8 Game Emulator in Rust for PineTime Smart Watch in lupyuen.org
5 March 2020

Running Retro Games with Rust is not that hard on PineTime Smart Watch. Here's how I ported a CHIP-8 Game Emulator to PineTime

Visual Rust for PineTime Smart Watch in Visual Studio Marketplace
5 March 2020

Create and edit Embedded Rust programs visually by dragging and dropping blocks

My First Week As Embedded FOSS Advocate in lupyuen.org
4 February 2020

Have humans become so greedy for profit… That we have forgotten how to teach one another and advance our species?

Debug RIOT-OS on PineTime with VSCode in Medium
2 February 2020

VSCode debugging configuration for RIOT

If you're in the East, please consider Rust! in Medium
24 January 2020

Coding in Embedded C is like building a skyscraper without scaffolding

Debug Rust+Mynewt Firmware for PineTime on Raspberry Pi in lupyuen.org
23 January 2020

Using only a Raspberry Pi, we can debug the firmware on PineTime Smart Watch: Step into the flashed program line by line, set a breakpoint to pause execution at a line, inspect variables at runtime, … Just like the Embedded Pros!

OpenOCD on Raspberry Pi: Better with SWD on SPI in lupyuen.org
18 January 2020

Instead of sending SWD data over GPIO one bit at a time, what if we could blast out the data over Raspberry Pi's SPI interface?

Build and Flash Rust+Mynewt Firmware for PineTime Smart Watch in lupyuen.org
8 January 2020

Programming a PineTime is not that hard… All you need is a Raspberry Pi, some wires and a little creativity!

Optimising PineTime's Display Driver with Rust and Mynewt in lupyuen.org
29 December 2019

Simple tweaks like Batched Updates and Non-Blocking SPI can have a huge impact on rendering performance

Porting [druid] Rust Widgets to PineTime Smart Watch in lupyuen.org
14 December 2019

Code Watch Apps in Rust the Declarative Way

My 5-Year IoT Mission in lupyuen.org
4 December 2019

5 years ago I decided to fix every link in the IoT Chain so that we can create really useful and affordable IoT gadgets, the Lean and Agile Way

Hey GD32 VF103 on RISC-V: I surrender… For now in lupyuen.org
23 November 2019

Porting Mynewt OS to GD32 VF103 on RISC-V was a nightmare

Building a Rust Driver for PineTime's Touch Controller in lupyuen.org
22 November 2019

Programming the Hynitron CST816S Capacitive Touch Controller

Sneak Peek of PineTime Smart Watch… And why it's perfect for teaching IoT in lupyuen.org
15 November 2019

PineTime is the spiritual successor to BBC micro:bit

Porting Apache Mynewt OS to GigaDevice GD32 VF103 on RISC-V in lupyuen.org
30 October 2019

Many GD32 VF103 RISC-V developer boards are coming real soon... And Mynewt OS would be perfect for them

Bluetooth Mesh with nRF52 and Apache Mynewt in lupyuen.org
15 October 2019

Set up an nRF52 mesh network, step by step, without any coding

Coding nRF52 with Rust and Apache Mynewt on Visual Studio Code in lupyuen.org
3 October 2019

nRF52 works with popular open-source tools on Windows and macOS like VSCode, OpenOCD, Rust and ST-Link

Build an NB-IoT GPS Tracker on STM32 L476 with Apache Mynewt and Embedded Rust in lupyuen.org
22 September 2019

Let's build a simple gadget that determines its current location based on received GPS signals… And transmits the location to a server via NB-IoT

Quick Peek of Huawei LiteOS with NB-IoT on Ghostyu NB-EK-L476 Developer Kit (STM32L476RCT6) in lupyuen.org
4 September 2019

Peek into the LiteOS + Application source code that was bundled with the NB-IoT Developer Kit

Low Power NB-IoT on STM32 Blue Pill with Apache Mynewt and Embedded Rust in lupyuen.org
30 August 2019

Learn to optimise the power consumption of the NB-IoT Sensor Application in the previous tutorial

Visual Embedded Rust Programming with Visual Studio Code in lupyuen.org
17 August 2019

Create and edit Embedded Rust programs for STM32 Blue Pill and Apache Mynewt… By dragging and dropping blocks!

Advanced Topics for Visual Embedded Rust Programming in lupyuen.org
17 August 2019

Watch what happens behind the scenes when you create a Visual Embedded Rust program

Rust Rocks NB-IoT! STM32 Blue Pill with Quectel BC95-G on Apache Mynewt in lupyuen.org
4 August 2019

Hardly anyone writes embedded programs in Rust for microcontrollers (like STM32 Blue Pill), we all use C. But we really should switch to Rust!

Connect STM32 Blue Pill to NB-IoT with Quectel BC95-G and Apache Mynewt in lupyuen.org
25 July 2019

Let's build an IoT sensor with a real microcontroller — STM32 Blue Pill — and a real NB-IoT module — Quectel BC95-G!

Get Started with NB-IoT and Quectel modules in lupyuen.org
15 July 2019

How to use a Quectel evaluation board to send a CoAP message to the CoAP server hosted at thethings.io

Visual Programming with Embedded Rust? Yes we can with Apache Mynewt and Google Blockly! in Medium
11 July 2019

Simpler embedded coding, the visual way

Safer, Simpler Embedded Rust with Apache Mynewt on STM32 Blue Pill in lupyuen.org
7 July 2019

Declarative and Procedural Macros (plus bindgen and tips for Visual Studio Code) to protect Embedded Rust coders from stumbling into embedded traps

Hosting Embedded Rust apps on Apache Mynewt with STM32 Blue Pill in lupyuen.org
9 June 2019

It's time to drop our legacy programming practices and adopt smarter, safer ways to exploit these microcontrollers… starting with Apache Mynewt and Rust.

Build Your IoT Sensor Network—STM32 Blue Pill + nRF24L01 + ESP8266 + Apache Mynewt + thethings.io in lupyuen.org
27 May 2019

Let's build a Sensor Network running on two Blue Pills with nRF24L01 and ESP8266

Super Blue Pill—Like STM32 Blue Pill, But Better! in lupyuen.org
21 May 2019

Friendlier for newbies, supports ESP8266 WiFi and nRF24L01

Connect STM32 Blue Pill to ESP8266 with Apache Mynewt in lupyuen.org
20 April 2019

And WiFi Geolocation with ESP8266

Create your IoT gadget with Apache Mynewt and STM32 Blue Pill in lupyuen.org
26 March 2019

Apache Mynewt is a free, open-source realtime operating system for microcontrollers

Push AWS IoT sensor data to Redshift with Kinesis Firehose in Medium
10 March 2019

AWS IoT Rules Engine and Kinesis Firehose were designed to stream live sensor data into Redshift for storage and analysis

Transform and Import a JSON file into Amazon Redshift with AWS Glue in Medium
8 March 2019

With AWS Glue it's now possible to keep our Redshift data warehouses in sync with JSON-based data stores… So we may exploit the full potential of business analytics and machine learning in AWS!

Connecting AWS Lambda Node.JS to Redshift or PostgreSQL? Try AWS Lambda Layers! in Medium
6 March 2019

With Lambda Layers it's really easy to connect our Node.js Lambda Function to Redshift or PostgreSQL

STM32 Blue Pill—Bootloading the WebUSB Bootloader in lupyuen.org
25 February 2019

How do we upgrade the Bootloader when it's always running in the background, waiting for flashing requests? This article explains a special technique I used to upgrade the MakeCode Bootloader over WebUSB… I call it "Baseloading"

STM32 Blue Pill—Dissecting the WebUSB Bootloader for MakeCode in lupyuen.org
16 February 2019

Explore the innards of the MakeCode Bootloader that I have ported to Blue Pill

STM32 Blue Pill — Unit Testing with Qemu Blue Pill Emulator in lupyuen.org
7 February 2019

Computing sensor values in IoT devices can be prone to bugs… And Unit Testing can help to stop the bugs before they pollute the entire IoT chain

STM32 Blue Pill – Shrink your math libraries with Qfplib in lupyuen.org
30 January 2019

Filling in tiny math functions with nano-float

STM32 Blue Pill—Analyse and Optimise Your RAM and ROM in lupyuen.org
24 January 2019

Learn the tips and tools to prevent Blue Pill Bloat

STM32 Blue Pill USB Bootloader—How I fixed the USB Storage, Serial, DFU and WebUSB interfaces in lupyuen.org
18 December 2018

STM32 Blue Pill is a remarkable microcontroller for US$ 2. I proved it by running the USB Storage, USB Serial, USB DFU (Direct Firmware Upgrade) and WebUSB interfaces all on the same Blue Pill concurrently, without any additional hardware!

STM32 Blue Pill Visual Programming with MakeCode, CODAL and libopencm3 in Medium
9 December 2018

This work-in-progress document describes an incomplete implementation of STM32 Blue Pill visual programming

Sigfox Teacher Answers Your Questions in Medium
7 December 2018

I teach Sigfox to working professionals. Here are their questions…

以 thethings.iO 來將 BBC micro:bit 感測器圖形化 in 少儿编程教程网
29 November 2018

如果您可以將您以電池供應電力的BBC micro:bit設置在城市裡的任何一個角落來收集感測資料 … 或者是隨時查看從家裡、學校、工作場所即時更新的感測資料 … 不是很酷嗎?

Visualising BBC micro:bit sensors with thethings.iO in Medium
17 November 2018

Wouldn't it be cool if you could plant your BBC micro:bit anywhere in the city (powered by batteries) to collect sensor data… And watch live updates of the sensor data from your home, school, workplace, … Even on the go?

連接 BBC micro:bit 與 Sigfox 物聯網 in MakerPRO
13 November 2018

使用 BBC micro:bit 連接 Sigfox 物聯網網路會是一個很好幫助孩子們理解感測器與感測網路如何運作的理想方式。micro:bit 是新式以電池提供電力的感測器裝置典範，具備充足的處理能力並支援大多數的感測器類型。在教育用途上，Sigfox 可能是今日用於城市規模測試的感測網路之中，最為便宜的方案。

Connect BBC micro:bit to Sigfox in Medium
5 November 2018

BBC micro:bit connected to the Sigfox IoT network is the perfect way to help kids understand how Sensors and Sensor Networks operate. The micro:bit is a good representation of a modern battery-powered sensor device, with ample processing power and support for most types of sensors. For education, Sigfox is likely the cheapest option today for experimenting with a city-wide sensor network.

連接 STM32F103C8T6 Blue Pill 開發板與 Sigfox 物聯網 in MakerPRO
17 October 2018

以 STM32 微處理器為核心的 STM32F103C8T6 Blue Pill 開發板連接 Sigfox 收發器模組來接取 Sigfox 物聯網網路可能會是設計一款低功率物聯網裝置的最佳組合。

Connect STM32 Blue Pill to Sigfox in Medium
28 September 2018

STM32 “Blue Pill” microcontroller connected to a transceiver module for the Sigfox IoT network might be the best combination for low-power IoT devices right now.

Watch STM32 Blue Pill Juggle Two SPI Sensors With DMA in Medium
19 September 2018

This article that explains all that I have learnt about SPI ports, DMA and interrupts on the Blue Pill

Program Your First FPGA With GOWIN GW1N-4 in Medium
5 September 2018

As we learn how to program the FPGA, we’ll soon realise that FPGA programming is really extraordinary, unlike any other kind of programming we have done before

Juggling STM32 Blue Pill For Arduino Jugglers in Medium
27 August 2018

Upsizing from Arduino Uno to a 32-bit STM microcontroller doesn’t have to be hard

Juggling Sigfox Downlink And Arduino Sensors With cocoOS in Medium
20 August 2018

Using the cocoOS task scheduler to run Sensor Tasks concurrently while waiting for the Network and UART Tasks

Juggling Arduino Sensors With cocoOS in Medium
11 August 2018

Juggle multiple Arduino sensors, using an open source library for cooperative processing: cocoOS

Why use FPGA for IoT? Here’s what I think… in Medium
31 July 2018

Since FPGAs are already mainstream, could we use them to create IoT devices that are more power-efficient than current devices based on microcontrollers?

Coding the STM32 Blue Pill with Rust and Visual Studio Code in Medium
10 July 2018

Let's learn Rust, a modern systems programming language that promotes safe, concurrent low-level coding

Making my first ever PCB with Seeed Fusion PCB assembly service in Medium
5 July 2018

Here’s the story of the first gadget that I have ever created, with help from the brilliant minds at Seeed in Shenzhen

Running Rust and FreeRTOS on the PADI IoT Stamp in Medium
18 June 2018

Better tools for building robust and reliable programs for microcontrollers

First Impressions of Alibaba Cloud (Aliyun) in Medium
21 May 2018

Could Alibaba Cloud be the economical cloud for high volume IoT?

Multitasking on the Arduino with a Finite State Machine – And why you’ll need it for Sigfox Downlink in Medium
13 May 2018

How to implement a Finite State Machine on the Arduino Uno

Realtime sensor data processing with thethings.io and Amazon Web Services Kinesis in Medium
1 May 2018

How to experiment with IoT today while minimising the security and performance risks, and keeping costs low

I Teach IoT. Here’s what you’ll learn in Medium
24 April 2018

Arduino, Low Power Networks, IoT Networks, IoT Analytics, ...

Developing cost-effective, energy efficient IoT solutions for outdoor as well as indoor applications in OpenGov
20 March 2018

Lup Yuen talks about two classes of IoT, ‘deep’ IoT and ‘wide’ IoT. Deep IoT devices require high bandwidth and power supply. UnaBiz looks at wide IoT, which refers to devices that are very light, battery-powered and operate on pervasive networks. They can work anytime, anywhere in Singapore and do not rely on WiFi or the cellular network.

How To Build Your Sigfox Server (Version 1.0) in Medium
14 October 2017

Building highly reliable, robust and scalable systems for processing Sigfox messages

Story of the UnaShield in Medium
5 July 2017

Co-created with Upton Lai, the brilliant guy who could make anything

IoT is a Bad Word in Medium
26 May 2017

IoT is about solving real problems (not imaginary ones) in a sustainable way

Overcoming Productivity Challenges in the F&B Industry in Retail World Asia 2015
23 April 2015

Sigfox and Google Cloud Platform in Google Developer Group Singapore DevFest
20 October 2014

Patent: Enlargement of video content streamed from the internet in US Patent Office WO/2012/002906
30 June 2010

This invention relates to a system for displaying video content streamed from a network in a full screen mode. The system receives receiving a network address based on a selection from a user. The system then transmits a request for content from the network address and subsequently receives the content associated with the network address. A search is performed on the content for data that provides displaying a video content in a full screen mode. Upon detecting the data, the process generates the data and displays video content in full screen mode.

Patent: A system and method for providing mobile services in US Patent Office WO/2008/004981
27 June 2007

A system and method for providing mobile services, the system comprising: a mobile device executing a client application for generating a mobile service request; and a hub server for receiving and processing the mobile service request, wherein the mobile service request comprises location data of the mobile device, and the hub server pushes one or more mobile service offers to the mobile device based on the location data. The method comprises executing a client application for generating a mobile service request on a mobile device; receiving and processing the mobile service request at a hub server; and pushing one or more mobile service offers from the hub server to the mobile device based on location data, wherein the mobile service request comprises location data of the mobile device.

LANGUAGES

English
Native speaker

Mandarin
Native speaker

Cantonese
Fluent

INTERESTS

How was this JSON Resume created?
https://github.com/lupyuen/lupyuen.github.io