Using µT-Kernel 3.0 on micro:bit

June 16, 2026
Personal Media Corporation

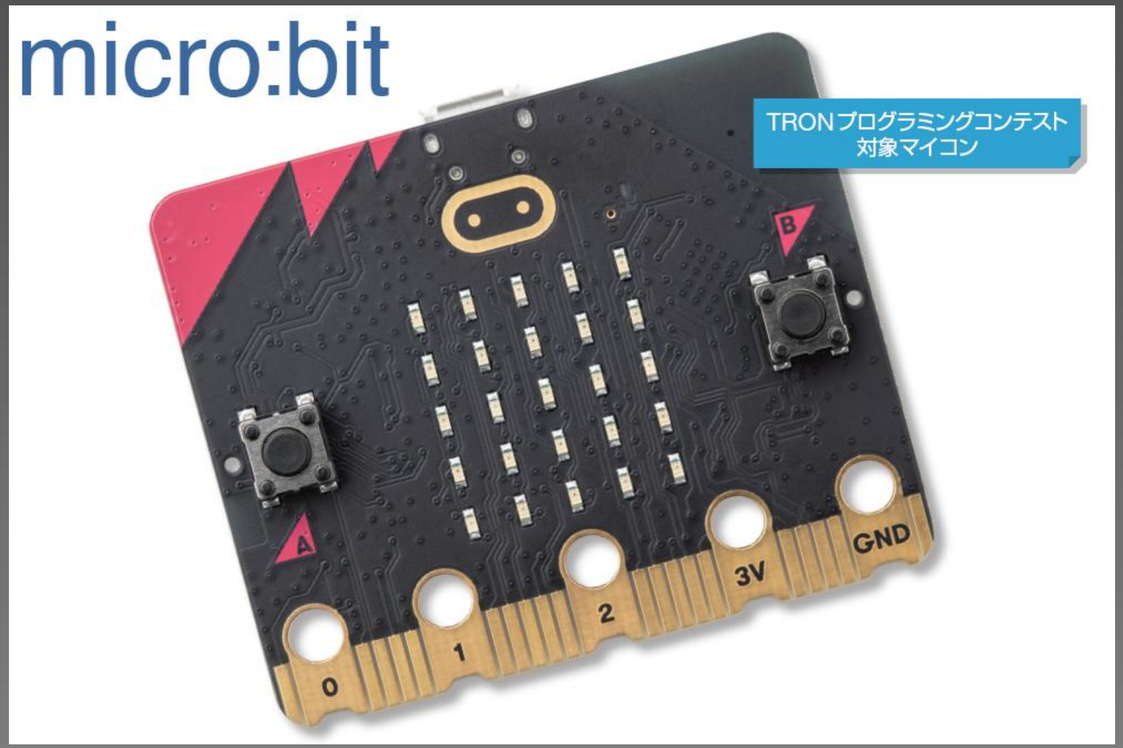
Agenda

- Introduction to micro:bit
- Running µT-Kernel 3.0 on micro:bit
- Development Environment
- Software Development with Eclipse
- Using Peripheral Devices
- Tips for contest entry and AI utilization
- Q & A

Introduction to micro:bit

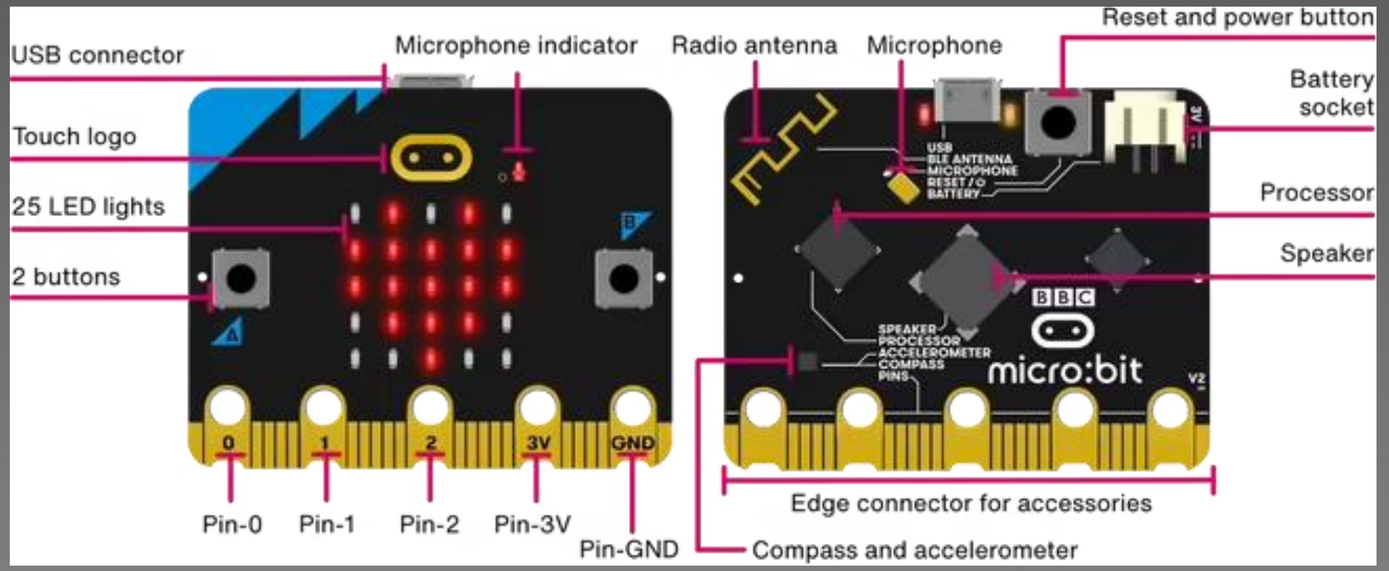
Introduction to micro:bit

- Mini-sized educational board computer, developed by BBC
- CPU：Nordic nRF52833（Arm Cortex-M4 core）



Introduction to micro:bit

- Many peripheral devices on micro:bit
  - Display : 5 * 5 matrix LED / single LED
  - Sensors : acceleration / illuminance / touch / temperature
  - Sound : speaker / microphone
  - Communication : USB / UART (serial) / BLE (Bluetooth Low Energy)
  - Push button switches
  - Connector pins



Introduction to micro:bit

- Standard software development is by Microsoft MakeCode

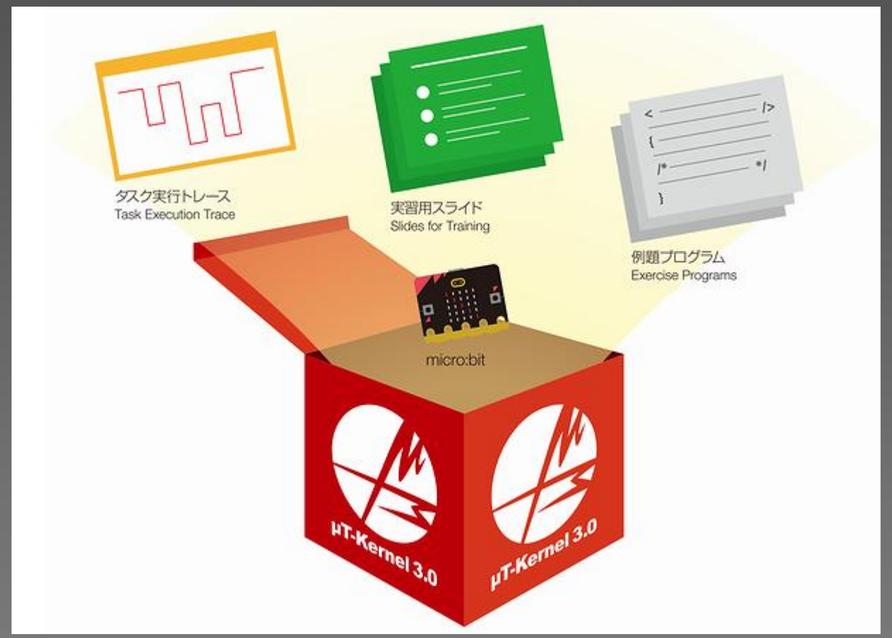
Running µT-Kernel 3.0 on micro:bit

Running µT-Kernel 3.0 on micro:bit

- Choice 1: “IoT edge node Practice Kit for micro:bit”
- Choice 2: Articles on TRONWARE magazine
- Choice 3: Same articles available on website
  - Now available on Personal Media Corporation website
  - https://www.t-engine4u.com/info/mbit/index.html
- Same RTOS and Cross Development Environment
  - RTOS: µT-Kernel 3.0 of TRON Forum, ported to micro:bit
  - Cross Development Environment: Eclipse

Running µT-Kernel 3.0 on micro:bit

- Choice 1: “IoT edge node Practice Kit for micro:bit”
  http://www.t-engine4u.com/products/ioten_prackit.html

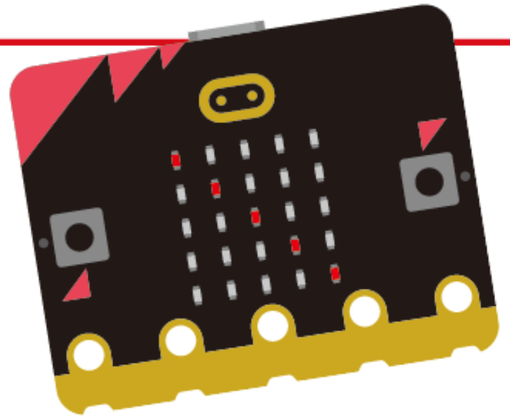


Running µT-Kernel 3.0 on micro:bit

- Choice 2: articles on TRONWARE magazine

連載 micro:bit で µT-Kernel 3.0 を動かそう

micro:bitで µT-Kernel 3.0を動かそう



[第8回] ドレミファ音階の再生とティック時間

トロンフォーラム T3 WG

本連載では、小学生向きのプログラミング教育などに使われているBBC micro:bit（以下「micro:bit」）の上で動くようになったµT-Kernel 3.0をご紹介している。連載第8回の本号では、micro:bitから音を出してみよう。µT-Kernel 3.0の持つ時間関連の機能をいろいろ試しながら、ドレミファの音階を再生するところまで進めていく。

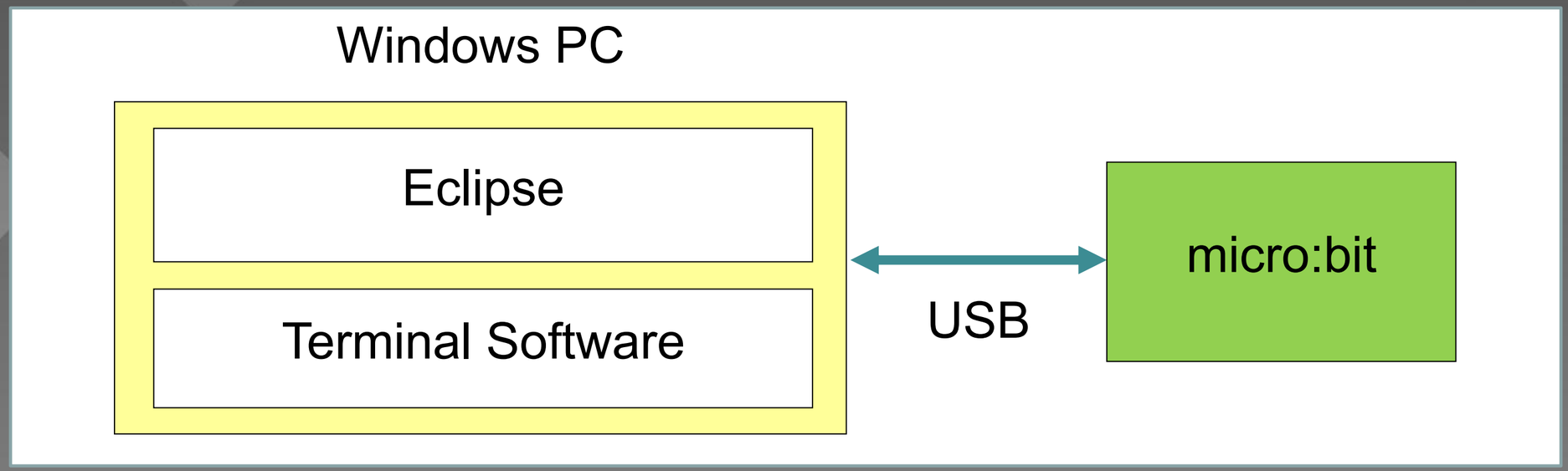
Running µT-Kernel 3.0 on micro:bit

- Choice 3: same articles available on website

Development Environment for µT-Kernel 3.0 on micro:bit

Development environment for µT-Kernel 3.0

- Cross development by Eclipse
  - Edit, compile, build, run and debug your software
  - Character I/O on terminal software via USB serial



Development environment for µT-Kernel 3.0

- C language programming for developing your applications
  - MakeCode is not available
- Programming for peripheral devices
  - Make device drivers, or access hardware directly by application
  - Articles on TRONWARE cover the following peripheral devices
    - ✓ LED matrix, push button switches
    - ✓ Speaker, PWM (=Pulse Width Modulation), A/D conversion
    - ✓ I2C, acceleration sensor
    - ✓ Serial communication between two micro:bit boards

Software Development with Eclipse

Software Development with Eclipse

- [Step-1] Installing development tools for µT-Kernel 3.0
  - (1) Install Eclipse
  - (2) Install GNU Arm Embedded Toolchain
  - (3) Install xPack Windows Build Tools
  - (4) Install Python and pyOCD
- [Step-2] Import µT-Kernel 3.0 and compile
  - (5) Get and expand source code of µT-Kernel 3.0 for micro:bit
  - (6) Make a project of µT-Kernel 3.0 on Eclipse
  - (7) Compile and build on Eclipse

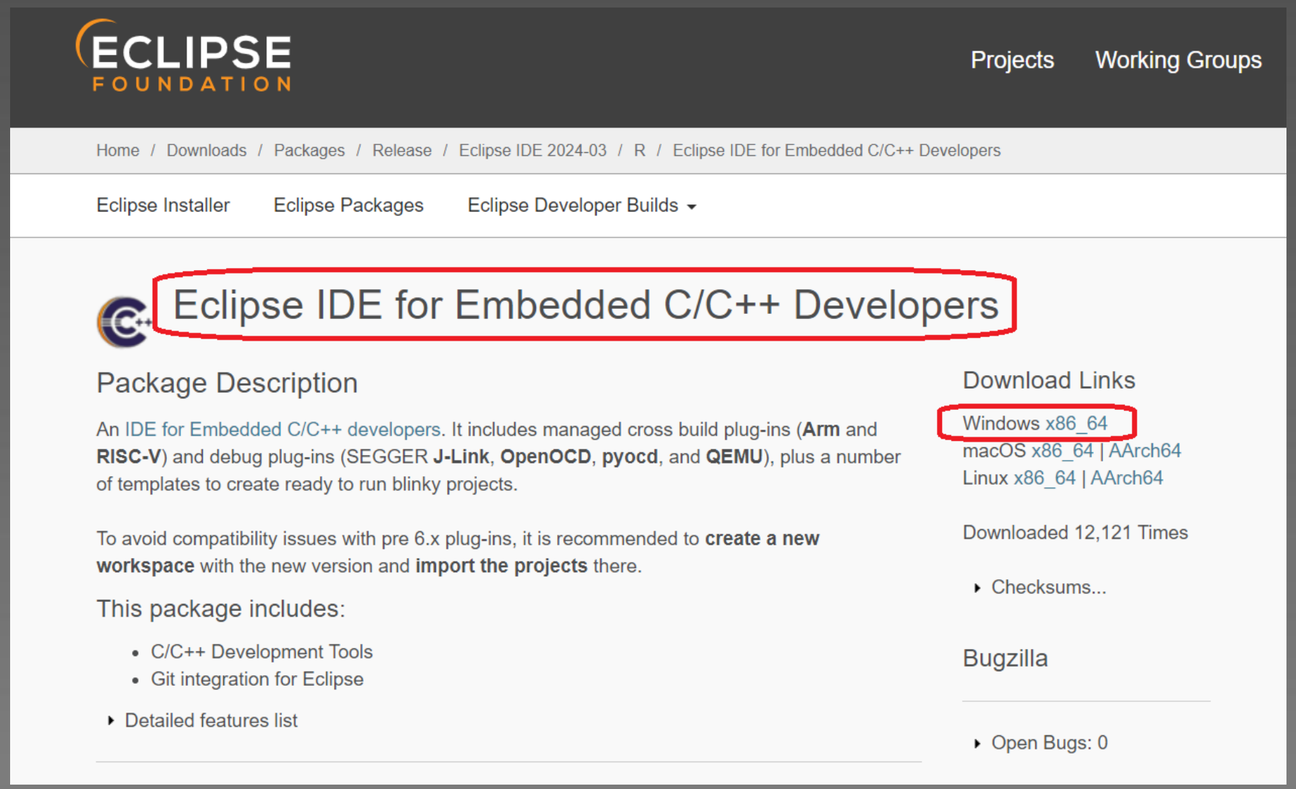
Software Development with Eclipse

Development tools

Tool	Description	URL
Eclipse IDE for Embedded C/C++ Developers	Integrated development environment to edit source code, compile, debug etc.	https://www.eclipse.org/downloads/packages/release/2024-03/r/eclipse-ide-embedded-cc-developers
GNU Arm Embedded Toolchain	GNU C compiler and related tools for embedded Arm processors	https://developer.arm.com/tools-and-software/open-source-software/developer-tools/gnu-toolchain/gnu-rm/downloads
xPack Windows Build Tools	Build tools running on Windows	https://github.com/xpack-dev-tools/windows-build-tools-xpack/releases
Python	Interpreter for programming language Python	https://www.python.org/downloads/
pyOCD	Debug tool for Arm processors running on Python	(Install in Python)
µT-Kernel 3.0 for micro:bit	Source code package (ZIP archive with password)	https://www.personal-media.co.jp/book/tw/tw_index/362.html

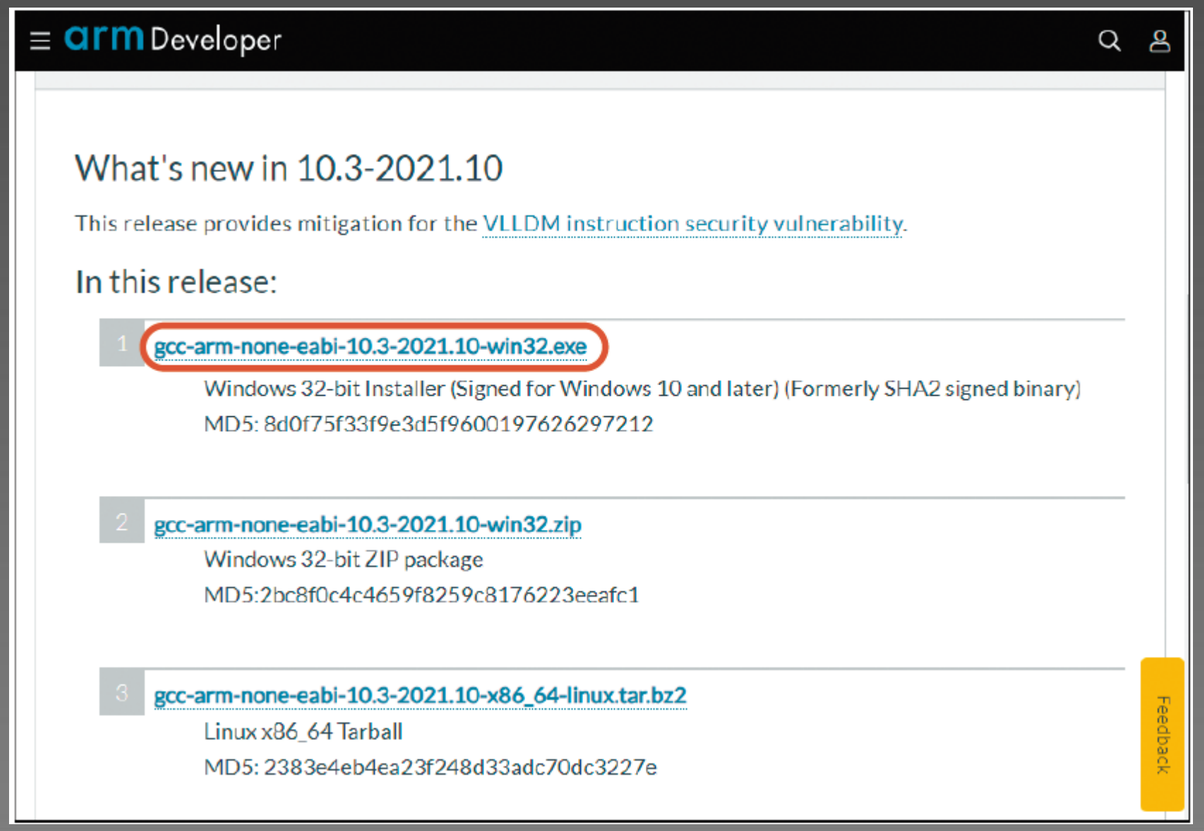
Application Development with Eclipse

- (1) Install Eclipse
  - Integrated development environment to edit source code, compile, debug etc.



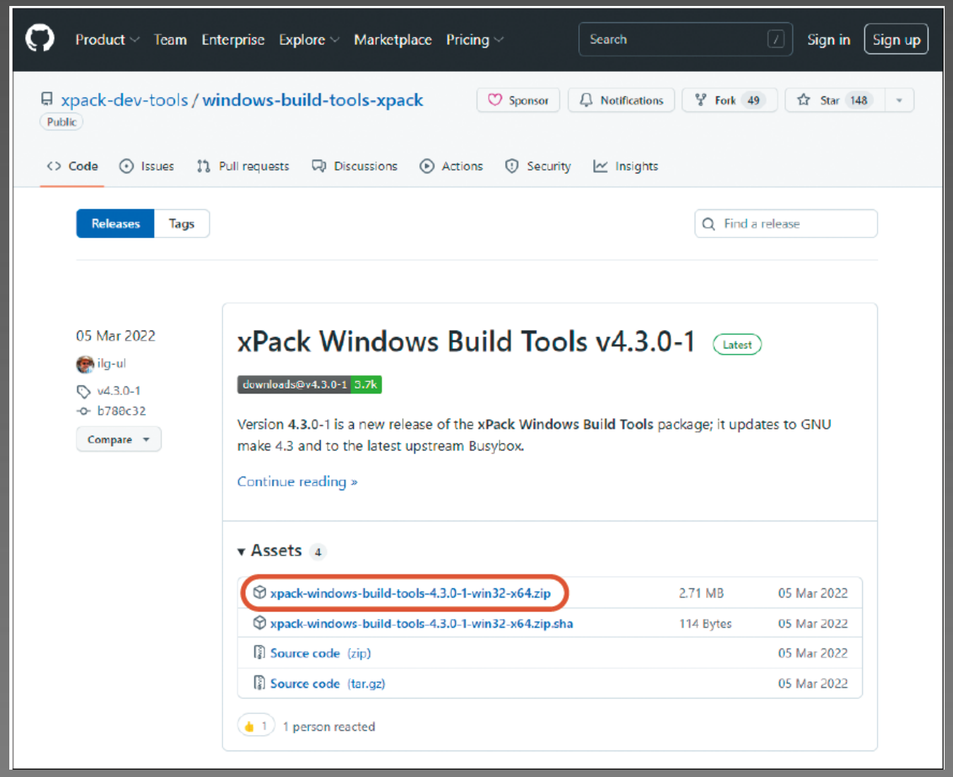
Software Development with Eclipse

- (2) Install GNU Arm Embedded Toolchain
  - GNU C compiler and related tools for embedded Arm processors



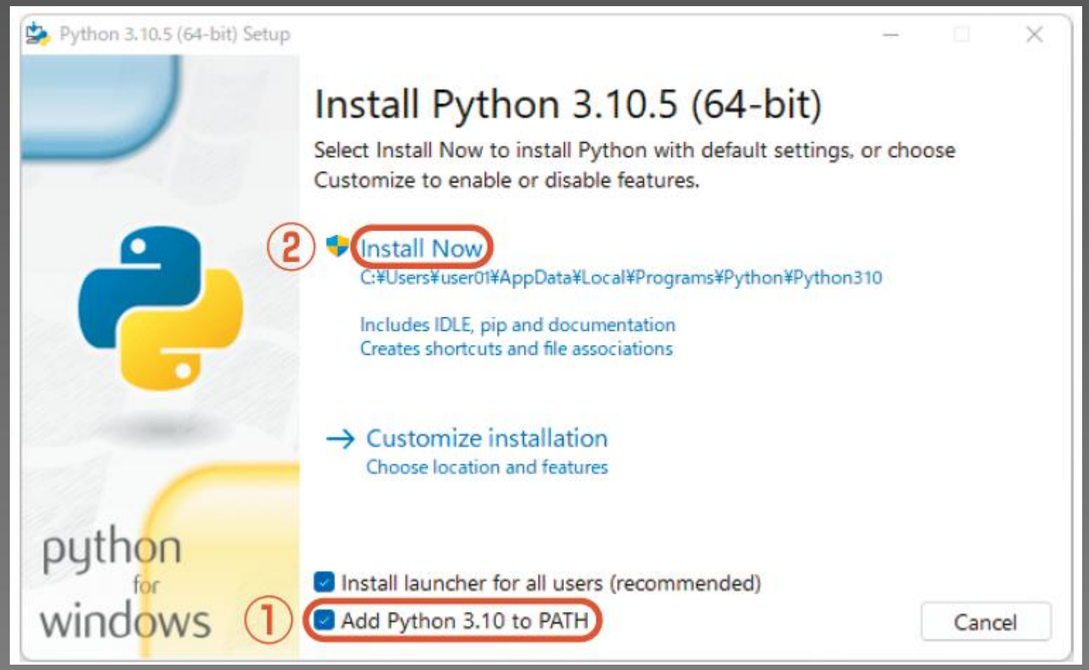
Software Development with Eclipse

- (3) Install xPack Windows Build Tools
  - Build tools running on Windows



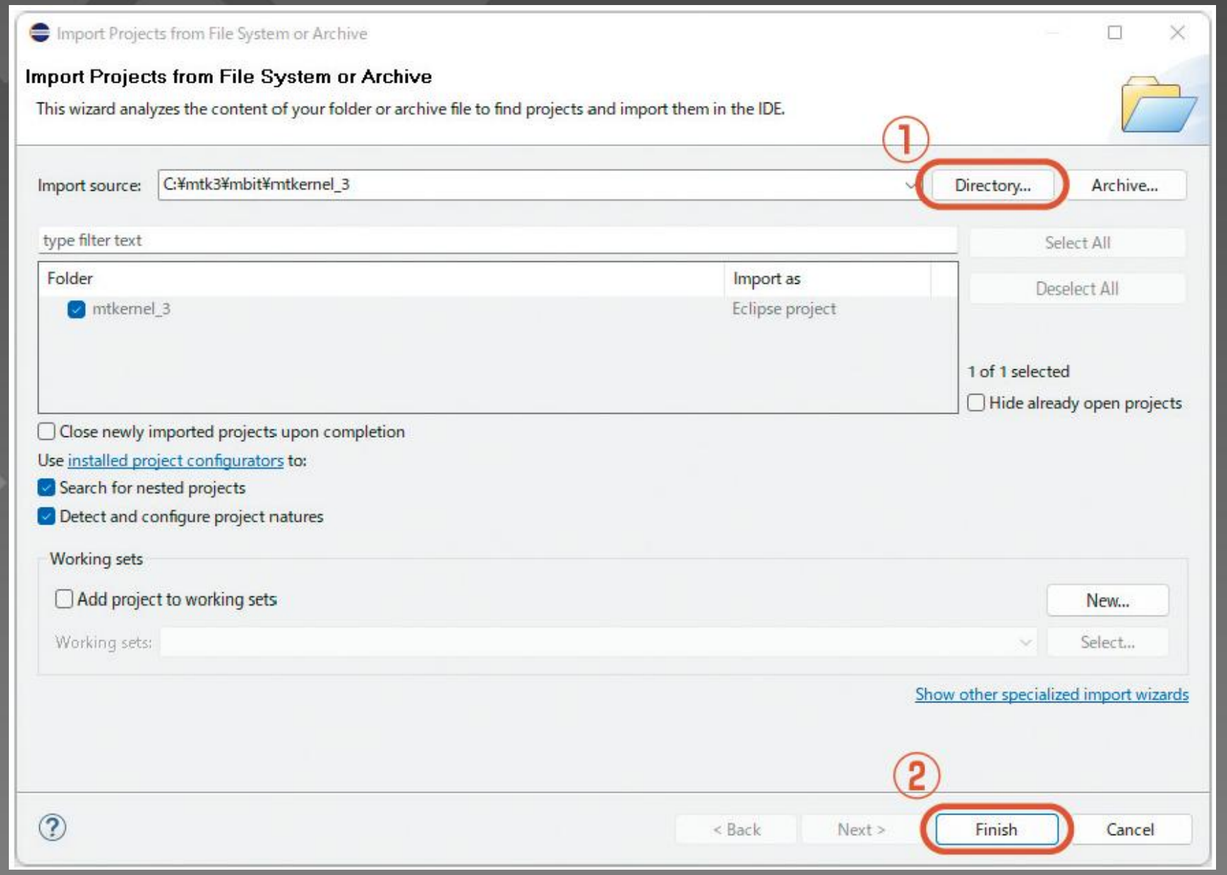
Software Development with Eclipse

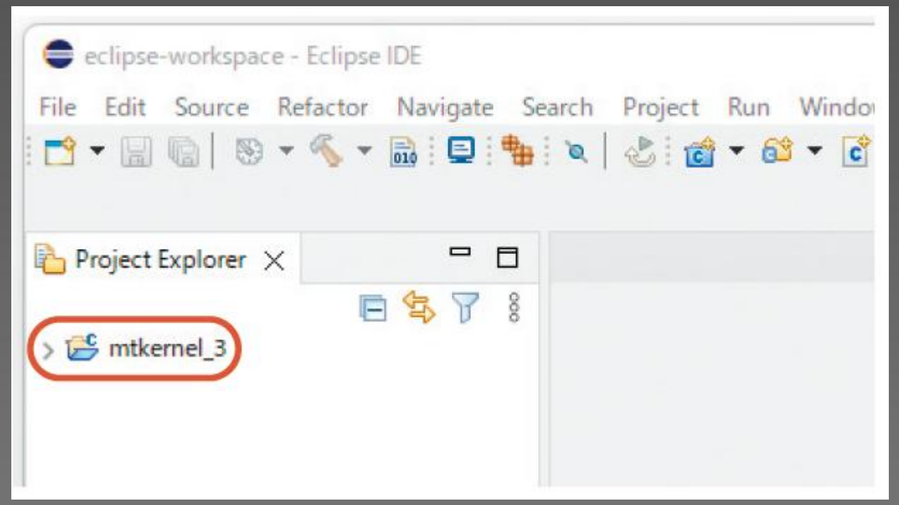
- (4) Install Python and pyOCD
  - Debug tool for ARM processors running on Python
  - “python -mpip install -U pyocd” after installing Python



Software Development with Eclipse

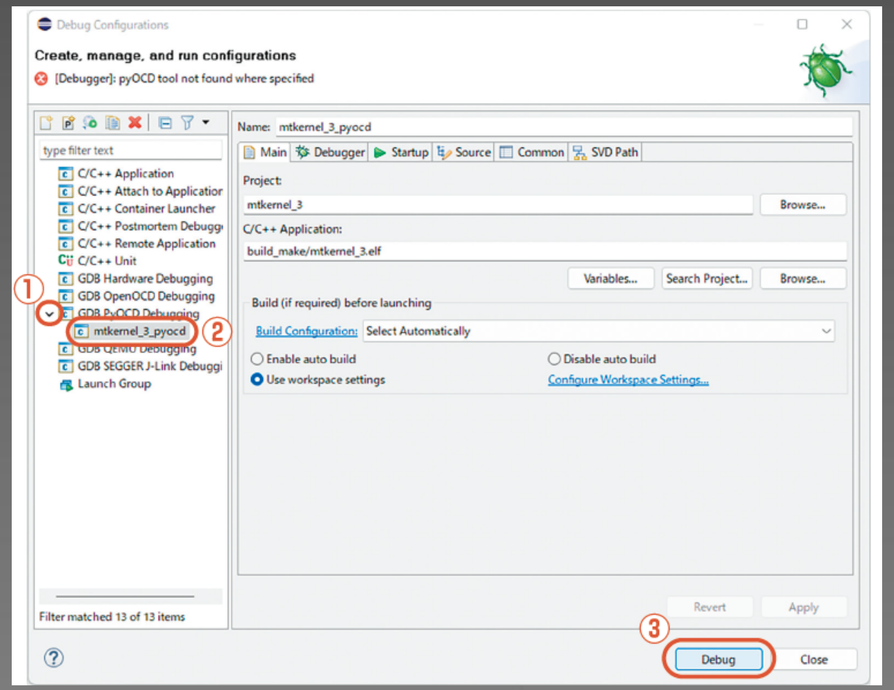
- [Step-2] Import µT-Kernel 3.0 source code and compile





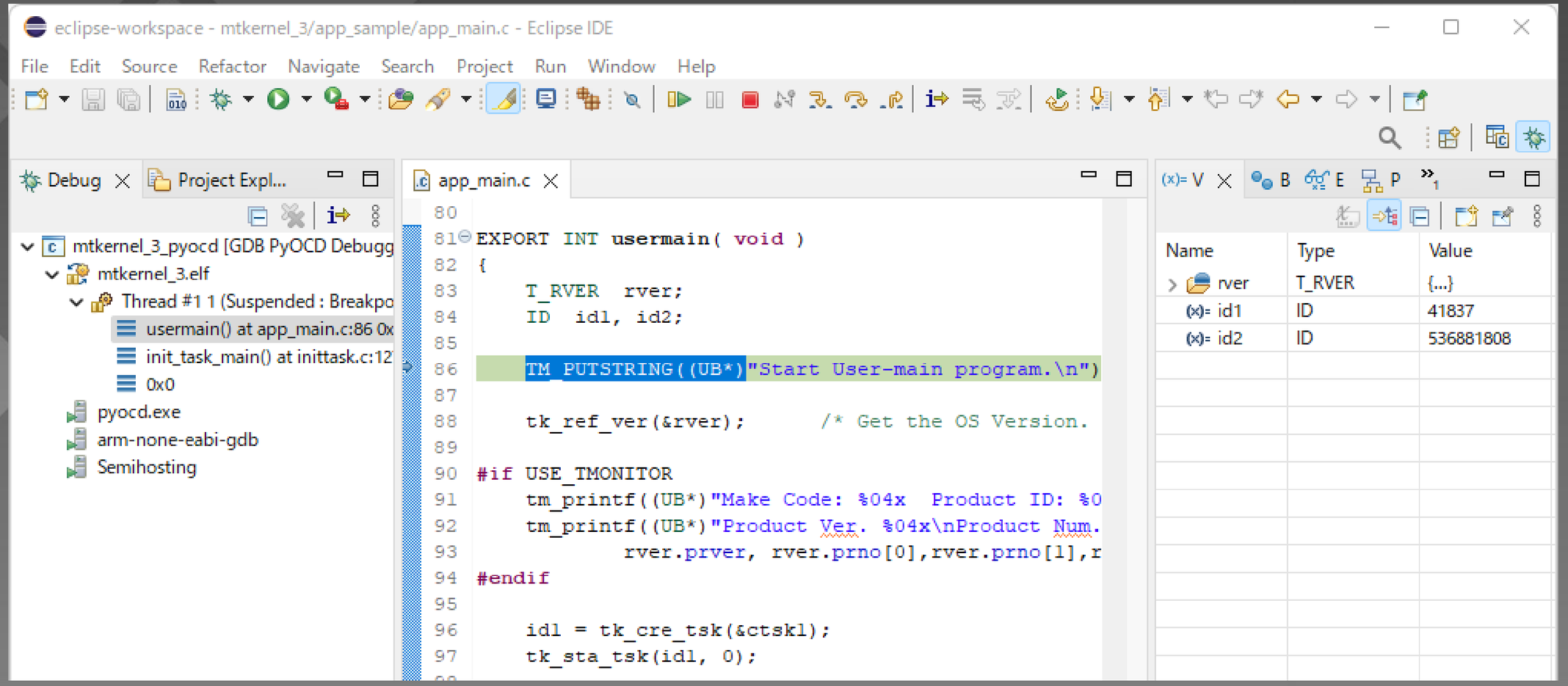
Software Development with Eclipse

- [Step-3] transfer µT-Kernel 3.0 to micro:bit and run on it
  - (8) Erase Flash ROM of micro:bit
  - (9) Start terminal software and connect it to micro:bit
  - (10) Eclipse configuration for debug
  - (11) Running on micro:bit



Software Development with Eclipse

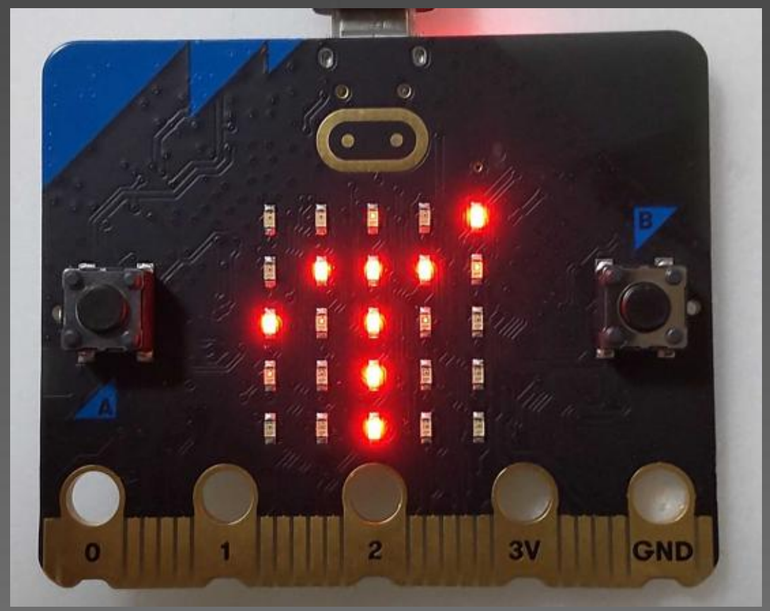
- Stop running at the top of usermain() function



Using Peripheral Devices

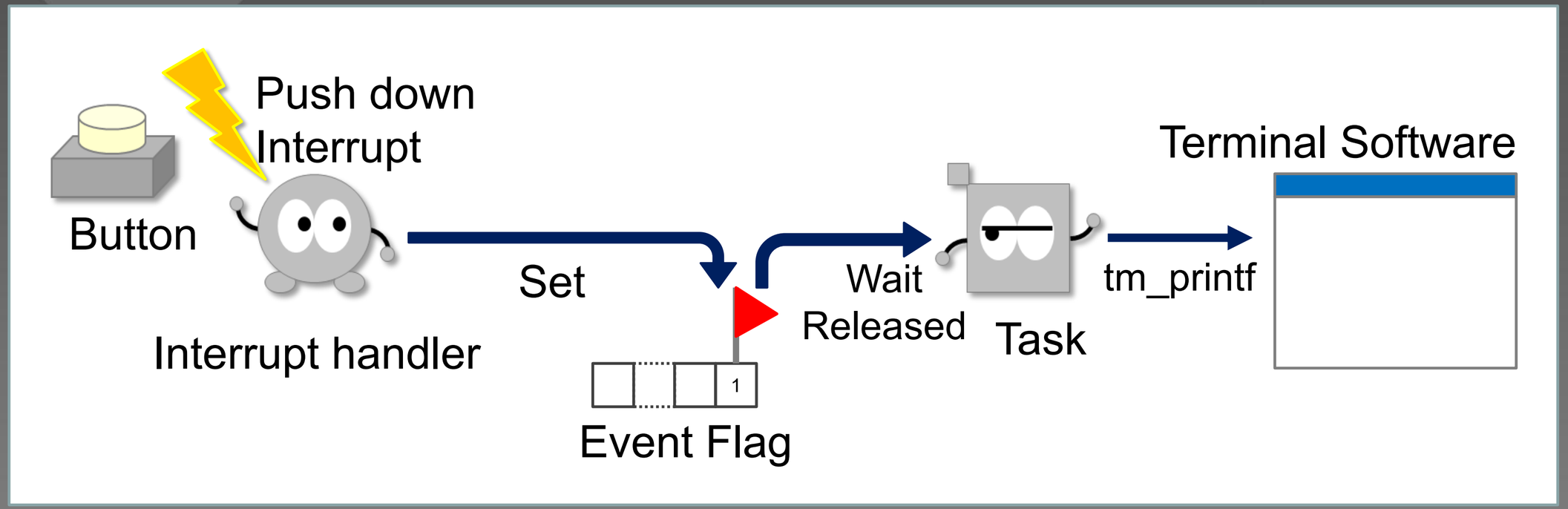
Using Peripheral Devices

- (1) GPIO and push button switch interrupt
- (2) Put “イ” pattern on LED matrix
- (3) Music and dimming LED by PWM
- (4) A/D conversion and joystick
- (5) I2C and acceleration sensor
- (6) UART comm. between 2 boards



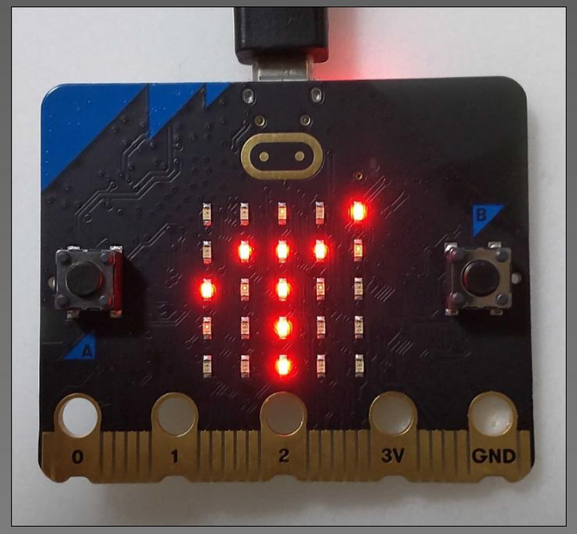
Using Peripheral Devices

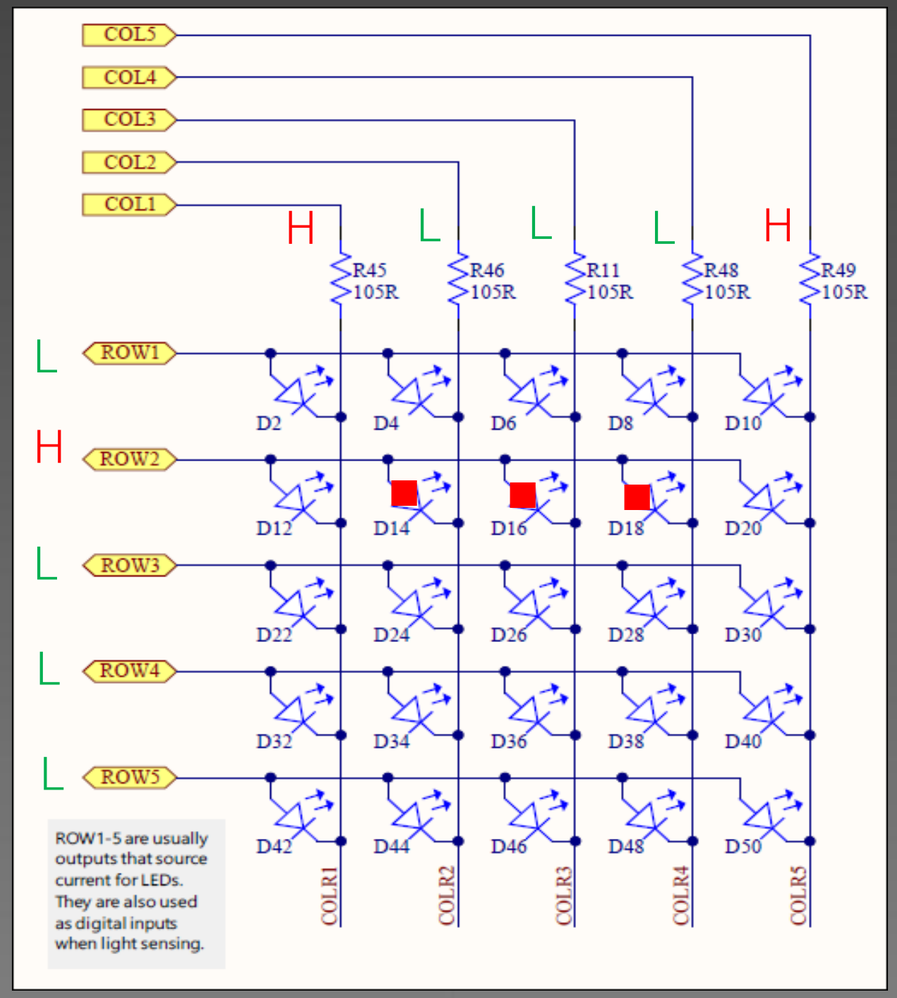
- (1) GPIO and push button switch interrupt
  - Push button → interrupt → set event flag → task wait released → print



Using Peripheral Devices

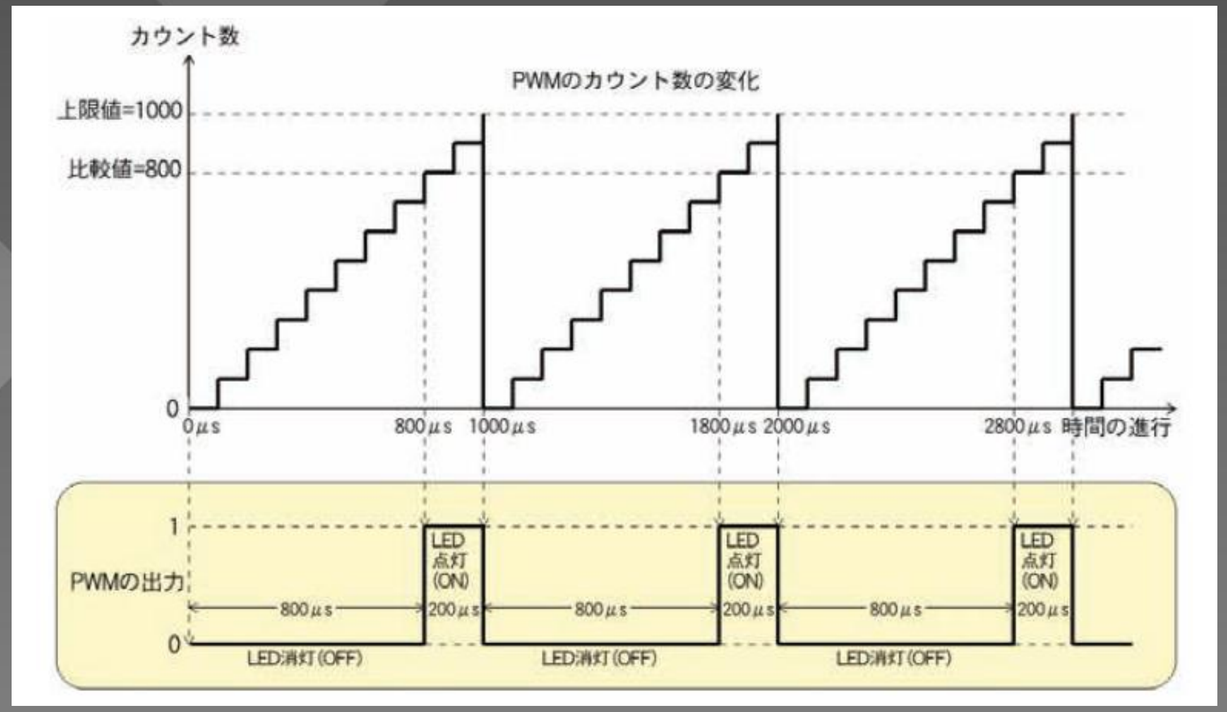
- (2) Put pattern “イ” on LED matrix
  - LED=ON ⇔ Row=High & Col=Low
  - Dynamic drive to put any patterns
  - 10 bits but 2**25 patterns
    - ✓ (“イ” was a test pattern of early TV in 1926)

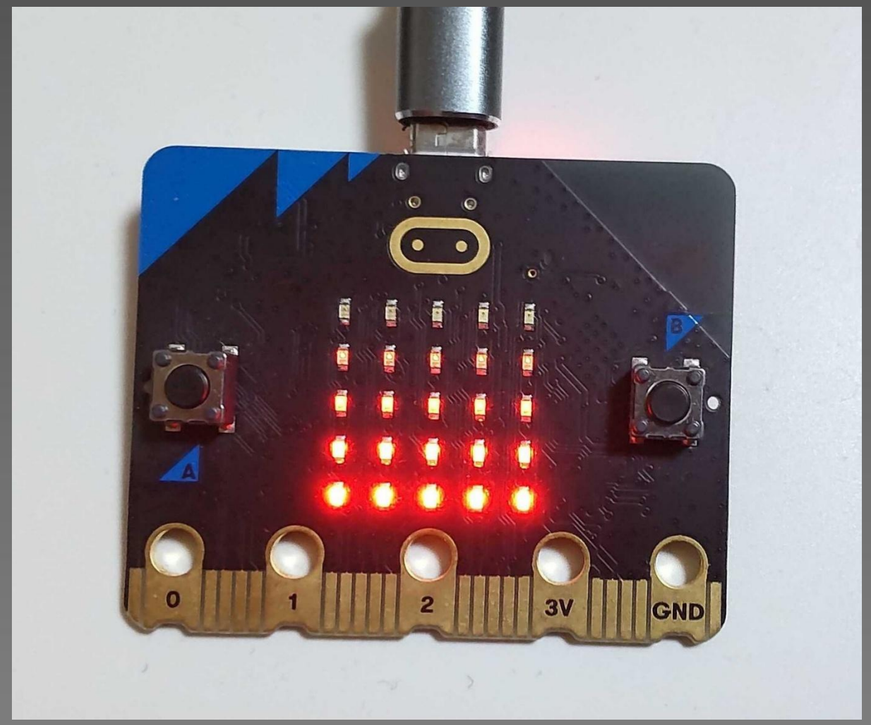




Using Peripheral Devices

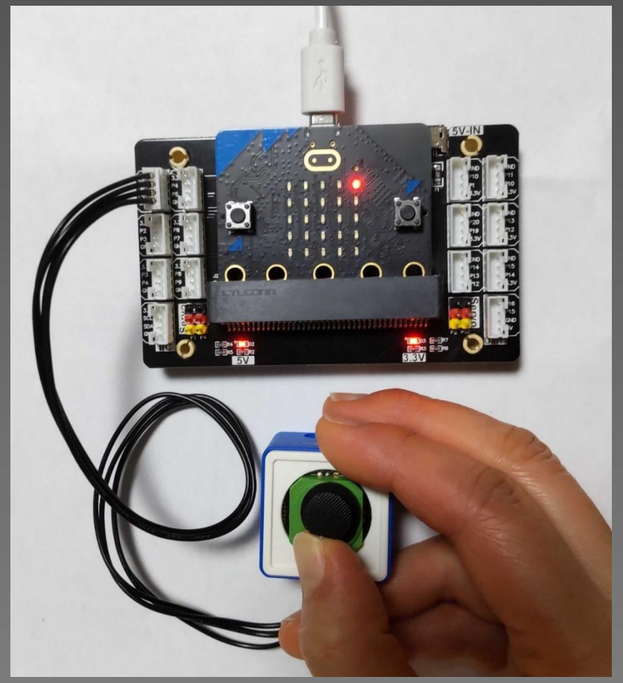
- (3) Play music & dimming LED by PWM: Pulse Width Modulation
  - Example 1: OFF 800μs, ON 200μs → Freq. 1000Hz / Duty ratio 20%
  - Example 2: OFF 100μs, ON 400μs → Freq. 2000Hz / Duty ratio 80%

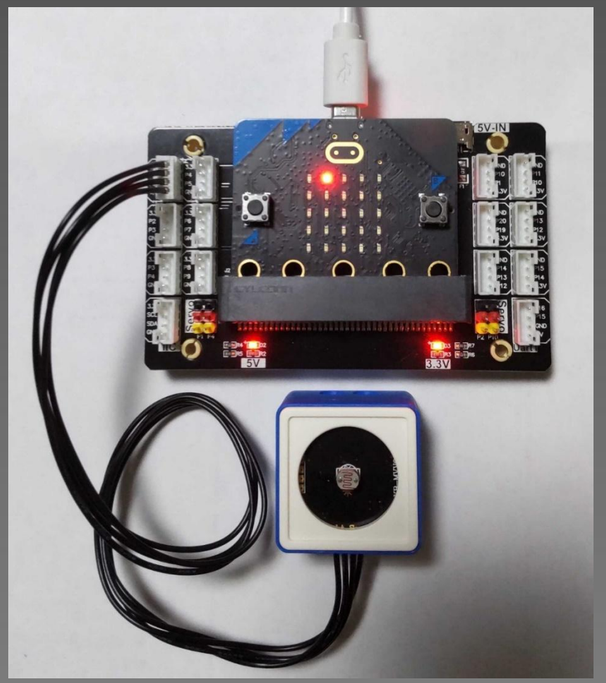




Using Peripheral Devices

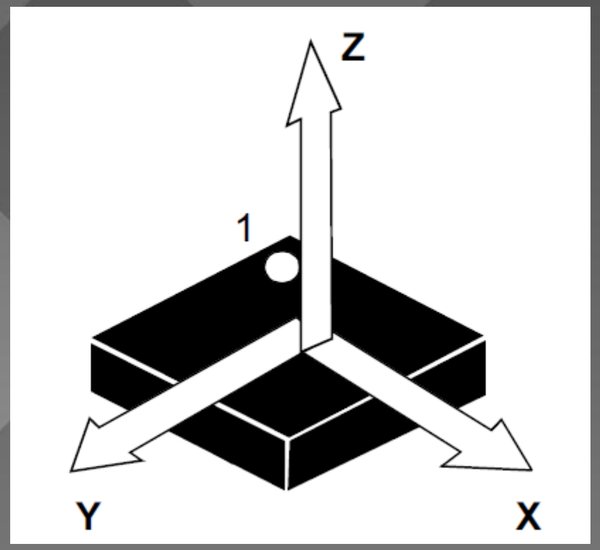
- (4) A/D conversion and joy stick
  - Joystick included in ”World of Module Sensor Kit” by iftiny:
    - ✓ https://store.iftiny.com/products/yahboom-world-of-module-programmable-sensor-kit-for-microbit-v2





Using Peripheral Devices

- (5) I2C and acceleration sensor




```
microT-Kernel Version 3.00

WHO_AM_I_A = 0x33
CTRL_REG1_A = 0x57

Acc: x,y,z= -10,  -6, 237
Acc: x,y,z=  -8,  -4, 247
Acc: x,y,z= -14, -11, 240
Acc: x,y,z=  36,   2, 241
Acc: x,y,z=  97,   3, 224
Acc: x,y,z= 127,  17, 208
Acc: x,y,z= 144,   6, 201
Acc: x,y,z=  11,  12, 259
Acc: x,y,z=-112,  -5, 214
Acc: x,y,z=-165,   2, 192
```

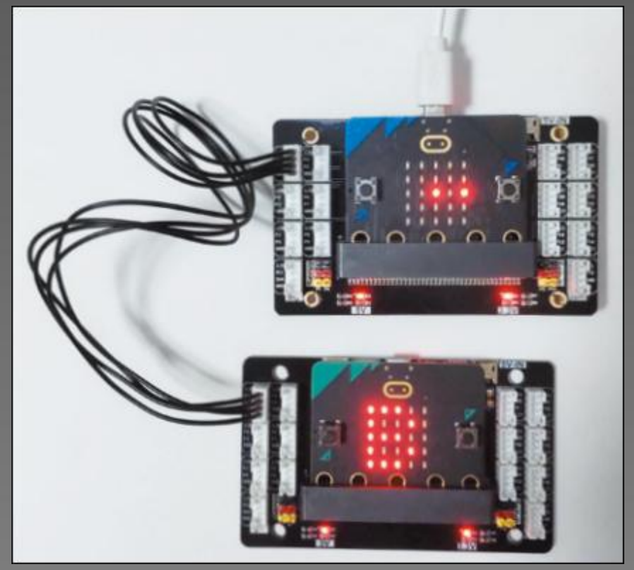
← ボードが水平（micro:bitの文字が上）

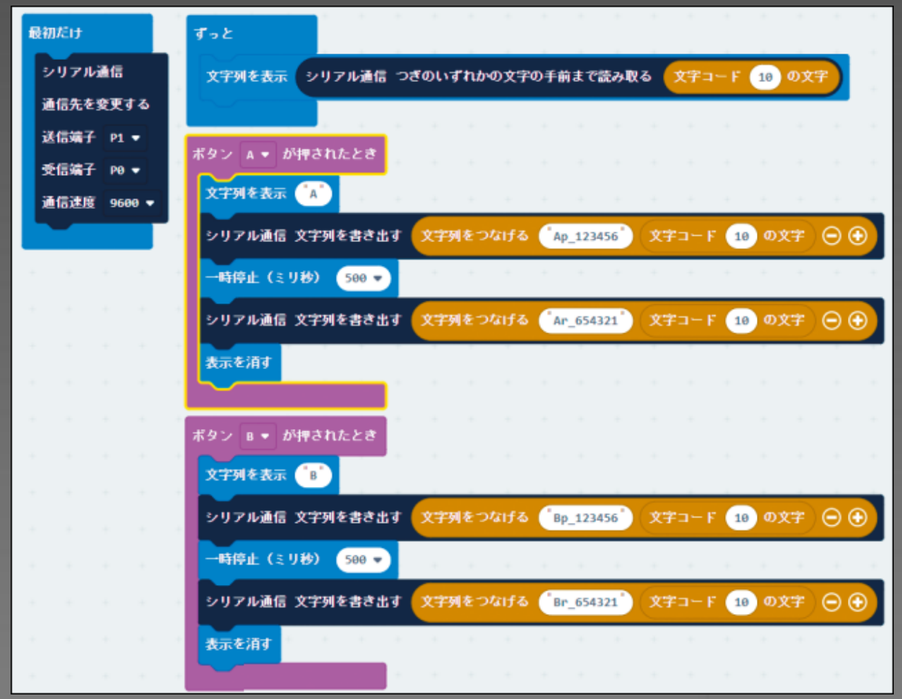
← ボードの左側を下に傾ける

← ボードの右側を下に傾ける

Using Peripheral Devices

- (6) UART communication between micro:bit A and B
  - micro:bit A is programmed by µT-Kernel 3.0
  - micro:bit B can be programmed by MakeCode



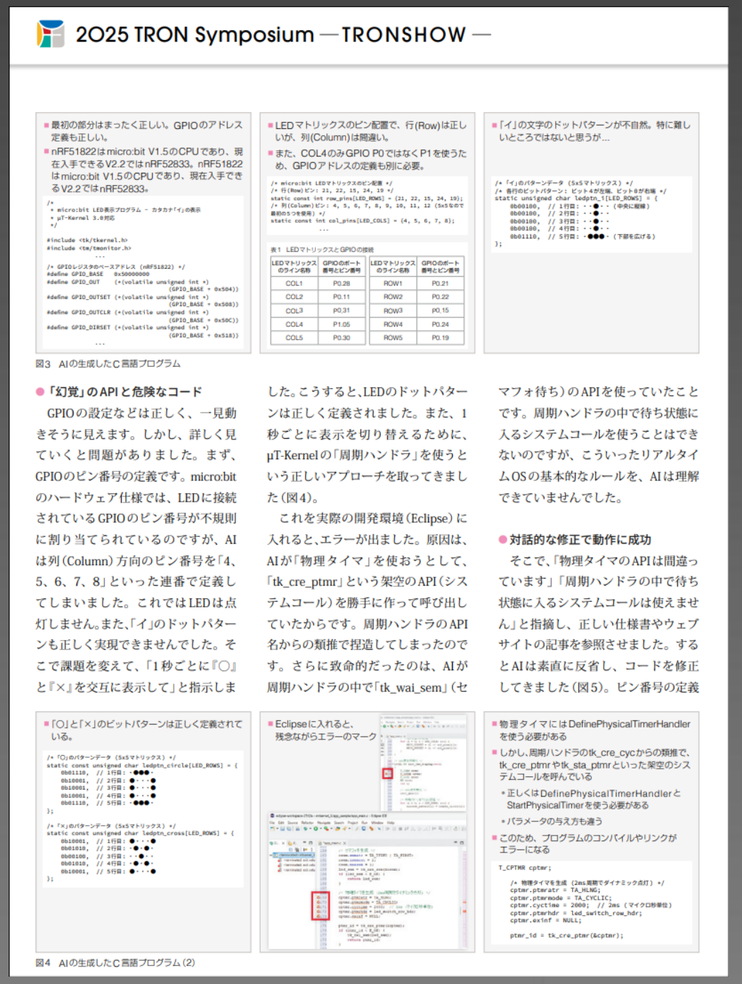


Using Peripheral Devices

- Sample Programs in articles on TRONWARE magazine and website
- (1) GPIO and push button switch interrupt (VOL.201)
  - https://www.t-engine4u.com/info/mbit/5.html, https://www.t-engine4u.com/info/mbit/6.html
- (2) Put pattern “イ” on LED matrix (VOL.202)
  - https://www.t-engine4u.com/info/mbit/7.html
- (3) Play music and dimming LED by PWM (VOL.205)
  - https://www.t-engine4u.com/info/mbit/10.html
- (4) A/D conversion and joystick (VOL.206)
  - https://www.t-engine4u.com/info/mbit/11.html
- (5) I2C and acceleration sensor (VOL.207)
  - https://www.t-engine4u.com/info/mbit/12.html
- (6) UART communication between two micro:bit boards (VOL.208)
  - https://www.t-engine4u.com/info/mbit/13.html

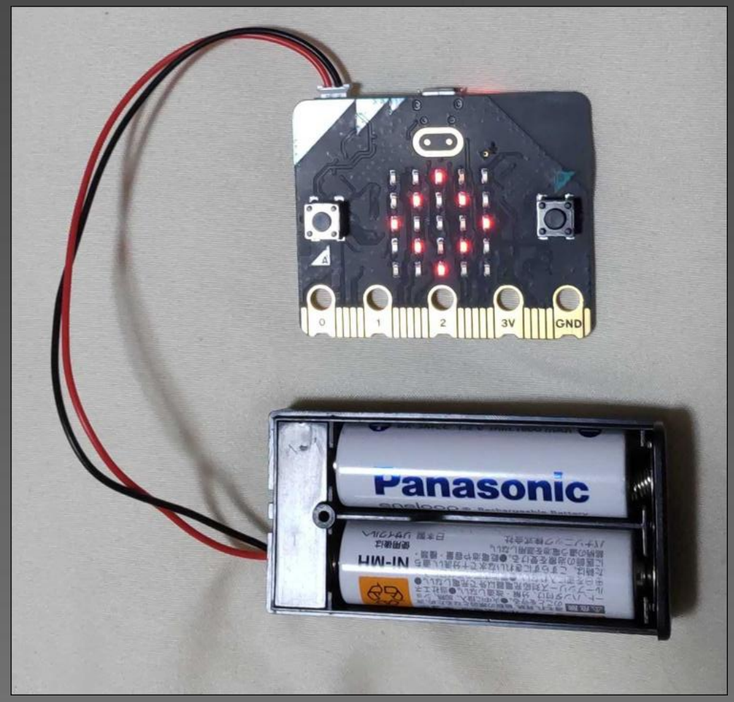
Using generative AI to program micro:bit＋µT-Kernel

- Generative AI can write program source code by inputting some prompts
- Prompt example
  - Write a program to put pattern “イ” for µT-Kernel 3.0 on micro:bit
- See TRONWARE VOL.217



Tips for contest entry and AI utilization

- Take advantage of micro:bit features
  - Mini-sized micro:bit board
  - Battery-powered portability
  - Many peripheral sensors
- Example: mini-sized music instrument
  - (3) Play music by PWM
  - (5) Acceleration sensor
- AI utilization
  - Very small AI framework or machine learning running on micro:bit
  - Connect cloud AI to micro:bit
  - Using AI for development tools
- Your new ideas are welcome



Q & A

- Your questions are welcome

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