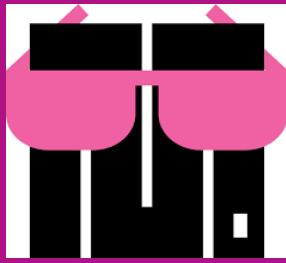
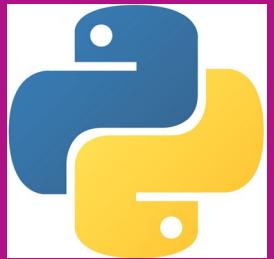
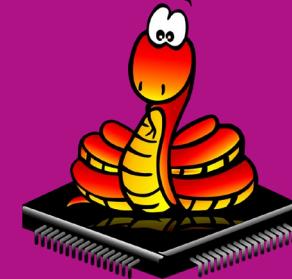


# INTERNET OF THINGS (IOT) PROJECTS USING PYTHON

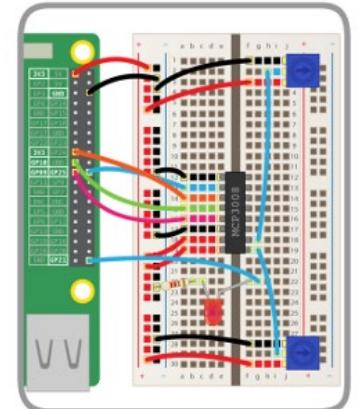
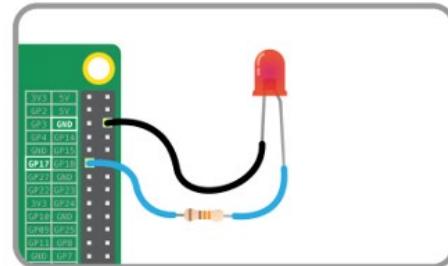
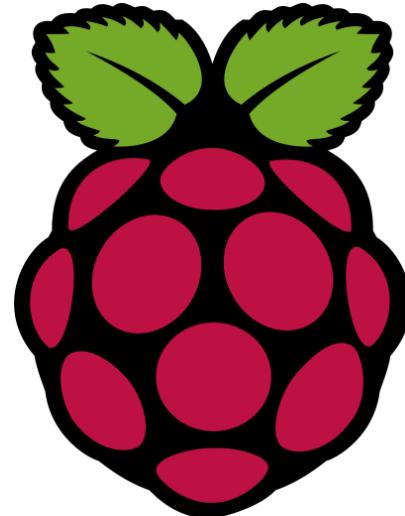


(CSE 4110)

(LECTURE – 1)

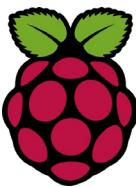


T<sub>h</sub>





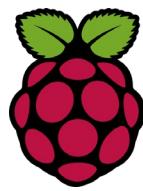
# What Is Outcome-Based Education? OBE Vs Traditional Education System



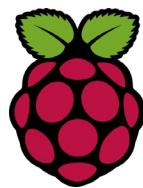
- Outcome-based education is a system where all the parts and aspects of education are focused on the outcomes of the course. The students take up courses with a certain goal of developing skills or gaining knowledge and they have to complete the goal by end of the course.
  
- There is no specific style or time limit of learning. The student can learn as per their choice. The faculty members, moderators, and instructors guide the students based on the target outcomes.



# Benefits Of Outcome-Based Education (OBE) For Students

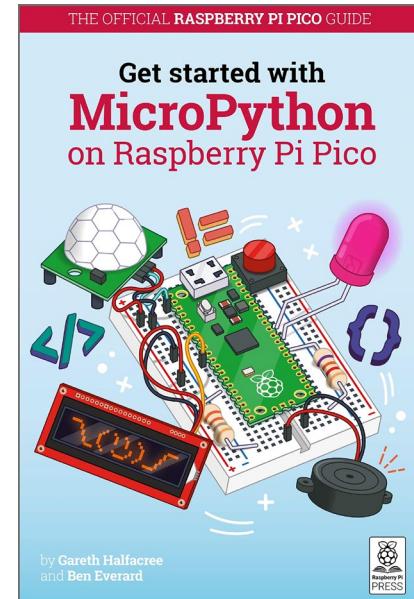
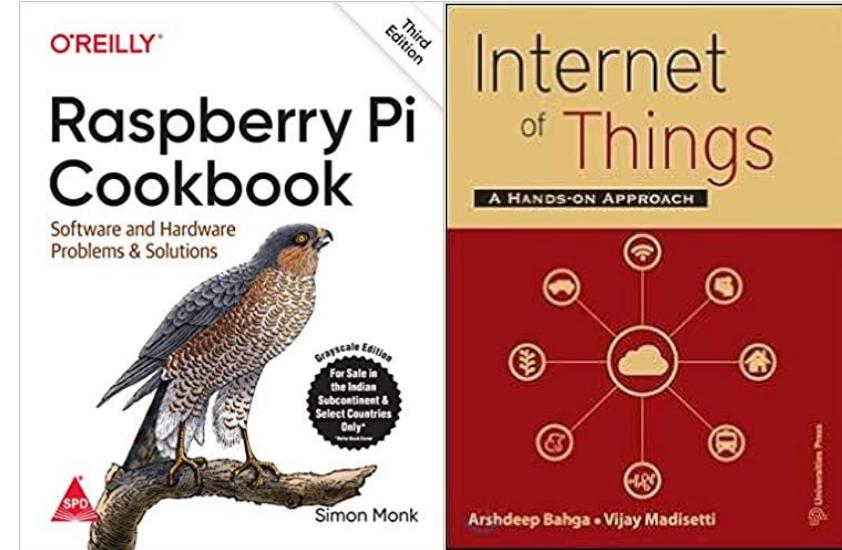


- Brings clarity among the teachers and students
- Every student has the flexibility and freedom of learning in their ways.
- There is more than one method of learning
- Reduces comparison among the students as everyone has a different target
- Completely involves students taking responsibility for their goals



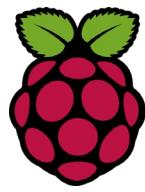
# About your subject

- **Grading Pattern : 3**
- **Credit : 4**
- **TextBook:** • 1) **Raspberry Pi Cookbook by by Simon Monk, shroff/O'Reilly**  
2) **Internet of Things - A hands on Approach By A Bagha and V Madisetti**
- **Reference : 3) Get started with Micro-Python**





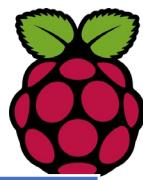
# Evaluation Scheme



- ATTENDANCE : 5
- WEEKLY ASSIGNMENTS / QUIZZES : 20 MID-TERM
- MID TERM : 15
- TOTAL INTERNAL : 40
  
- END TERM: 60
- TOTAL EXTERNAL : 60 END-TERM



# Course Outcomes

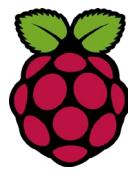


## Course Outcomes

CO1	Understand general concepts of Internet of Things (IoT), the working of Raspberry Pi and its features.
CO2	Recognize various components, sensors, actuators, devices and their applications.
CO3	Analyze various python programs to interface with sensors, actuators, LED's, cloud and camera using Raspberry pi.
CO4	Measure physical parameters using sensors.
CO5	Demonstrate the ability to transmit data wirelessly between different devices to build simple IoT systems using Raspberry Pi.
CO6	Create IoT devices and systems through a variety of interfaces, including web apps and mobile apps.

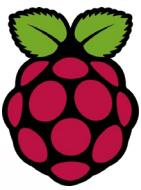


# What Students will learn?

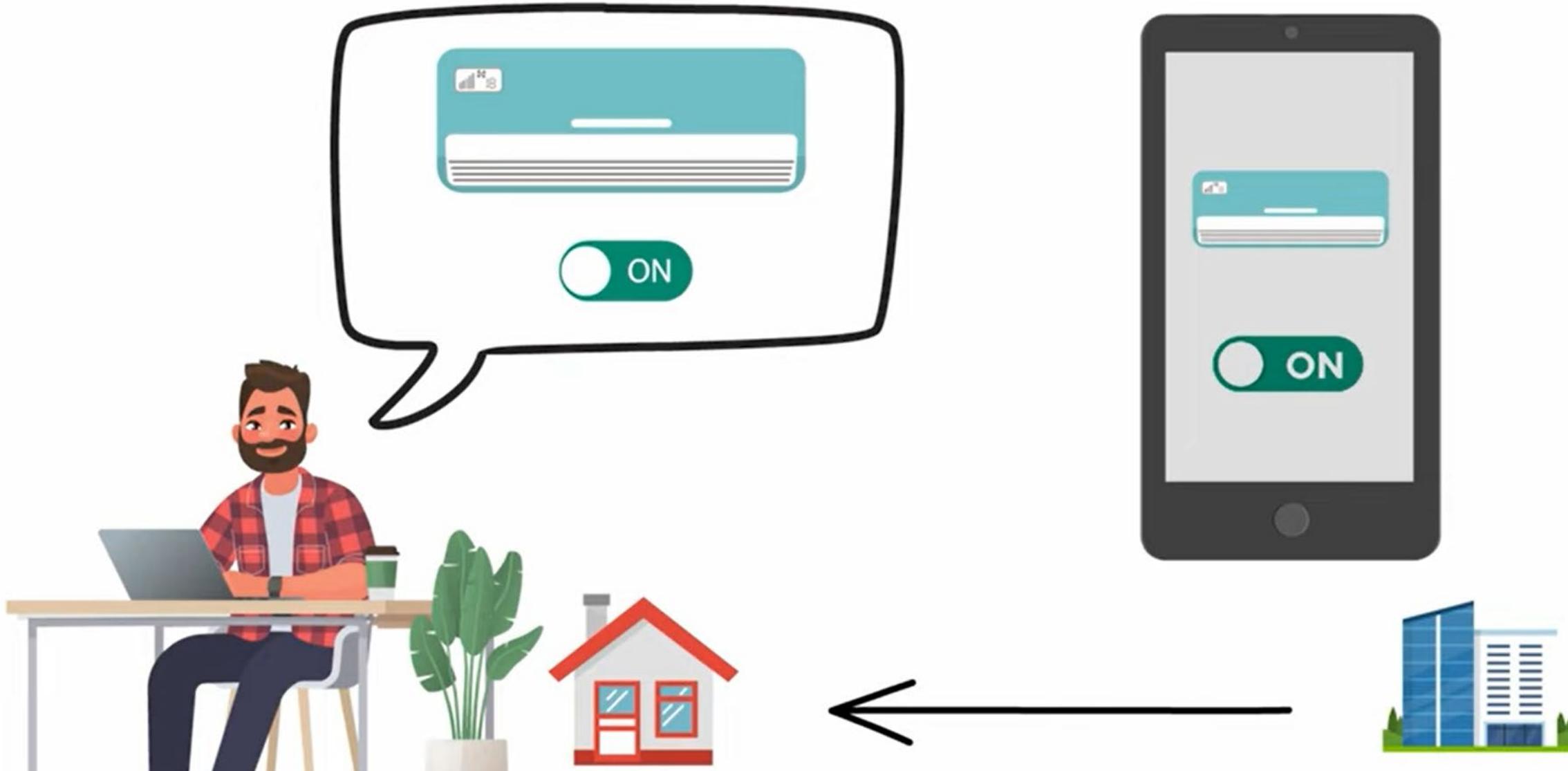


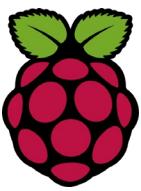
Students will get a glimpse into the ever-growing field of IoT, a technology that allows the intelligent exchange of data among a network of internet-connected objects. Also students will experience about “RP2040” chip which provides ample power for embedded as well as IOT projects and enables users of any age or ability to learn coding and electronics.

- ✓ Familiarization with IoT concepts, their origin, impact, methodologies and tools, and how IoT is integrated into different applications to improve technical as well as business results.
- ✓ Set up your Raspberry Pi Pico and start using it
- ✓ Prepare Raspberry Pi Pico with header for breadboard implementation.
- ✓ Introduction to the ONLINE SIMULATOR “WOKWI”

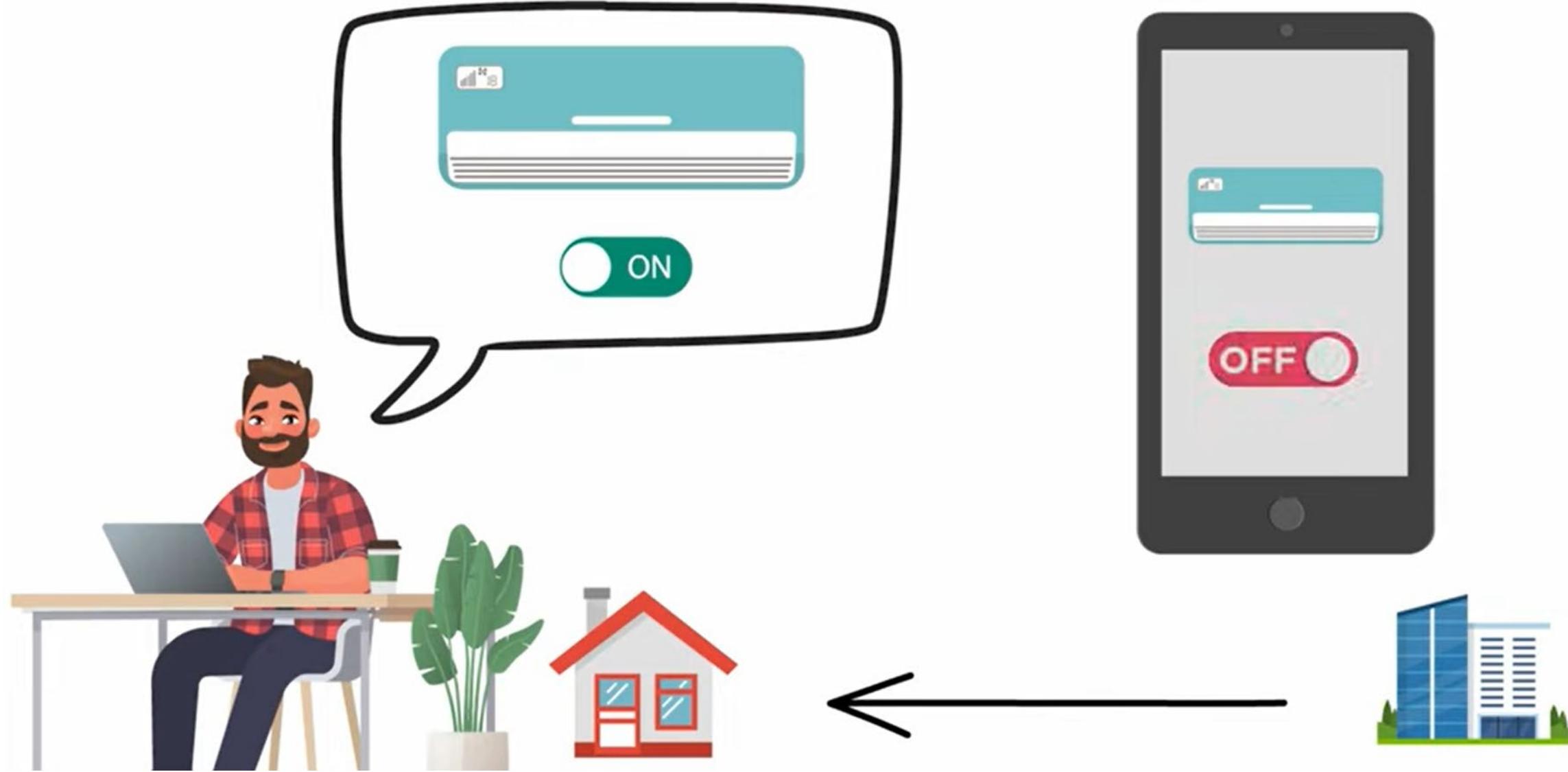


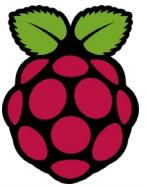
# Want to know status of my AC?



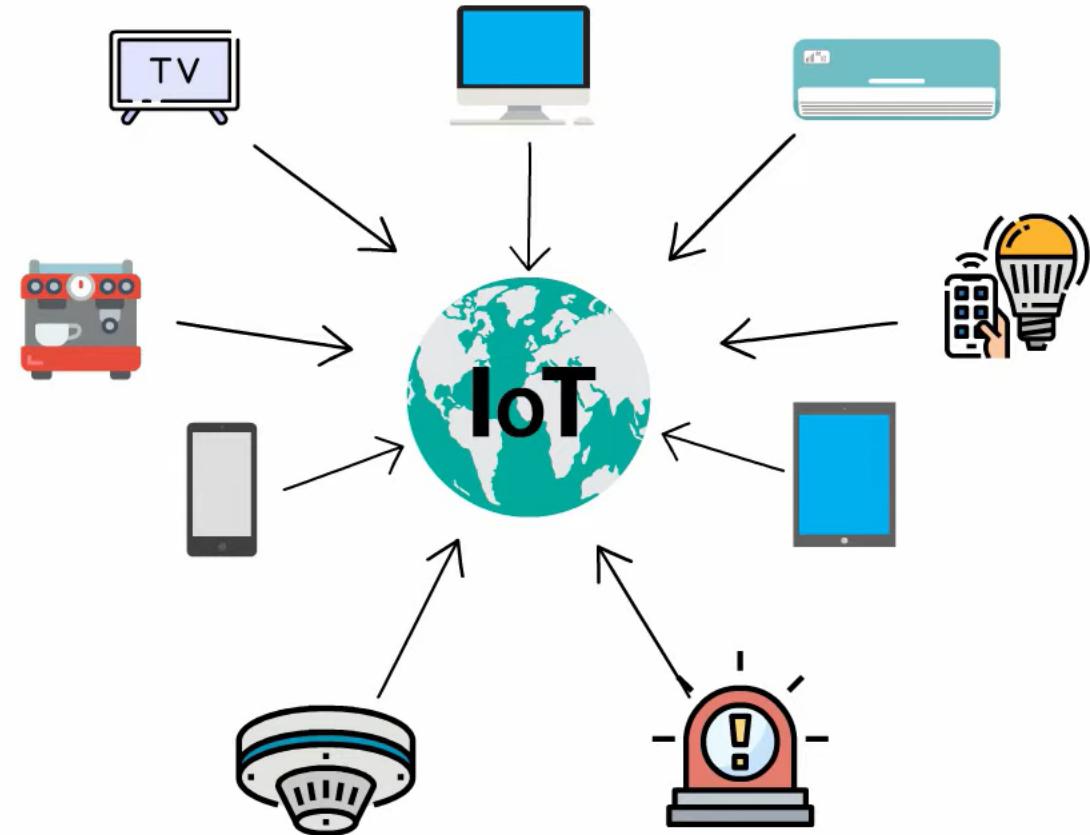


# Can I turn it off?

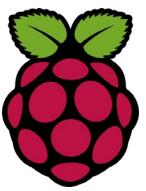




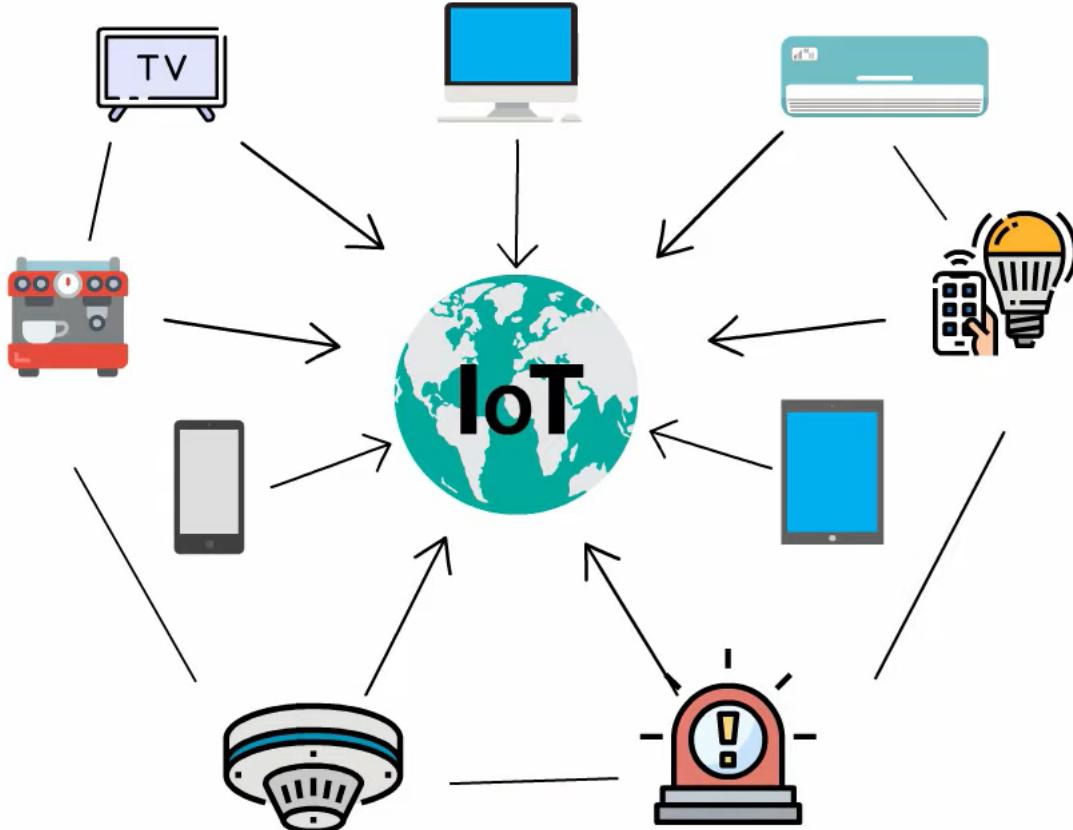
# What IoT can do?



IoT is shaping the way we live our lives



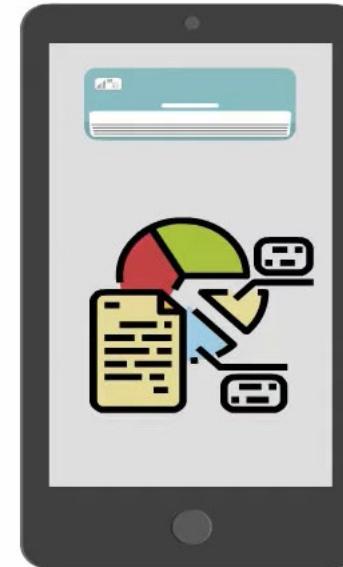
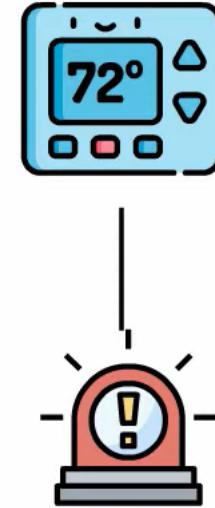
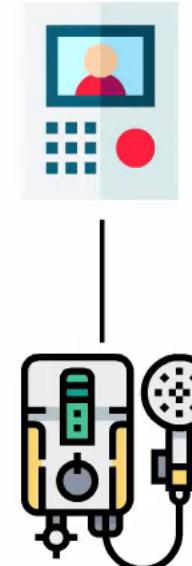
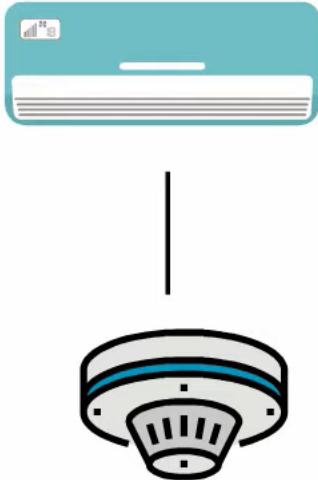
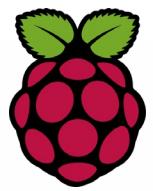
# What is IOT?

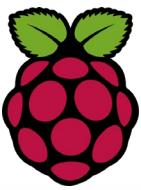


**Internet of Things (IOT) is a system of inter related devices connect to the internet to transfer and receive data from one to the other.**



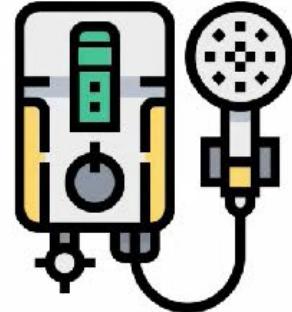
# A smart home is the best example of IoT



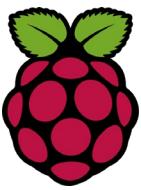


# Internet of Things

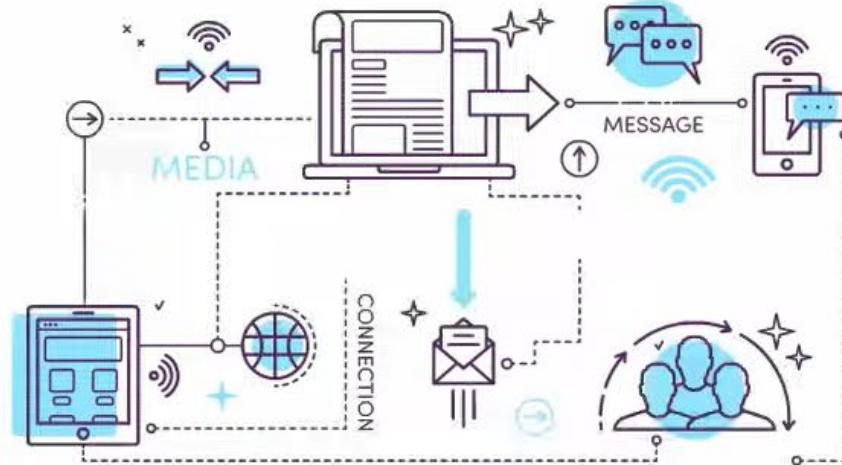
For example:



Although all of this is fascinating, there's a lot that goes on in the background to ensure seamless functioning



# Internet of Things

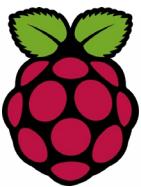


Communication  
between Devices

## Components

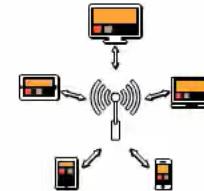


Accurate processing of  
received data



# IoT devices

## General devices



Gate way:  
wifi,  
blue tooth,  
ZegBee,  
GSM

## Sensing devices

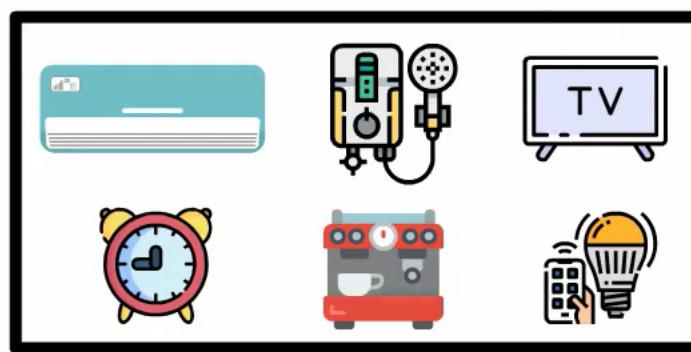


sensor



actuators

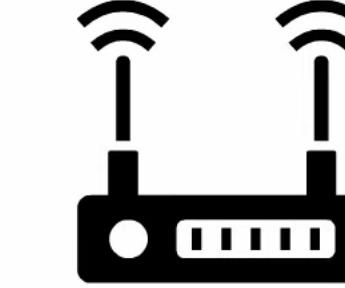
Main  
components



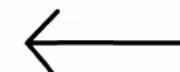
IOT devices



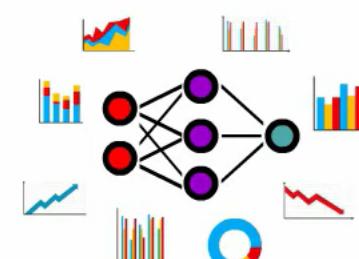
cloud access storage



gate way



sensors



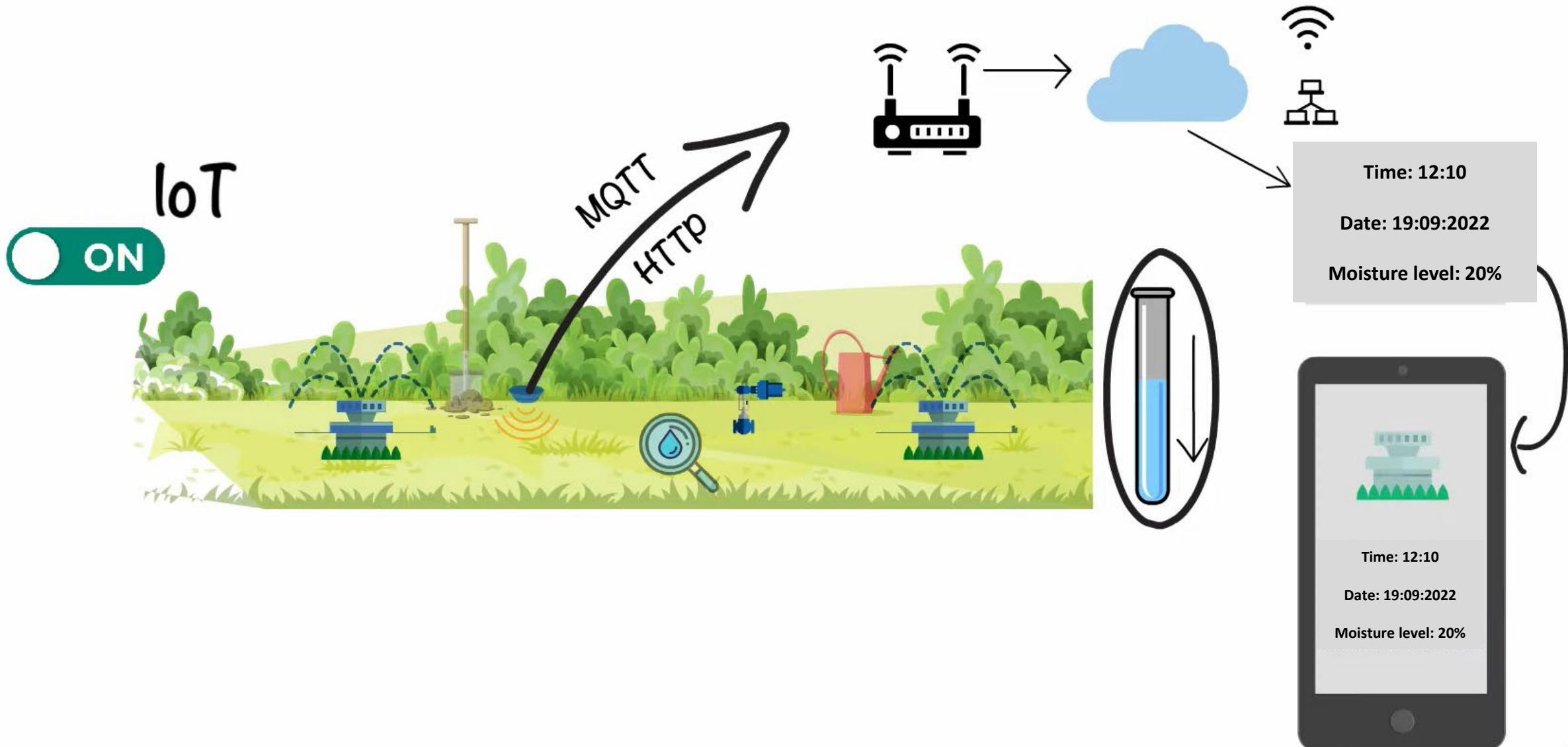
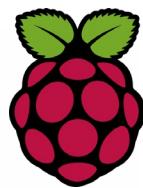
and data processing unit

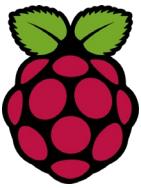


Gate way:  
wifi,  
blue tooth,  
ZegBee,  
GSM

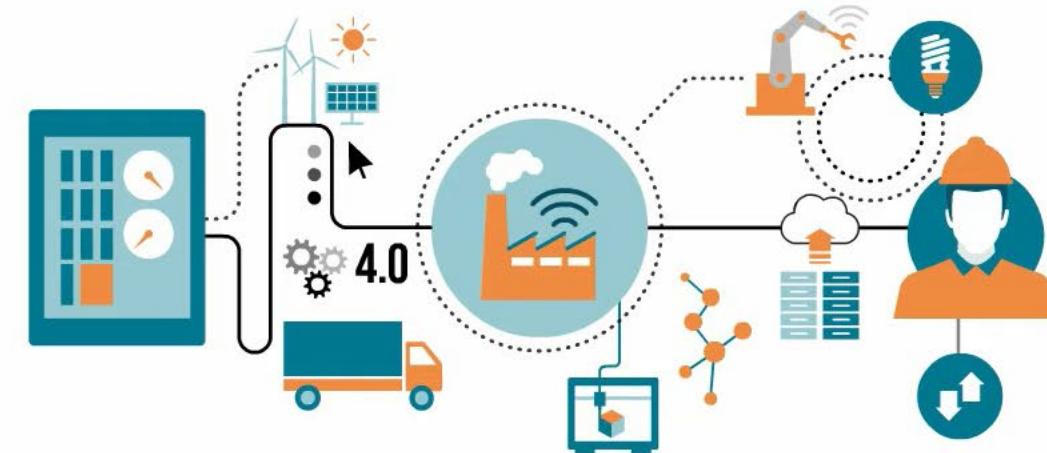
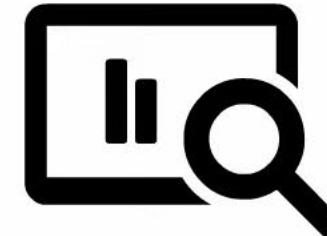


# To help you understand its working, let's take a simple scenario

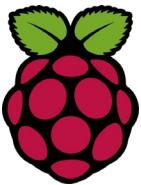




# Internet of Things



Today, IoT is being used extensively to lessen the burden on humans



# Internet of Things

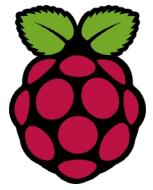
Today, IoT is being used extensively to lessen the burden on humans



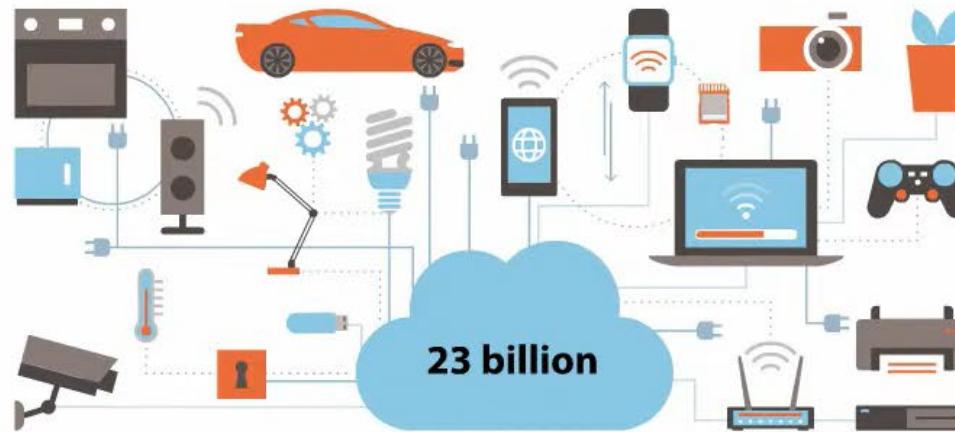
Promising than ever before



# Internet of Things



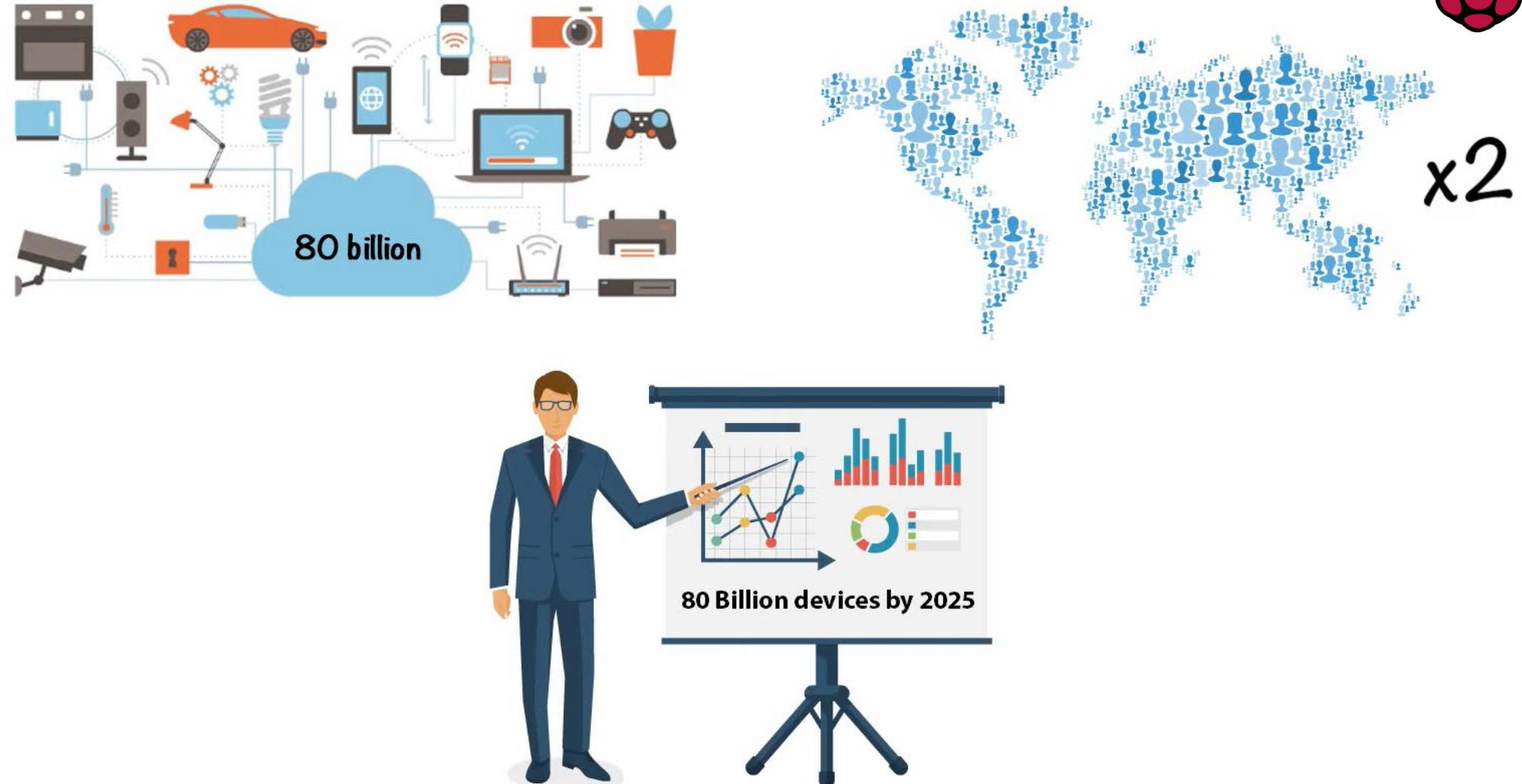
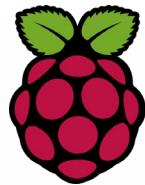
In 2018:



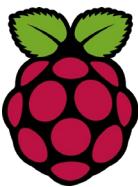


In 2025:

# Internet of Things



IoT is a vision to connect all devices with the power of the internet,  
always learning and always growing

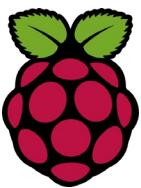


# QUIZ TIME???????

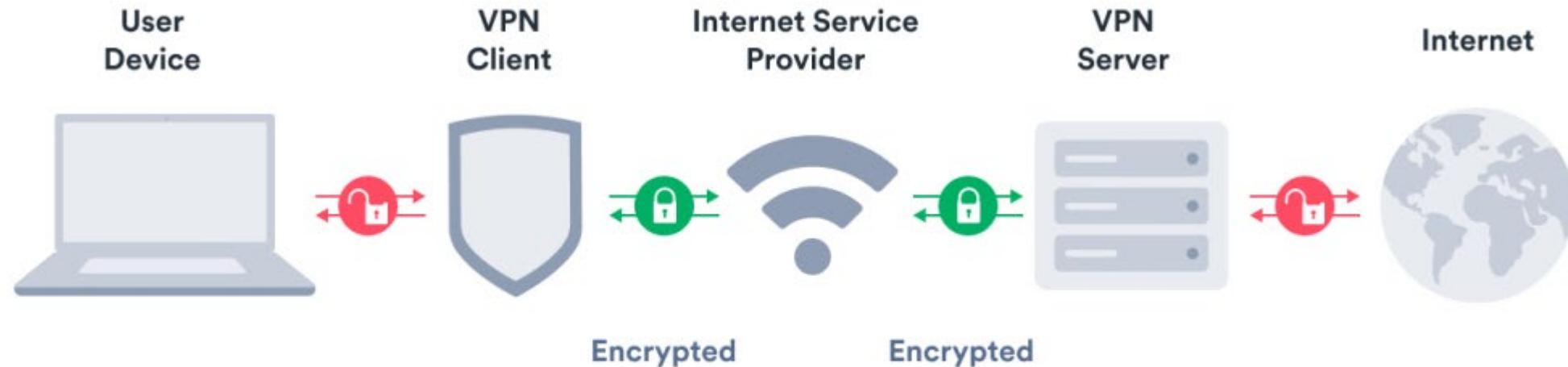


Which of the following technologies is not used as an interface for a network?

1. WiFi
2. Ethernet
3. ZigBee
4. VPN



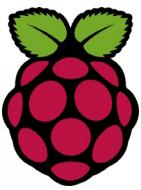
# Answer – D: VPN



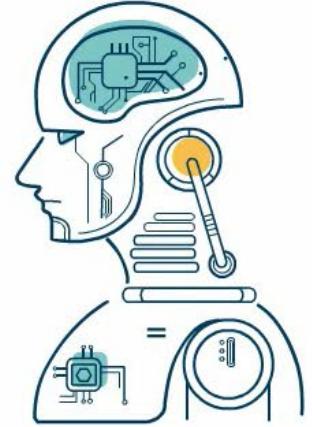
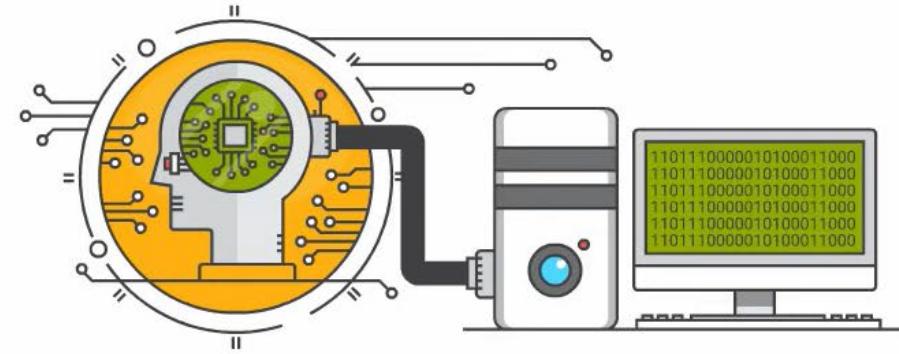
## VPN

A VPN (Virtual Private Network) **protects your connection while you're using the internet**. It makes your browsing private, hides your IP (Internet Protocol) address and ensures your internet service provider (ISP) doesn't track you.

**VPN is used to extend a private network over a public. The other options are used to provide a medium for data transfer.**



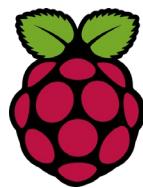
# The integration of IoT with other technologies like



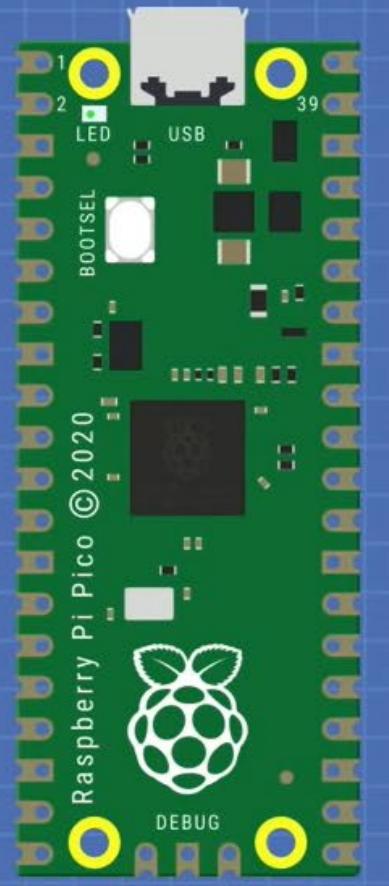
That is the  
Internet of Things  
for you in short

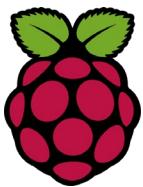


# Raspberry Pi Pico

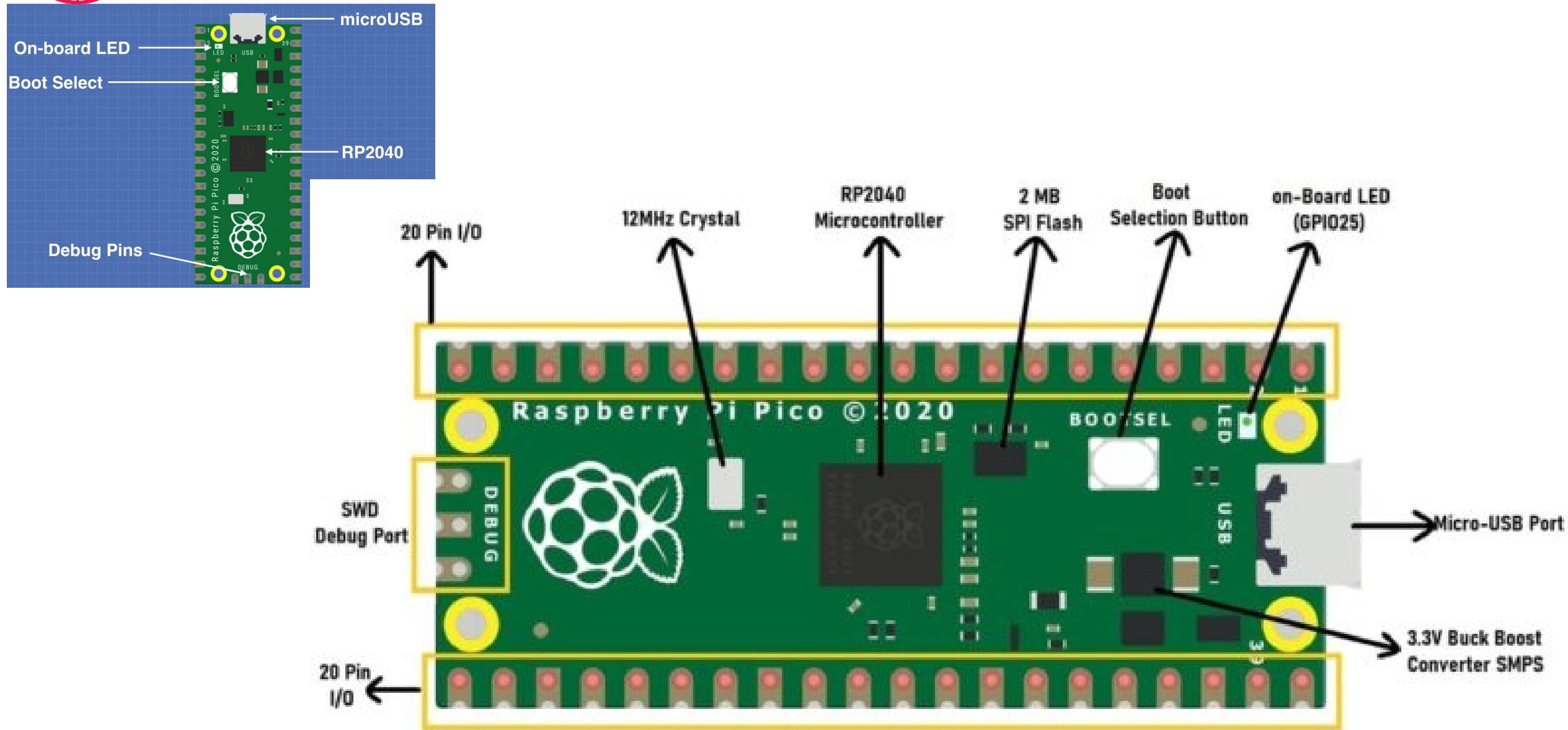


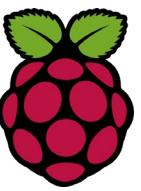
- Introduced by Raspberry Pi in January 2021
- First Microcontroller in Raspberry Pi Family
- Powered by RP2040 MCU
- Multiple PWM-capable I/O ports, I2C, SPI, ADC
- Retails for \$4.00 USD
- Other manufacturers also building with RP2040





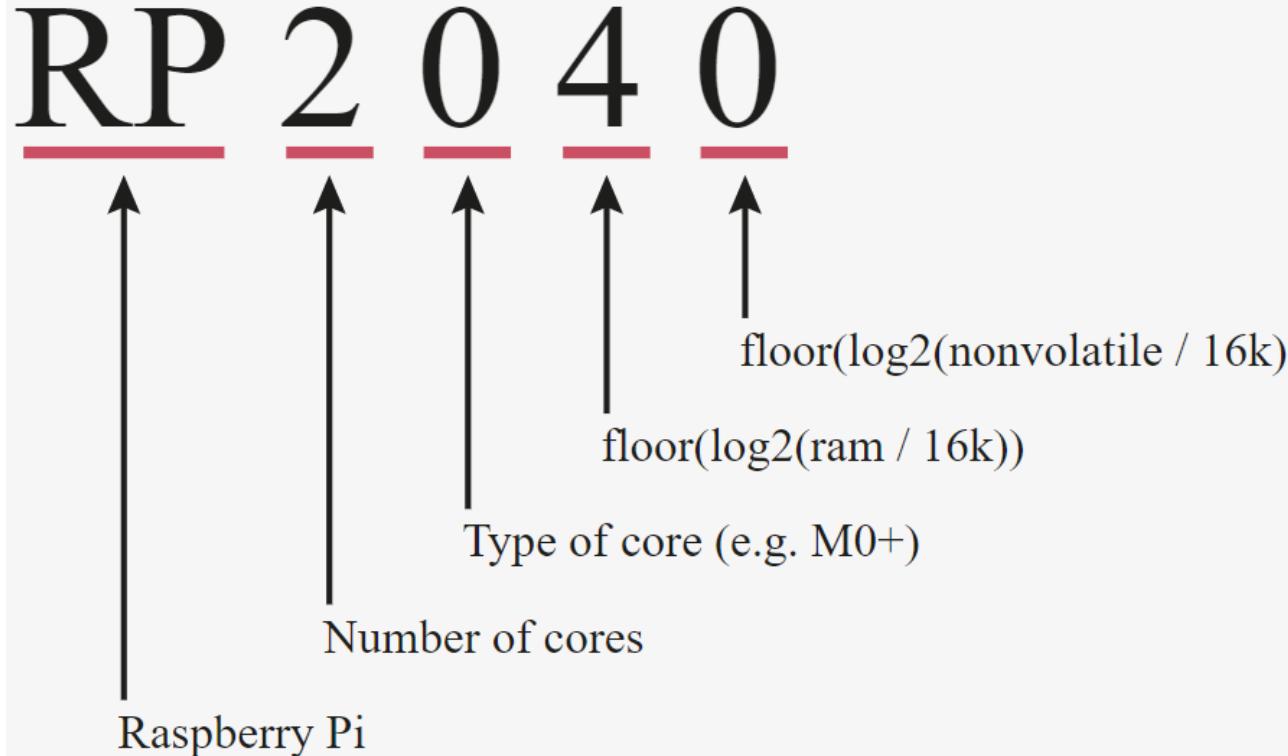
# Raspberry Pi Pico – Simple Pinout





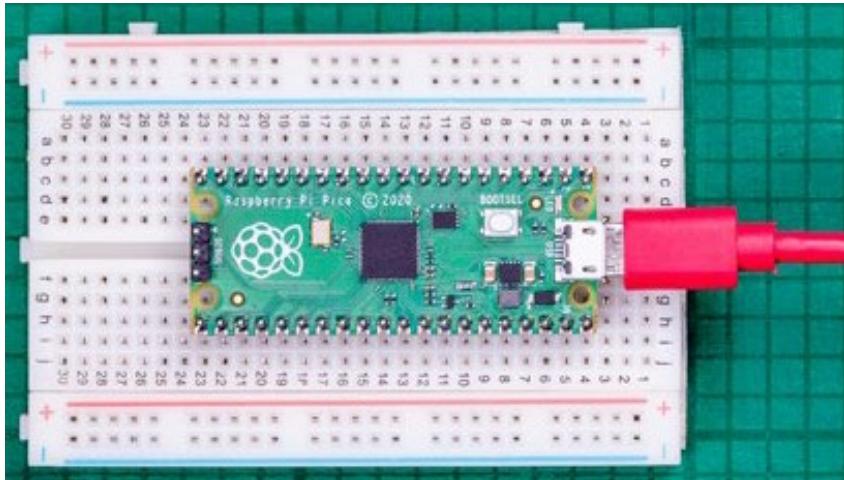
# Why is the chip called RP2040?

The post-fix numeral on RP2040 comes from the following,



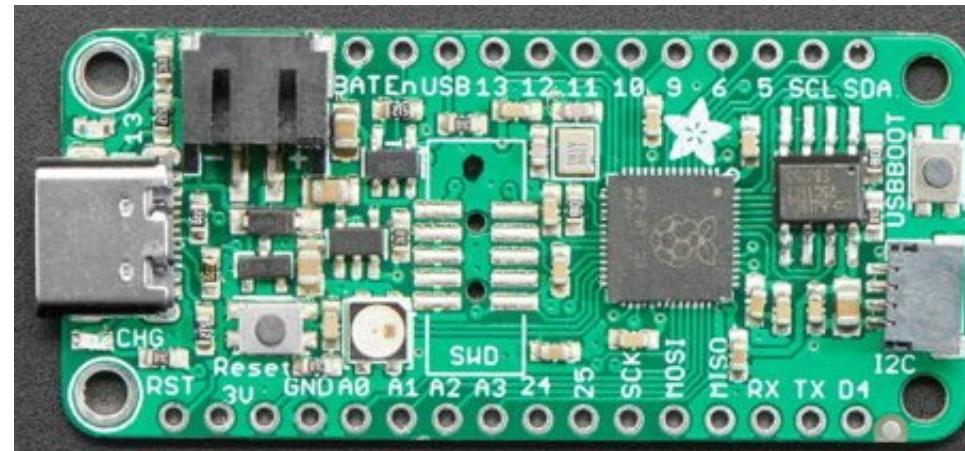
1. Number of processor cores (2)
2. Loosely which type of processor (M0+)
3.  $\text{floor}(\log_2(\text{ram} / 16\text{k}))$
4.  $\text{floor}(\log_2(\text{nonvolatile} / 16\text{k}))$  or 0 if no onboard nonvolatile storage

# RP2040-based Boards



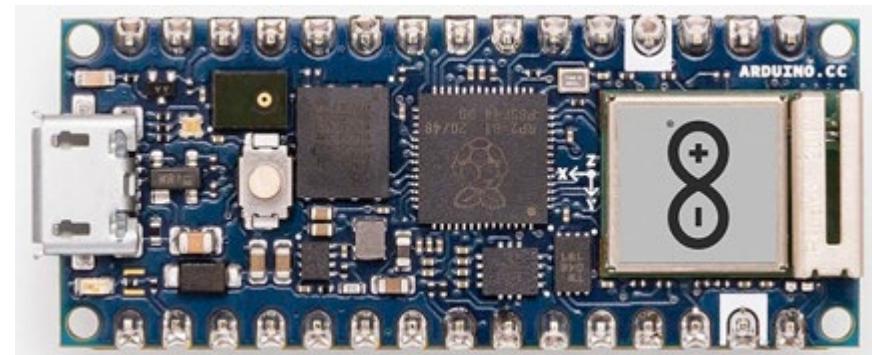
**Boards from Raspberry Pi**

Raspberry Pi Pico, and Raspberry Pi Pico W



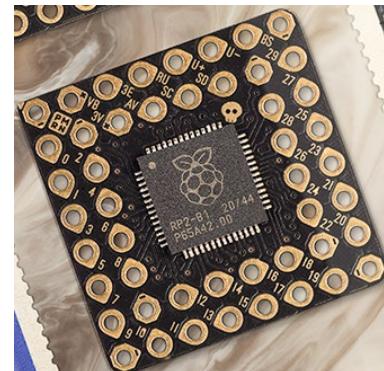
**Boards from Adafruit**

Feather 2040 and ItsyBitsy 2040



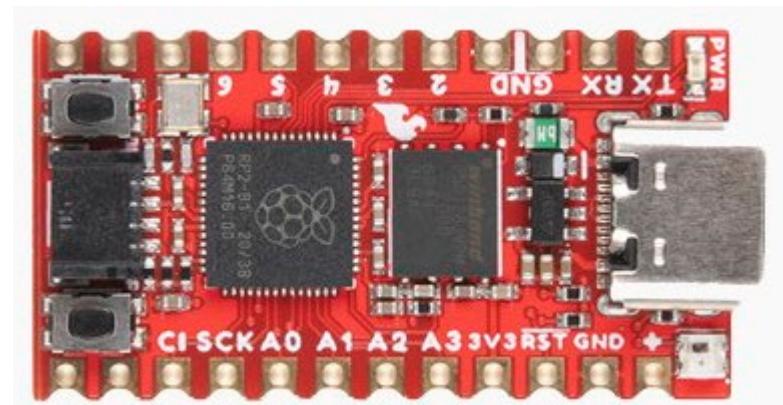
**Boards from Arduino**

Nano RP2040 Connect



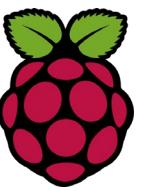
**Boards from Pimoroni**

PGA2040, Pico LiPo, Tiny 2040,  
Keybow 2040, PicoSystem, Plasma 2040



**Boards from SparkFun**

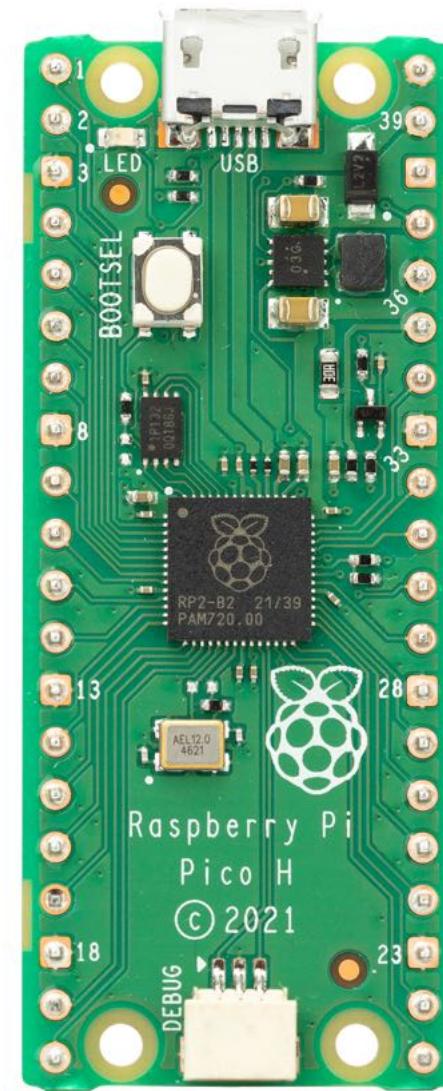
Pro Micro - RP2040, Thing Plus -  
RP2040, MicroMod RP2040 Processor



# Raspberry Pi Pico Family



Raspberry Pi Pico



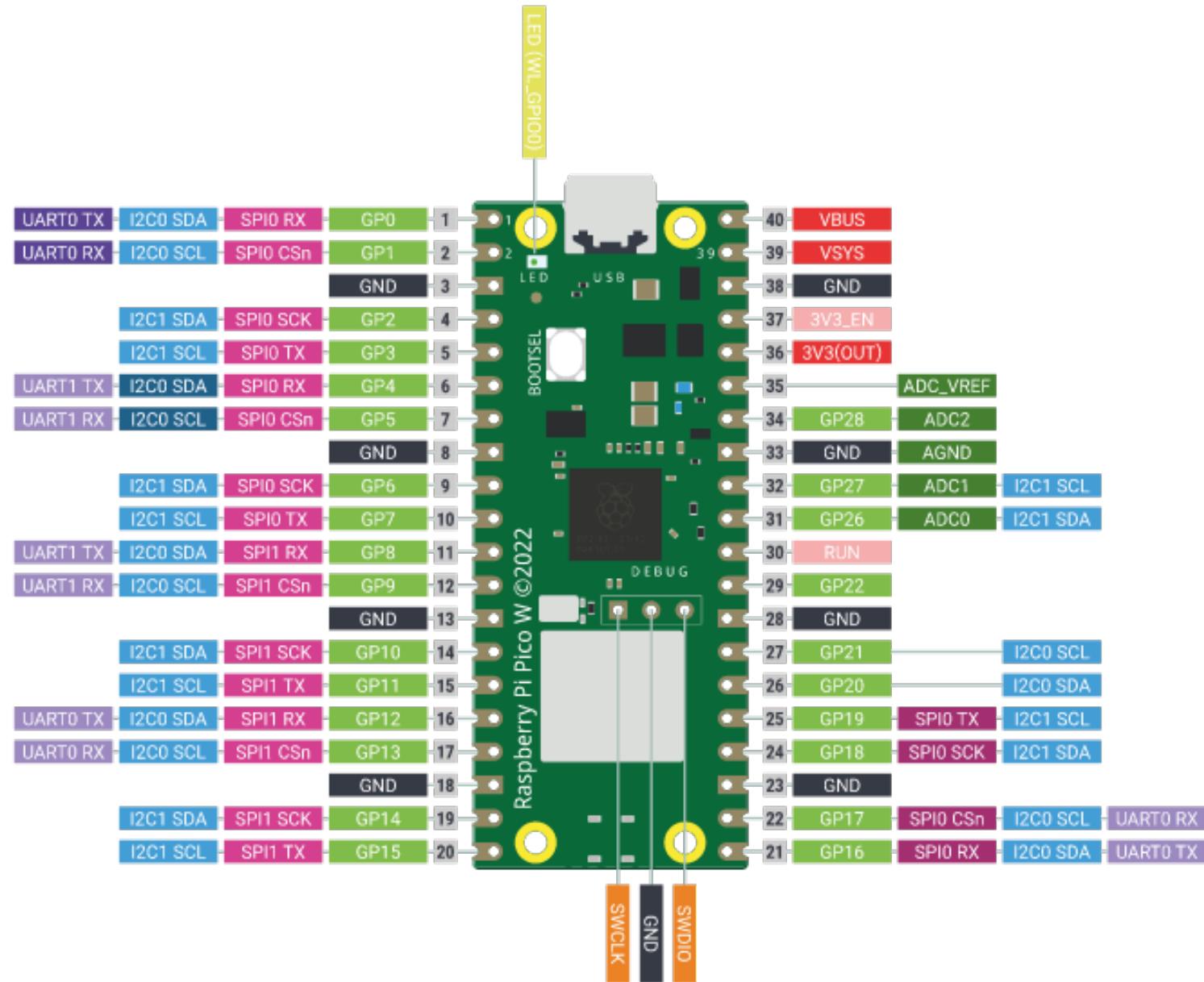
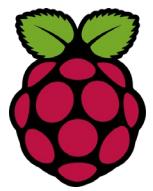
Raspberry Pi Pico H



Raspberry Pi Pico W



# Raspberry Pi Pico W Pinout



RP2040

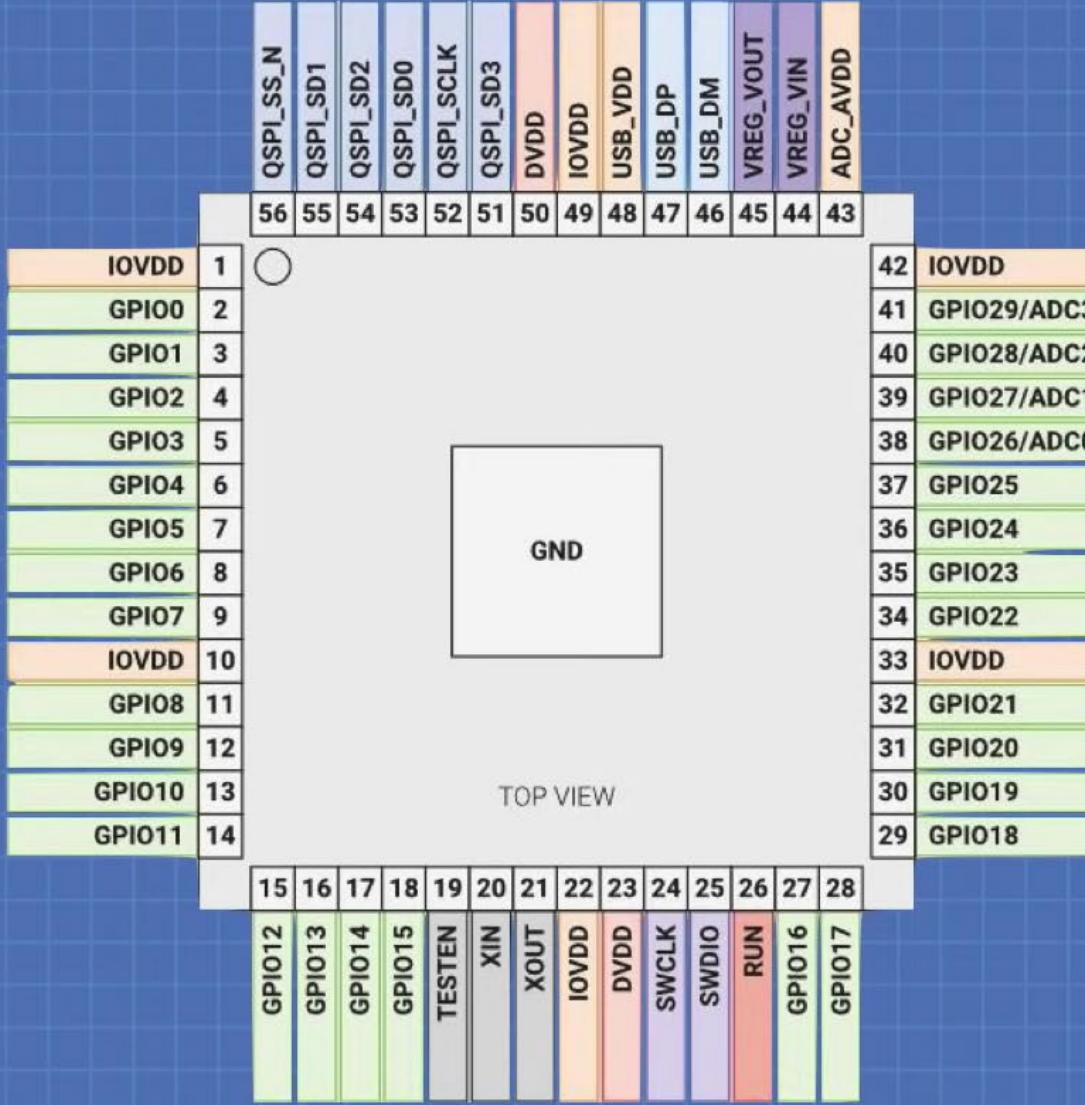
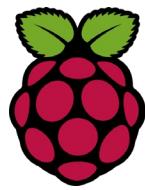


Infineon 43439



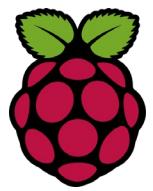


# Raspberry Pi Pico



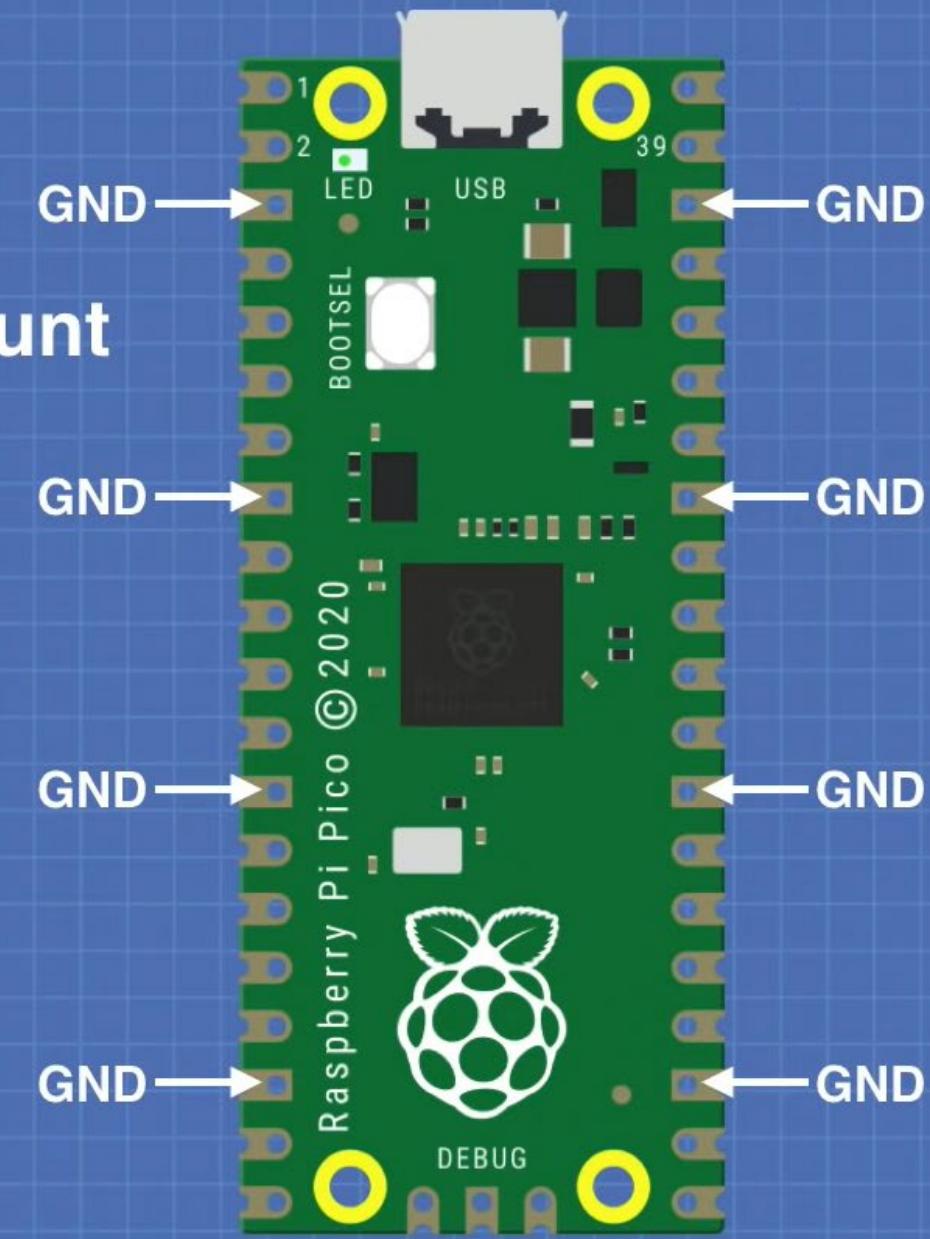
## RP2040

- 32-Bit Dual-Core ARM Cortex-M0+
- Clock speed 48MHz, boost to 133MHz
- 2MB onboard External Flash
- Onboard RTC
- Onboard Temperature Sensor



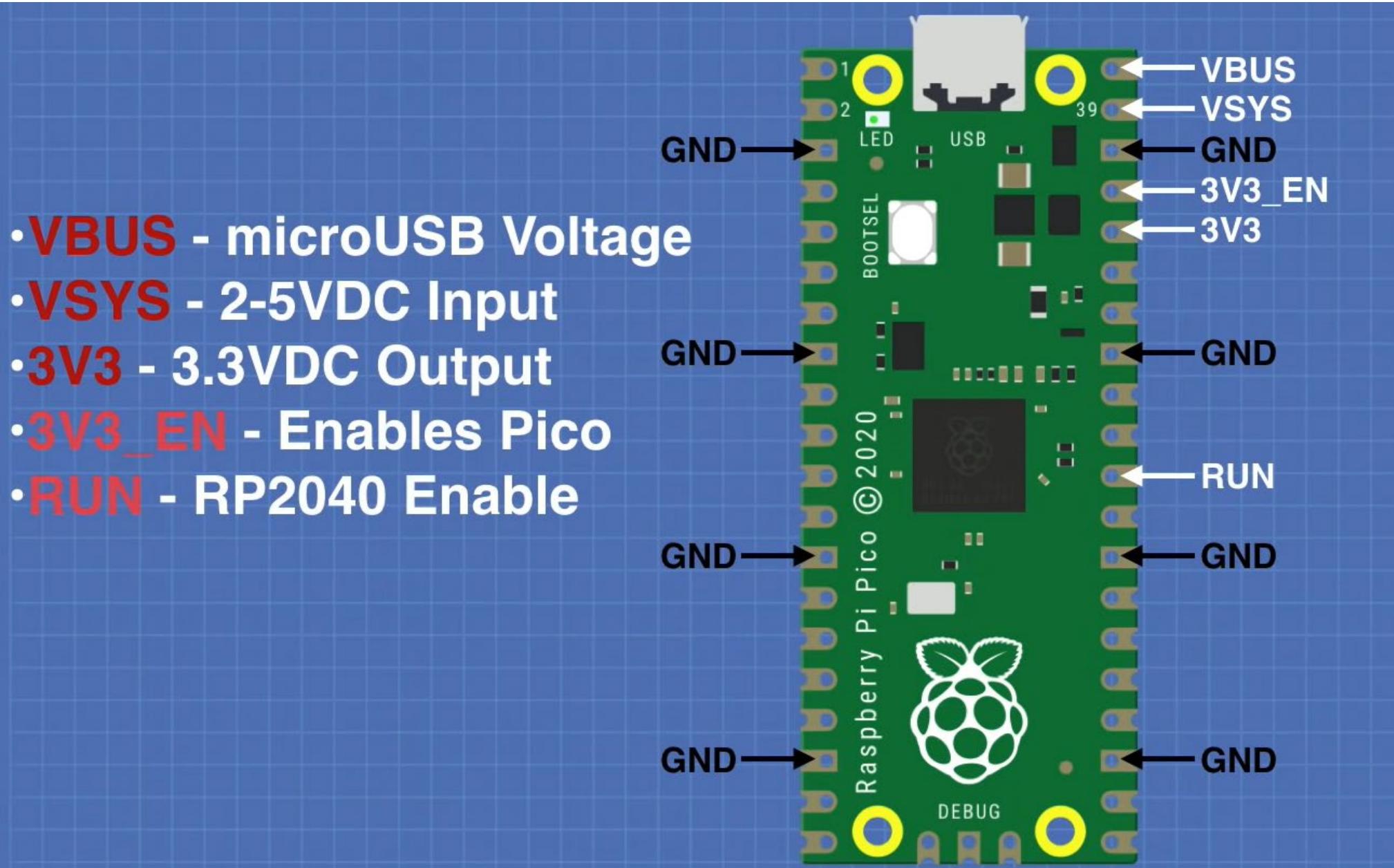
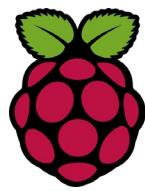
# Raspberry Pi Pico

- Use pins or surface-mount
- 8 Ground Points
- Evenly Spaced
- Square Pads



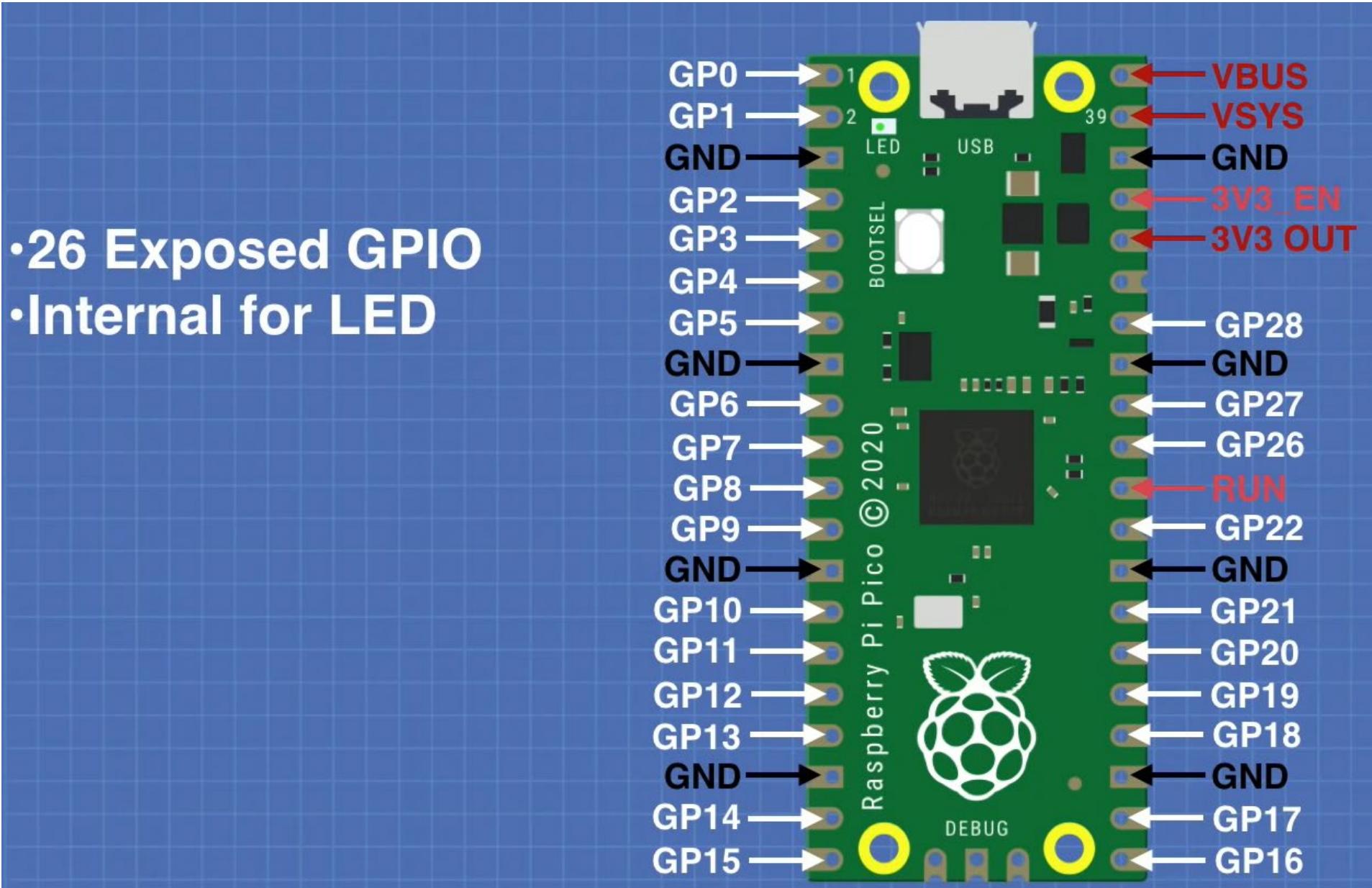
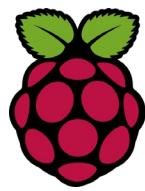


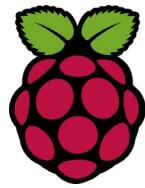
# Raspberry Pi Pico





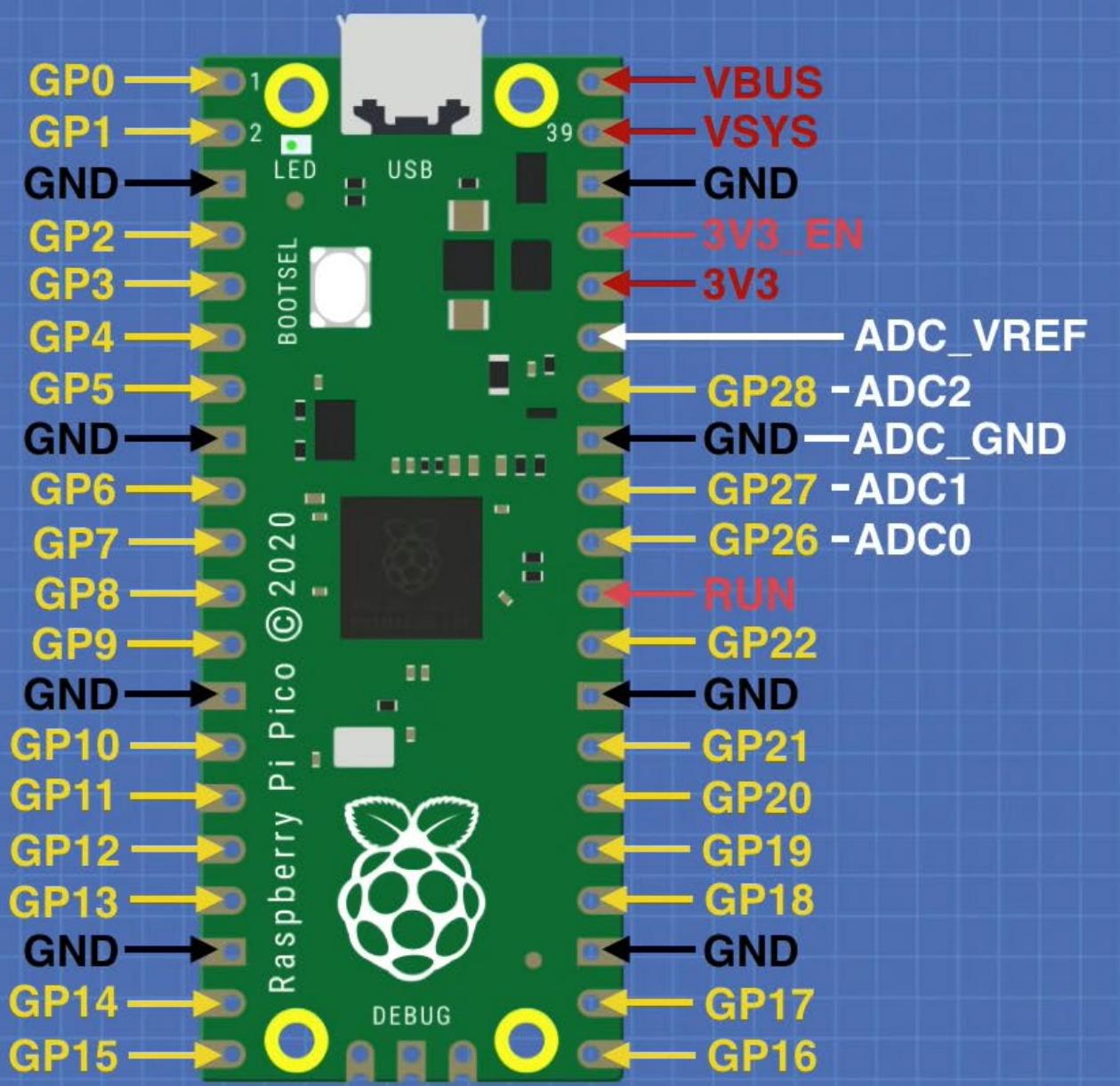
# Raspberry Pi Pico

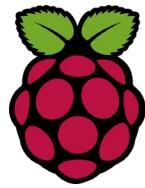




# Raspberry Pi Pico

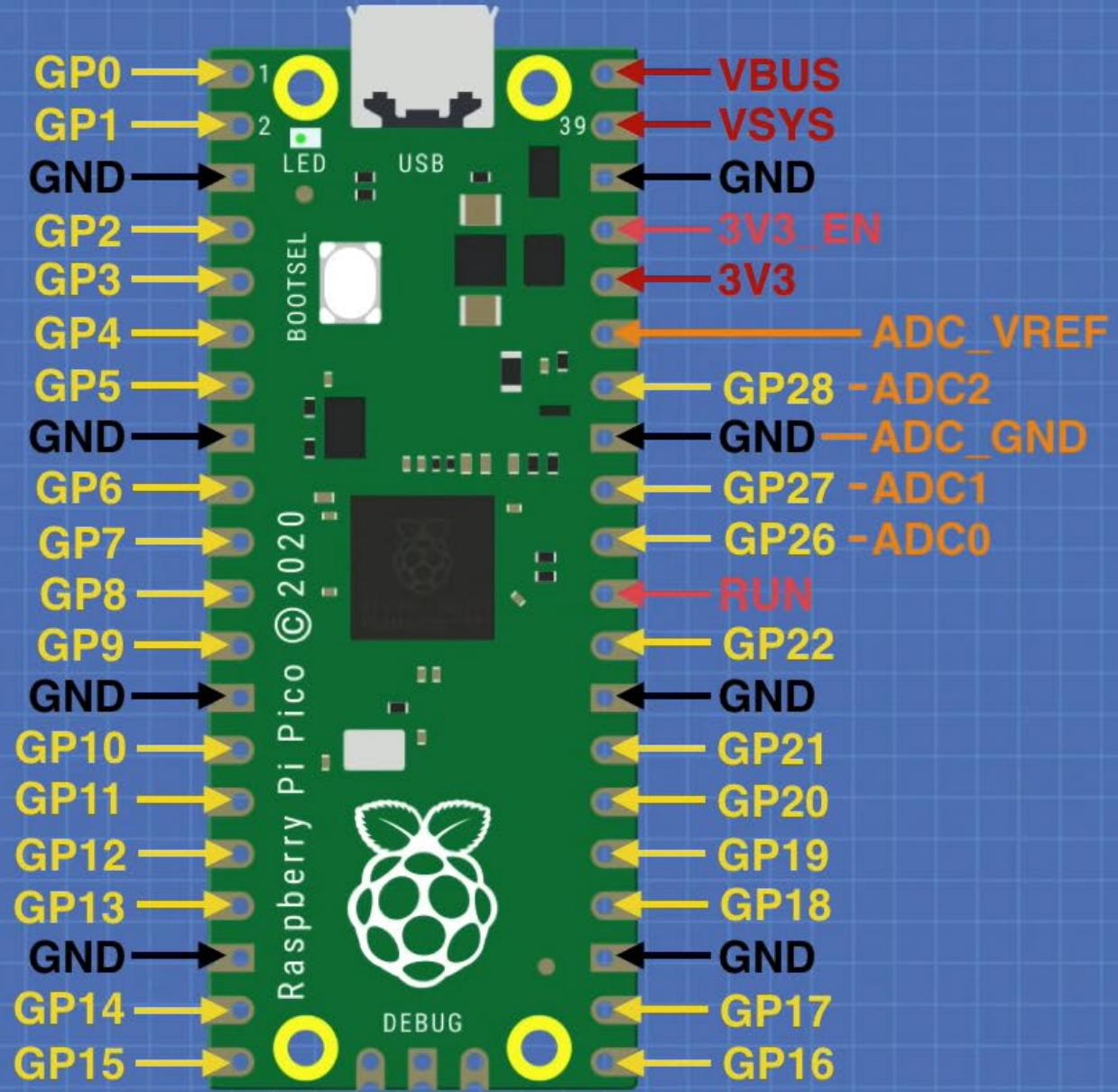
- 12-Bit ADC
- 3 plus Internal ADC
- Internal ADC for Temp
- ADC\_VREF for external
- ADC\_GND for external



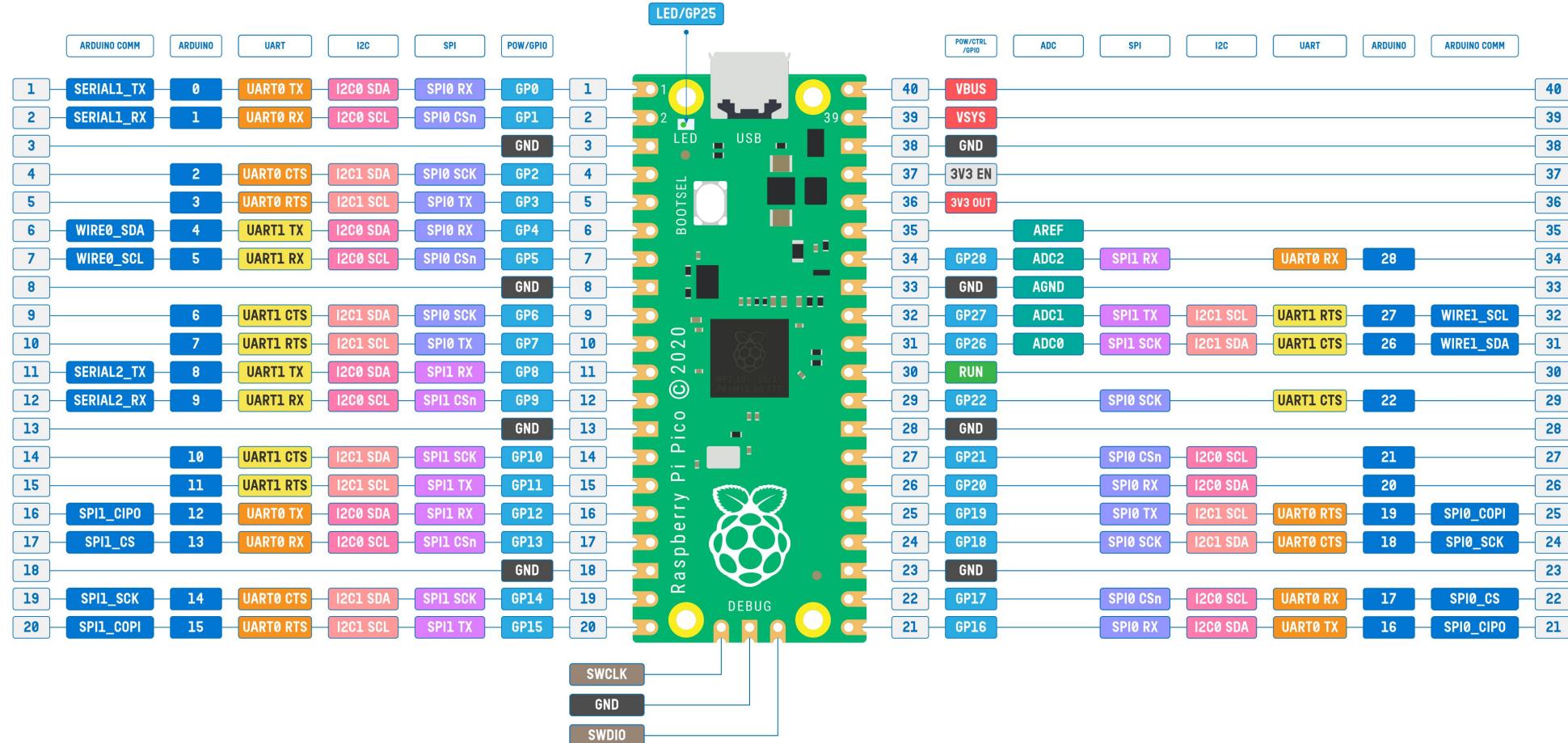
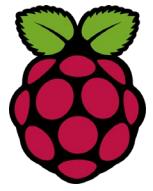


# Raspberry Pi Pico

- 2 x I2C Bus
- 2 x SPI Bus
- 2 x UART
- 16 x PWM Channels



# Raspberry Pi Pico – Full Pinout



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Raspberry Pi Pico vector image is originally designed by Raspberry Pi. Please visit [raspberrypi.com](https://www.raspberrypi.com) for more info.

## ARDUINO PINS

## SWD Pins

PHYSICAL PIN	POSITIVE SUPPLY	UART1 Pins	UART0 Pins
RESET/ENABLE	GROUND SUPPLY	I2C1 Pins	I2C0 Pins
GPIO PORT/PIN	ANALOG PIN	SPI1 Pins	SPI0 Pins

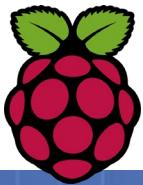
- GP29/ADC3 is used to measure VSYS.
- GP25 is used for debug LED.
- GP24 is used for VBUS sense.
- GP23 is connected to SMPS Power Save pin.
- All GPIO pins support PWM. There are total 16 PWM channels.
- All GPIO pins support level and edge interrupts.
- Arduino pins are as per [Arduino-Pico core](#) by [@earlephilhower](mailto:Earle F. Philhower, III)
- Arduino's default Serial is the USB-CDC of Pico.



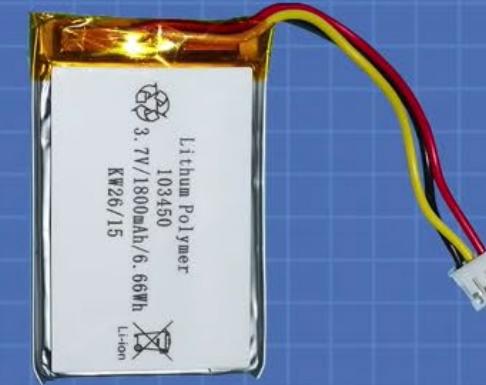
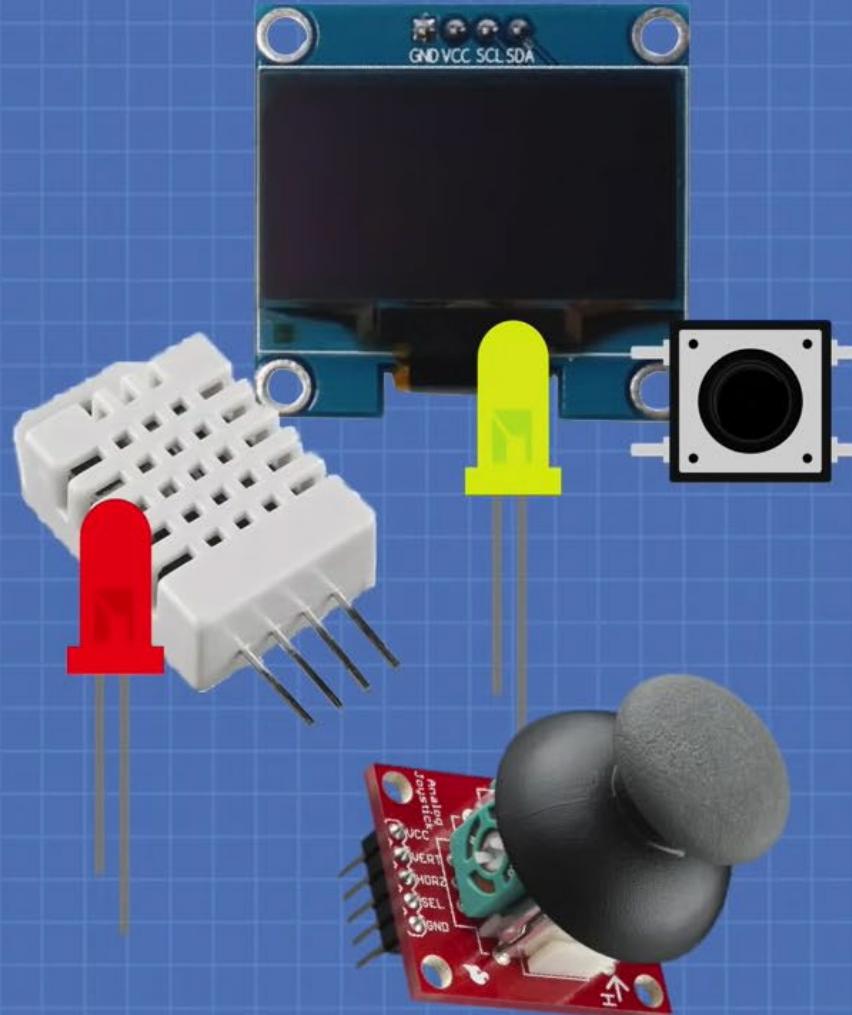
Rev. 0.2, 15-07-2022

Design: Vishnu Mohanan

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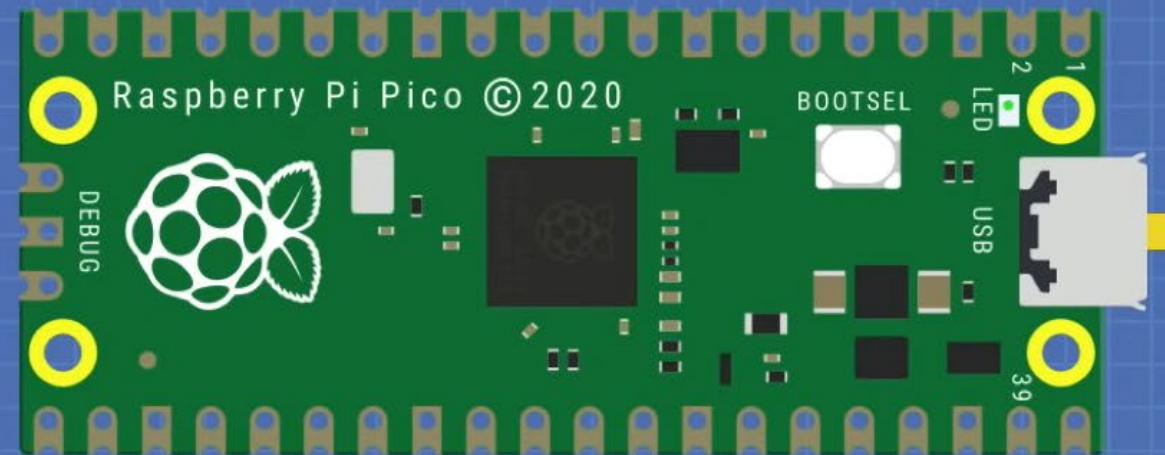
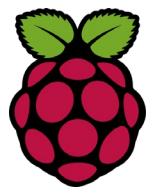
# Raspberry Pi Pico



- Can operate as normal MCU
- Power using microUSB
- Battery-powered, stand-alone
- Also operates as USB Device



# Raspberry Pi Pico

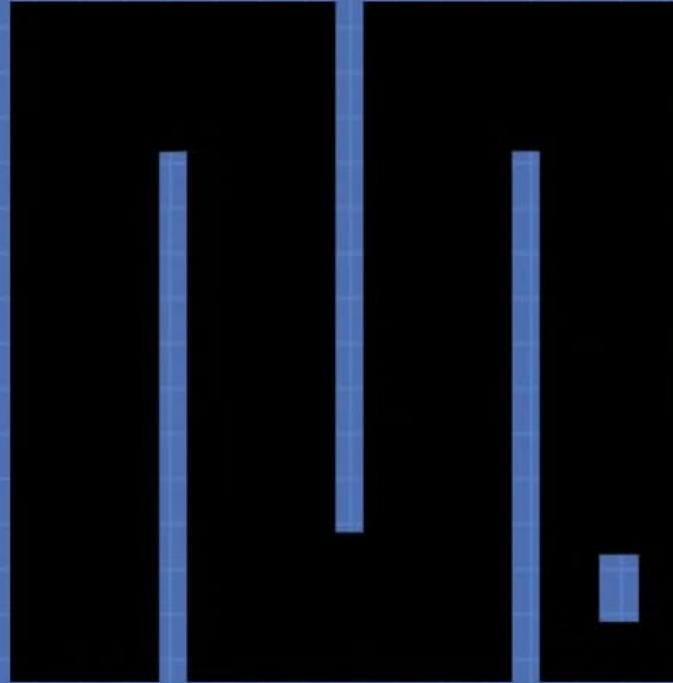
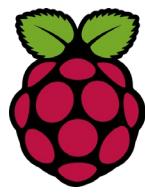


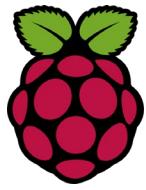
Can operate as a USB device



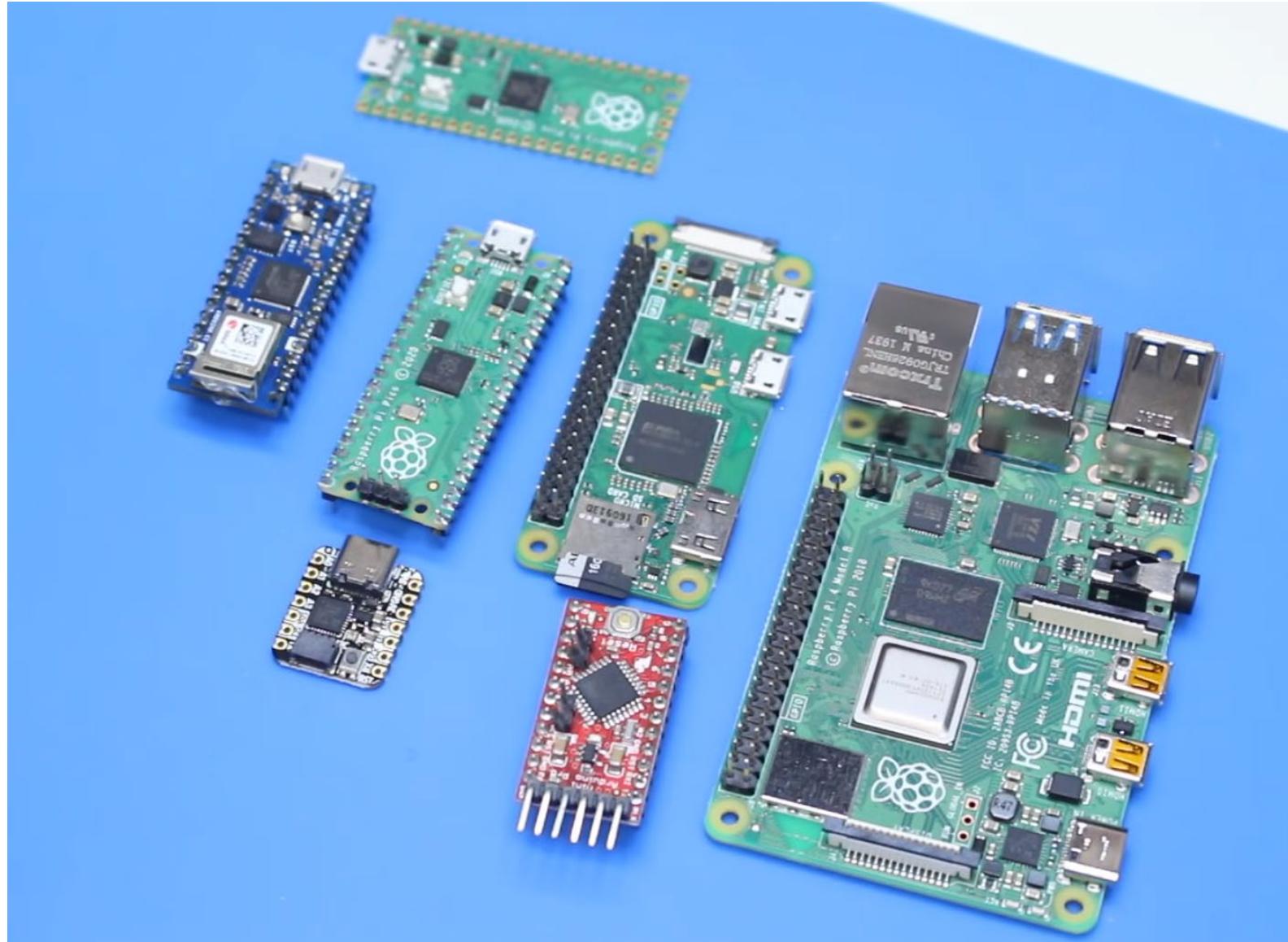


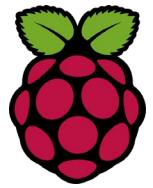
# languages used



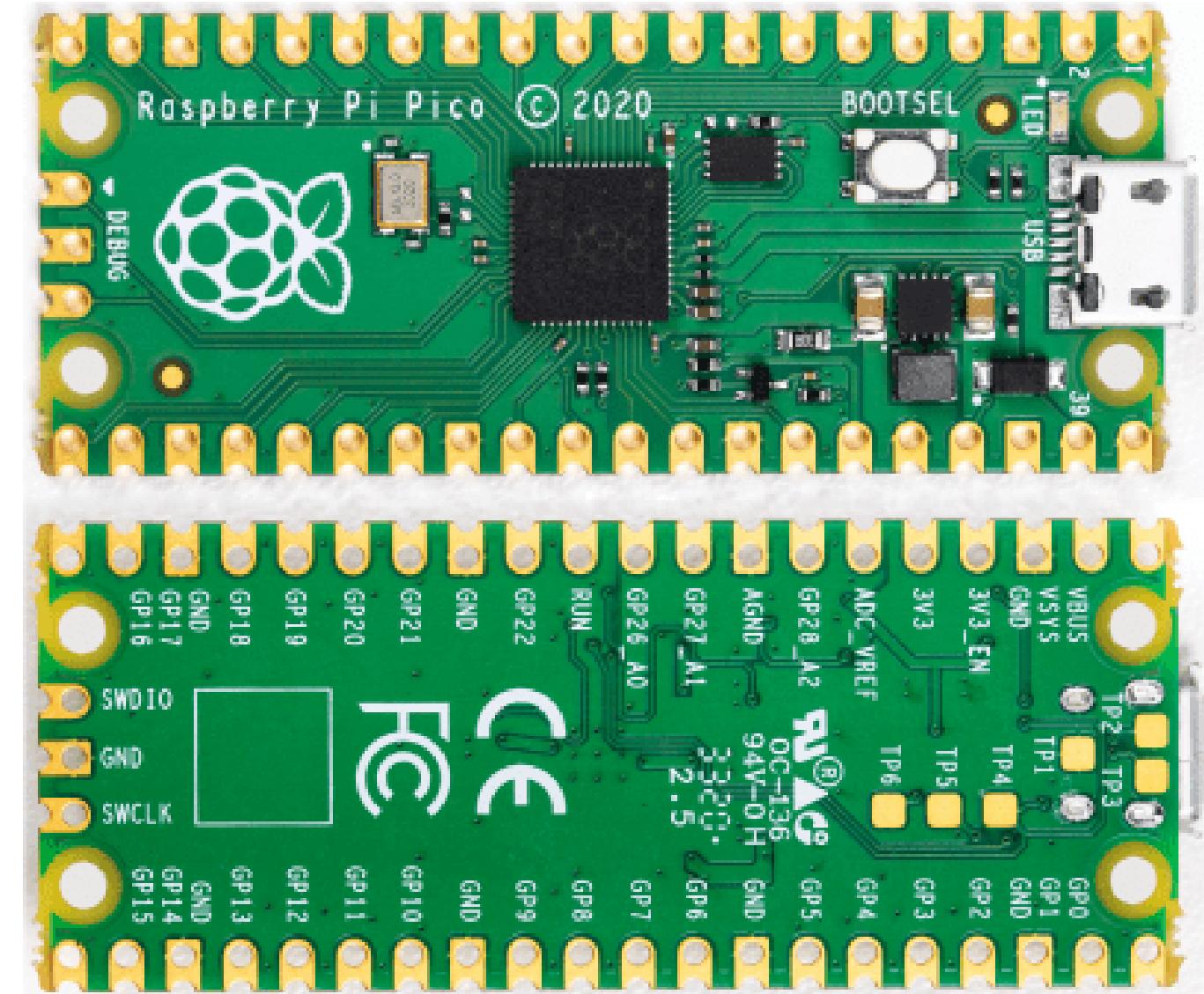


# Popular Raspberry Pi Family





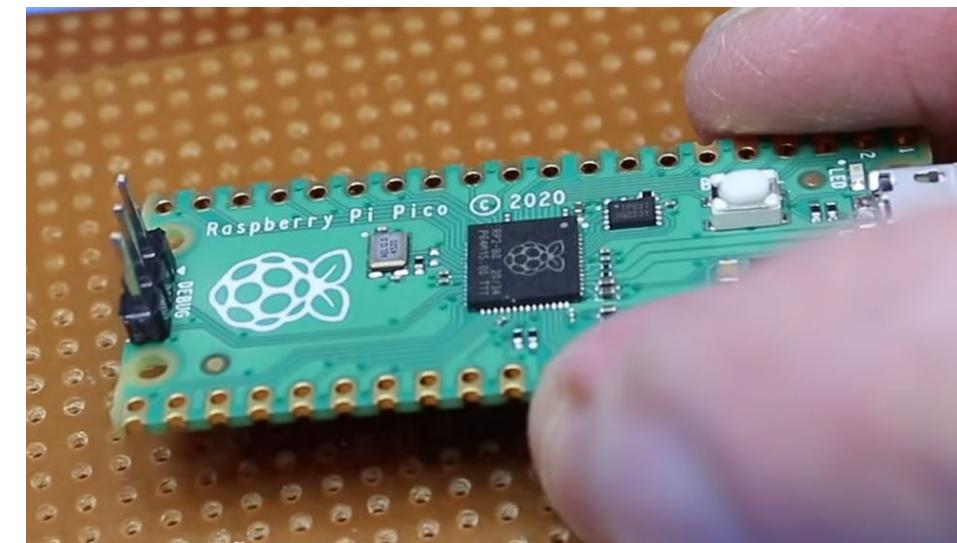
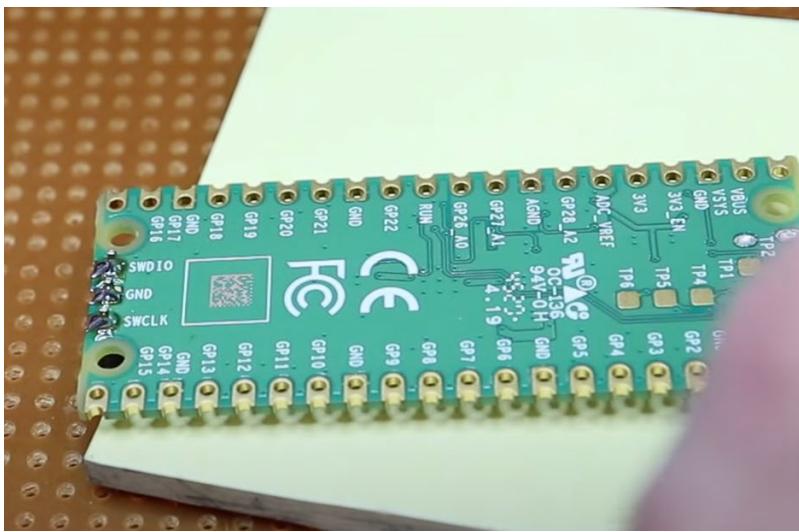
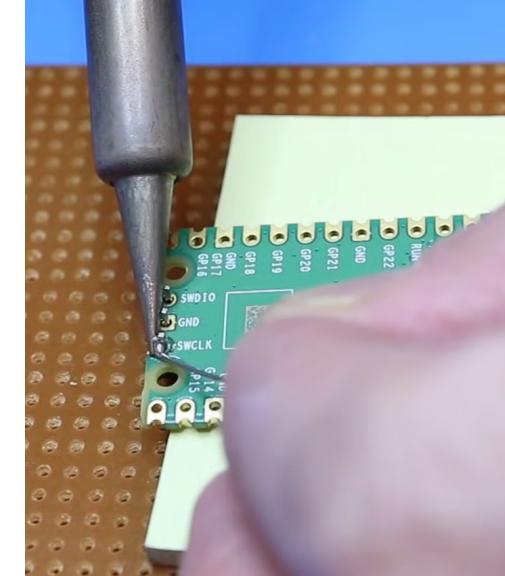
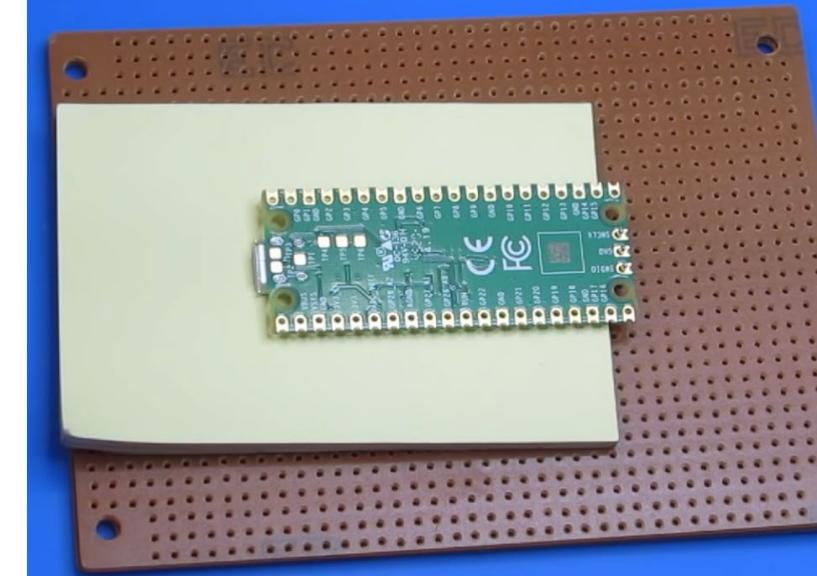
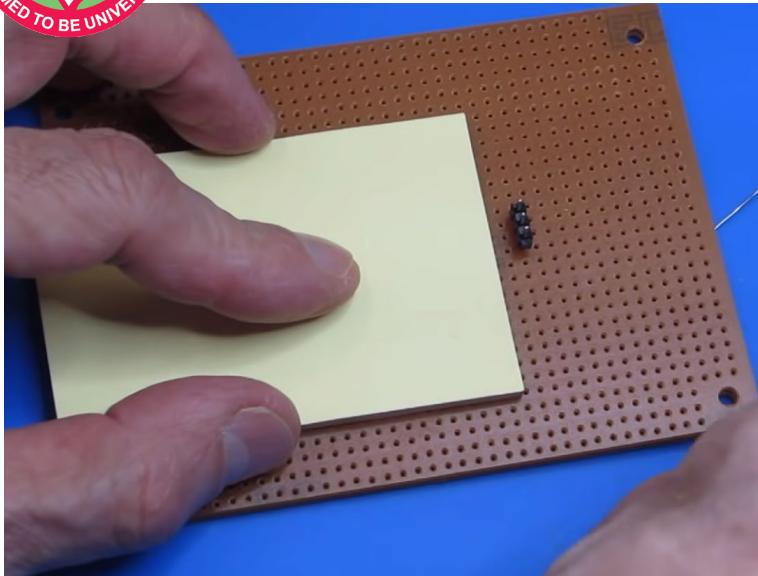
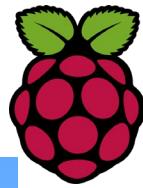
# Front and Back view



Front and Back view of the Raspberry Pi Pico

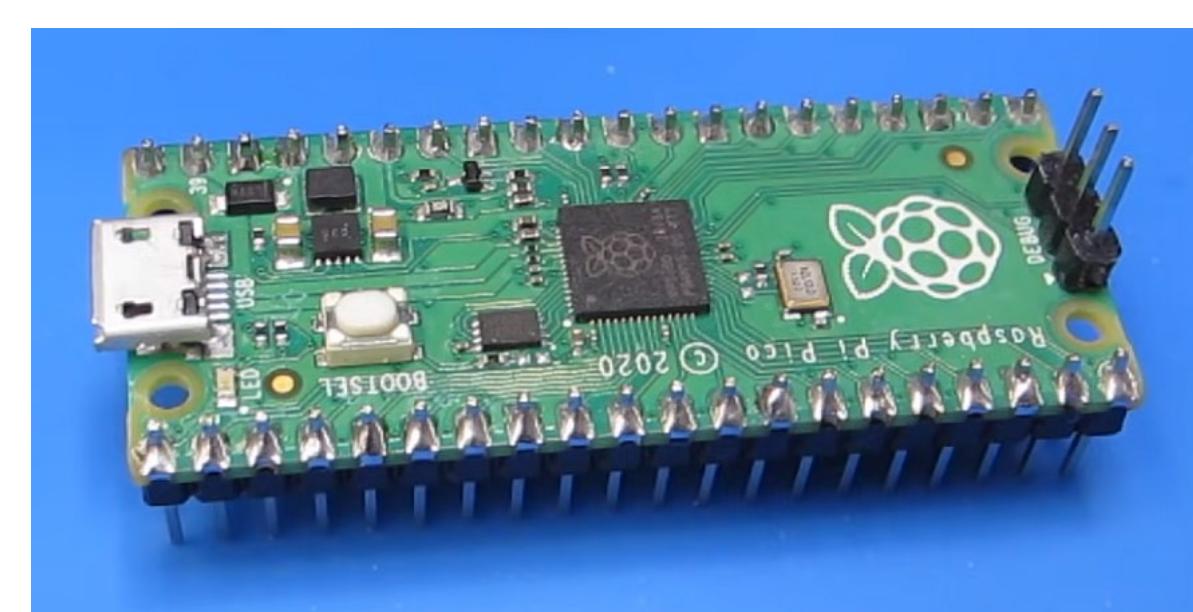
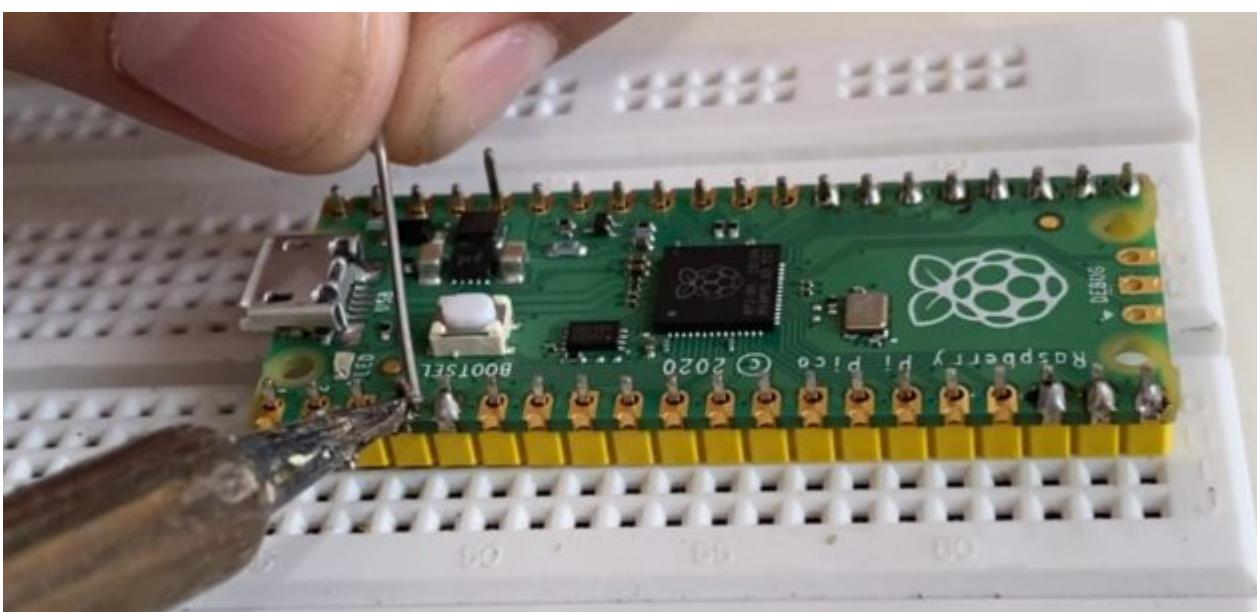
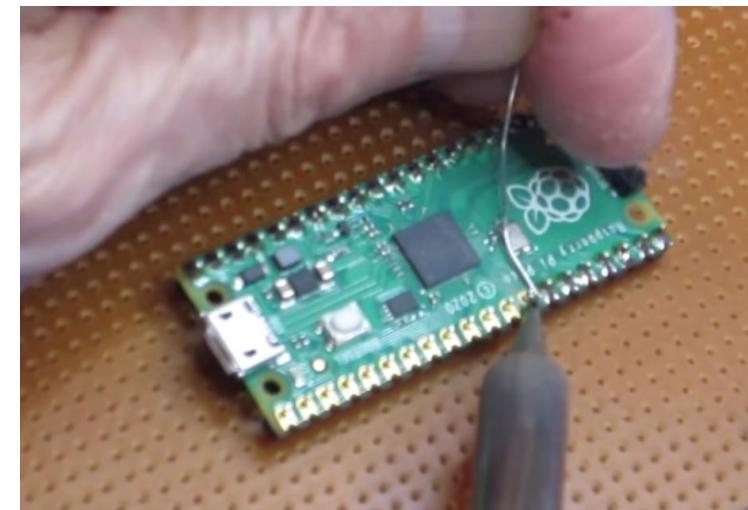
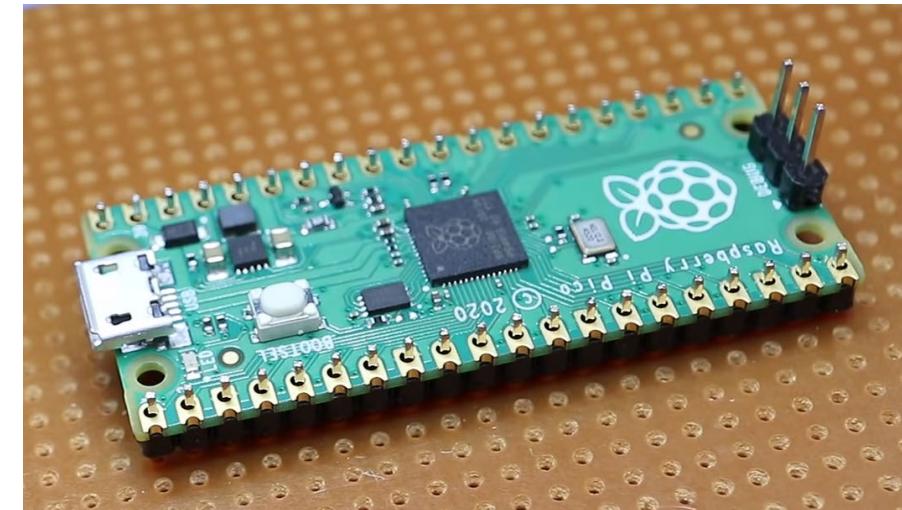
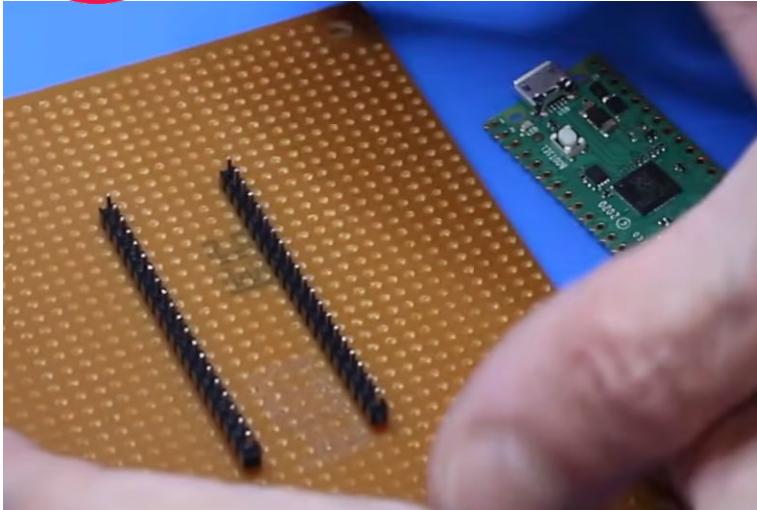
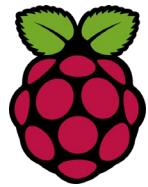


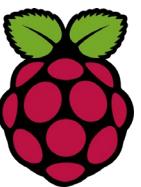
# Raspberry Pi Pico – H Preparation



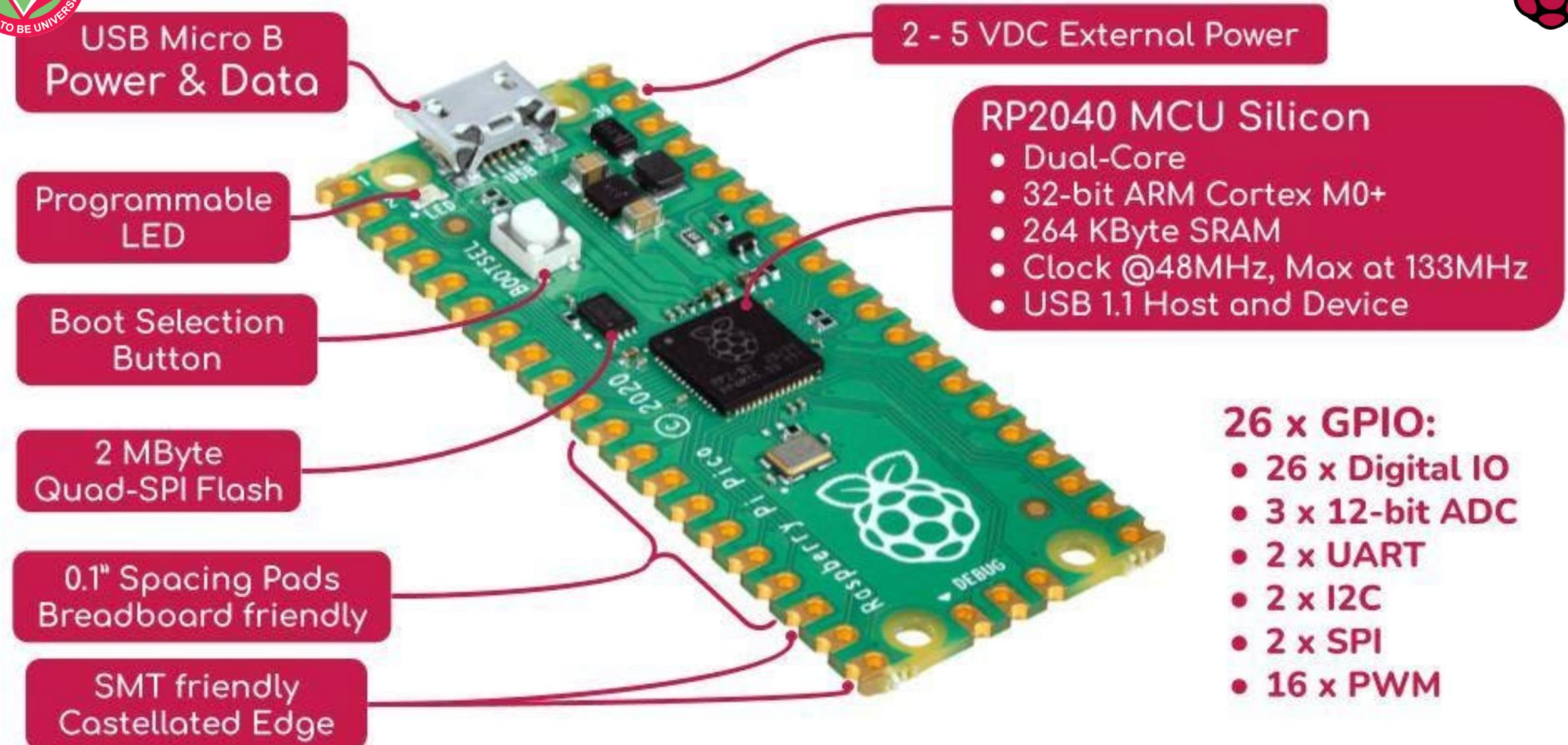


# Raspberry Pi Pico

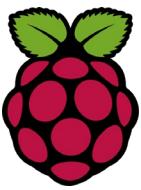




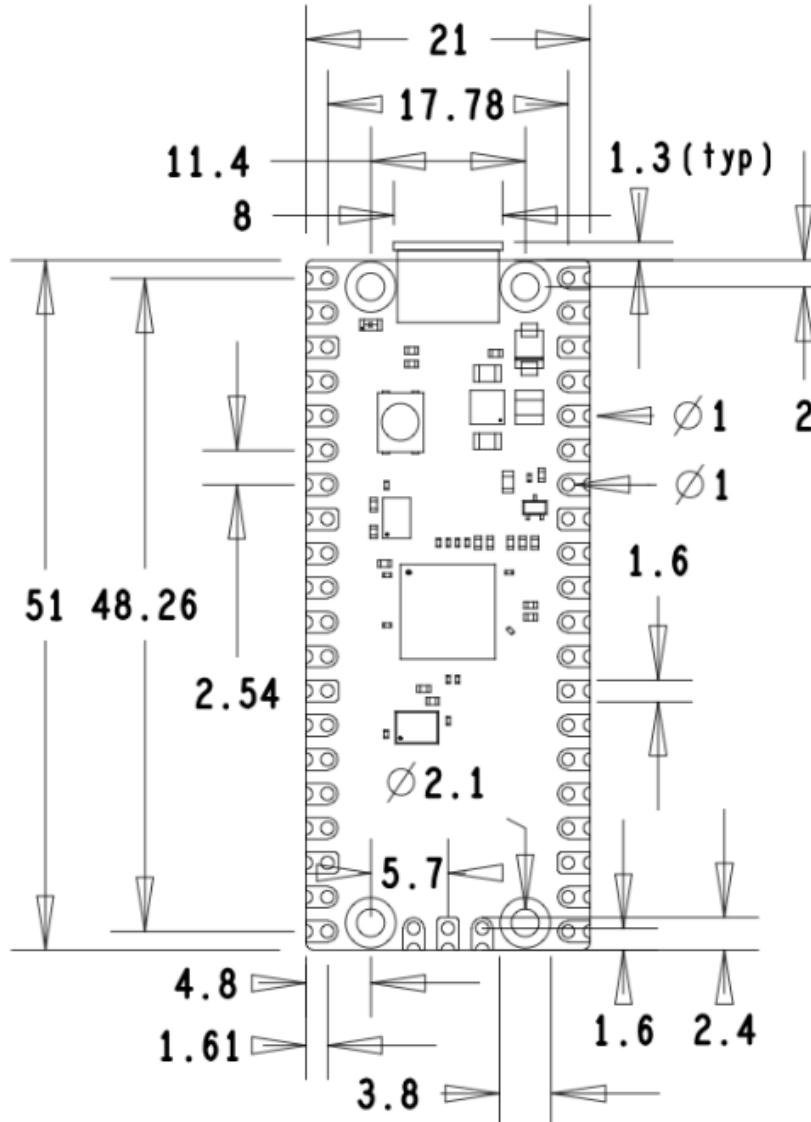
# Raspberry Pi Pico – In Short



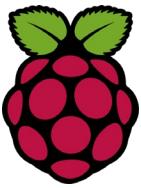
Pi Foundation has released an RP2040 Microprocessor based development board, in the same form factor as an Arduino Nano.



# Mechanical Specifications



- ✓ Single sided 51x21mm 1mm thick PCB
- ✓ Usable as a surface mount module as well as being in Dual Inline Package (DIP) type format
- ✓ 40 main user pins on a 2.54mm (0.1") pitch grid with 1mm holes and hence compatible with veroboard and breadboard.
- ✓ 4 x 2.1mm (+/- 0.05mm) drilled mounting holes to provide for mechanical fixing.



# Introduction to Online Simulator, WOKWI

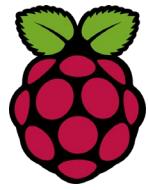
**Step 1:** Open <https://wokwi.com/>

**Step 2:** scroll down to Raspberry pi pico

The screenshot shows a browser window for 'Wokwi - Online Arduino and ESP'. The address bar contains 'wokwi.com'. Below the address bar is a toolbar with various icons. The main content area is titled 'Start from Scratch' and features six project cards arranged in two rows of three. Each card shows a circuit board image with a large white plus sign in the center. The projects are: Arduino Uno, Arduino Mega, ESP32 (top row); and Arduino Nano, Raspberry Pi Pico, MicroPython on ESP32 (bottom row). At the bottom of the page, there is a purple button labeled 'Franzininho Project | MicroPython on Pi Pico | + MORE OPTIONS'.



# WOKWI's First Look



## Step3: Click on Raspberry pi pico

New Raspberry Pi Pico Project - wokwi.com/projects/new/pi-pico

Bookmarks (81) Facebook Inbox (584) - swain.... UPSC NDA & NA (II...) RRB Senior Section... opsc Forums / Projects /... Electricity Generation... ScholarOne Manus...

WOKWI SAVE SHARE Docs SIGN IN

sketch.ino diagram.json Library Manager

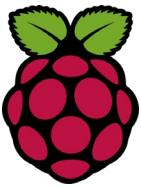
```
1 void setup() {
2     // put your setup code here, to run once:
3     Serial1.begin(115200);
4     Serial1.println("Hello, Raspberry Pi Pico!");
5 }
6
7 void loop() {
8     // put your main code here, to run repeatedly:
9     delay(1); // this speeds up the simulation
10 }
11
```

Simulation

Raspberry Pi Pico

Type here to search

21:24 12-09-2022 4



# WOKWI's Setting

**Step4:** Sign in using your Gmail account

**Step5:** Delete sketch.ino window

The screenshot shows a browser window with the WOKWI website open. The address bar shows the URL [wokwi.com/projects/new/pi-pico](https://wokwi.com/projects/new/pi-pico). The main area displays a code editor for a file named `sketch.ino`. The code is as follows:

```
1 void setup() {
2     // put your setup code here, to run
3     // once the sketch starts
4     Serial1.begin(115200);
5     Serial1.println("Hello, Raspberry
6 
7 void loop() {
8     // put your main code here, to run
9     delay(1); // this speeds up the si
10 }
11 }
```

A context menu is open over the code, listing the following options:

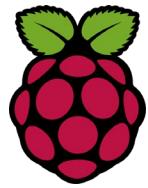
- Format code
- Rename
- Delete
- New file...
- Upload file(s)...

To the right of the code editor is a "Simulation" panel featuring a digital model of a Raspberry Pi Pico board. The board is green with a central Broadcom chip, two yellow LEDs, and various component pads. Below the simulation are three control buttons: a green play button, a purple plus button, and a grey ellipsis button.

At the bottom of the screen, a Windows taskbar is visible with icons for File Explorer, Task View, Edge, Google Chrome, Microsoft Edge, and Microsoft Word. The system tray shows the date and time as 22:44 13-09-2022, along with battery and connectivity status.



# WOKWI's new file creation

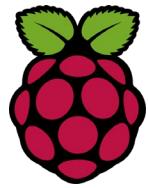


**Step6:** Create a new file with name “main.py”

The screenshot shows a browser window with the URL [wokwi.com/projects/new/pi-pico](https://wokwi.com/projects/new/pi-pico). The main area displays a JSON configuration file for a Raspberry Pi Pico project, specifically `diagram.json`. A context menu is open over the first few lines of the code, with options including "Rename", "Delete", "New file...", and "Upload file(s)...". To the right of the code editor is a "Simulation" panel featuring a digital representation of a Raspberry Pi Pico board with various pins and components labeled. The bottom of the screen shows a Windows taskbar with the Start button, a search bar, and icons for File Explorer, Task View, File History, Task Scheduler, Edge, Google Chrome, Microsoft Edge, and Firefox. The system tray shows the date and time as 13-09-2022 22:46, along with battery and connectivity status.



# WOKWI's Toggling inbuilt LED



## Step-7: Toggling inbuilt LED

4 WhatsApp    x | The Electronics    x | W New Raspberry Pi Pico Project - v x

← → ⌛ ⌂ 🔒 wokwi.com/projects/new/pi-pico

Bookmarks (81) Facebook (81) Inbox (584) - swain.... UPSC NDA & NA (II...) RRB Senior Section... opsc Forums / Projects /... Electricity Generation... ScholarOne Manus... »

WOKWI SAVE SHARE Docs B

diagram.json • main.py • Library Manager PIO

```
1 from machine import Pin
2 import utime
3
4 ledPin = Pin(25,Pin.OUT)
5
6 while True:
7     ledPin.value(1)
8     print("LED ON")
9     utime.sleep(1)
10    ledPin.value(0)
11    print("LED OFF")
12    utime.sleep(1)
13
```

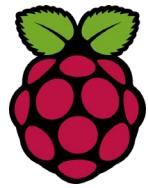
Simulation 00:08.331 100%

Type here to search

22:54 ENG 13-09-2022 5



# WOKWI's Toggling External LED



## Step-8: Toggling External LED

4 WhatsApp    x | The Electronics    x | W New Raspberry Pi Pico Project - v    +

← → ⌛ ⌂ wokwi.com/projects/new/pi-pico

Bookmarks Facebook Inbox (584) - swain.... UPSC NDA & NA (II...) RRB Senior Section... opsc Forums / Projects / ... Electricity Generatin... ScholarOne Manus... »

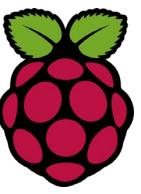
WOKWI SAVE SHARE Docs B

diagram.json • main.py • Library Manager PIO

```
1 from machine import Pin
2 import utime
3
4 ledPin = Pin(15,Pin.OUT)
5
6 while True:
7     ledPin.value(1)
8     print("LED ON")
9     utime.sleep(1)
10    ledPin.value(0)
11    print("LED OFF")
12    utime.sleep(1)
13
```

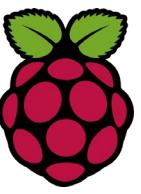
Simulation 00:16.362 102%

The screenshot shows the WOKWI web-based development environment. On the left, there's a code editor with Python code for a Raspberry Pi Pico project. The code initializes pin 15 as an output and enters a loop where it alternates the LED state between high and low every second. On the right, a simulation window displays a breadboard-style circuit. A red LED is connected in series with a 220 ohm resistor, which is then connected to the Raspberry Pi Pico. The Pico's pin 15 is connected to the positive terminal of the LED. The negative terminal of the LED is connected to ground. The simulation shows the LED toggling between being lit and off. At the bottom, a Windows taskbar is visible with various icons and system status.



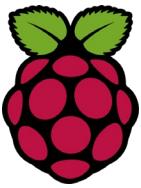
# How Students will submit the Physical Prototype?

**COST of the Project???**



# How Students will submit the Physical Prototype?

**Mid-Sem : Mini Project (with IOT)**



# Requirements

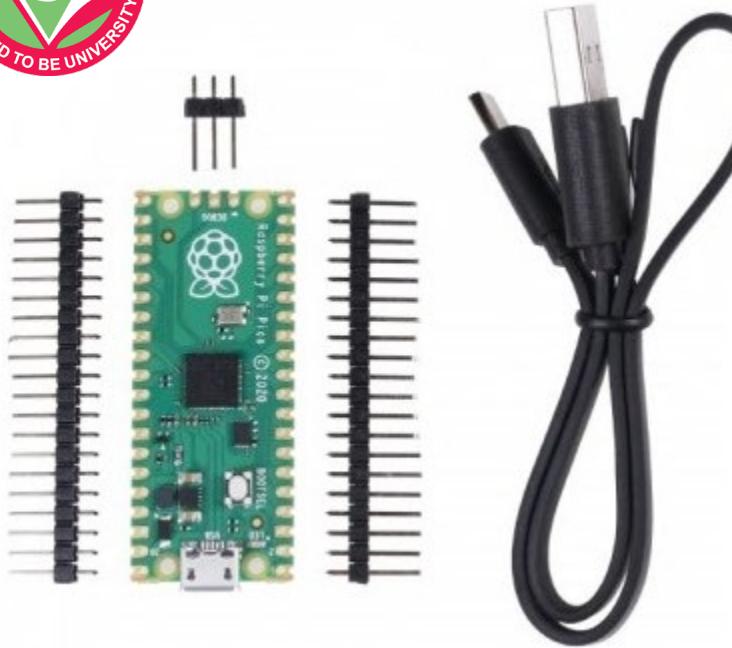
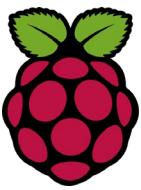
## Hardware

- A Raspberry Pi Pico with soldered headers
- A computer that can run the Thonny IDE and program a Raspberry Pi Pico
- A micro USB cable
- A selection of electronics components, such as a button, an LED with appropriate resistor, and a potentiometer (optional)
- A breadboard and M-M jumper leads for connecting additional components (optional)
- An external 5V micro USB power source (optional)

## ➤ Software

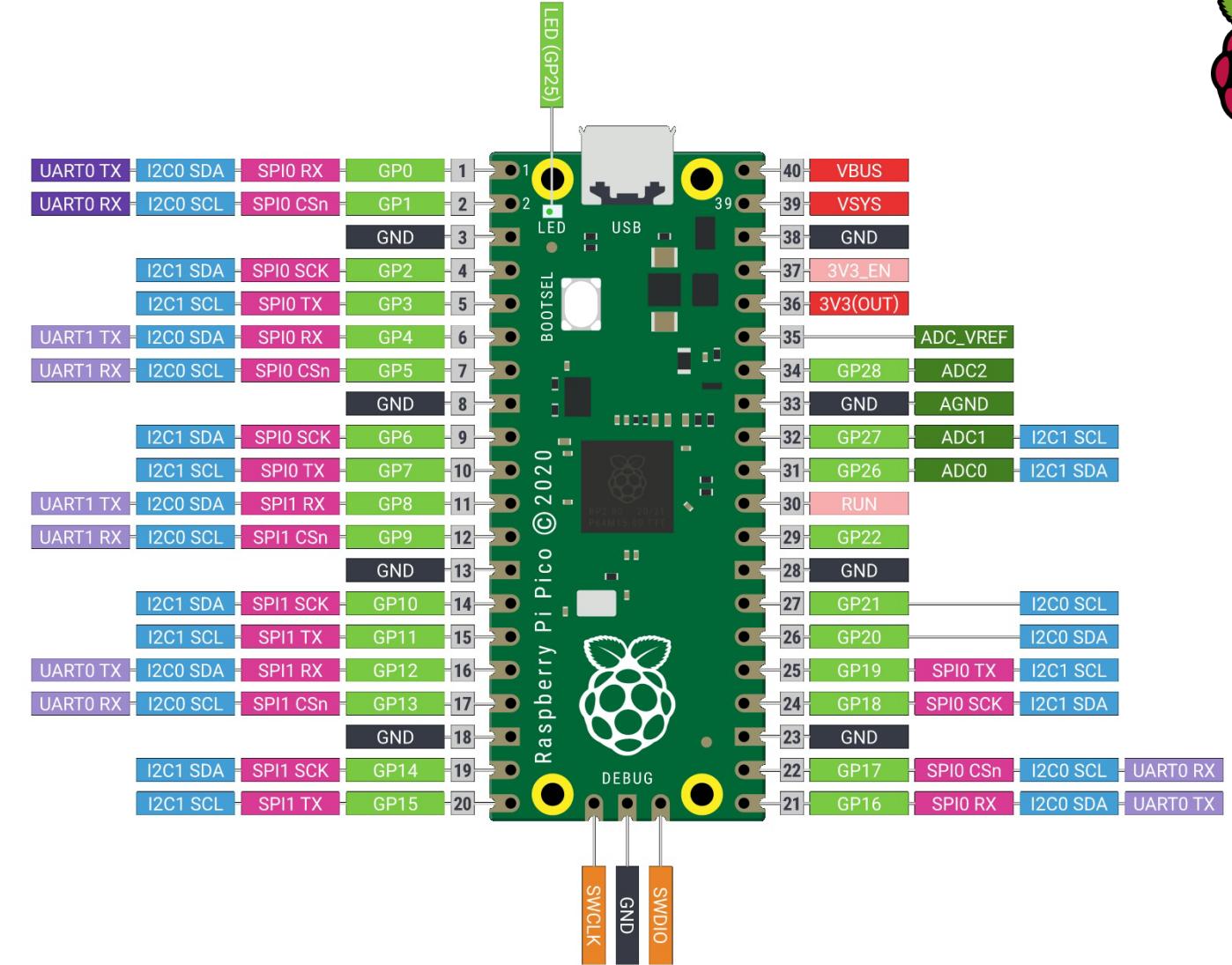
The next class will guide you through the installation of:

- MicroPython firmware for Raspberry Pi Pico
- The Thonny Python IDE

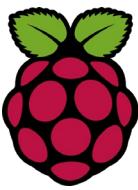


## Package Includes:

- 1 x Raspberry Pi Pico
- 1 x Micro-USB cable
- 2 x 20 Pin Header
- 1 x 3 Pin Header

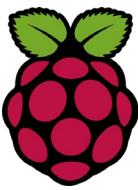


■ Power ■ Ground ■ UART / UART (default) ■ GPIO, PIO, and PWM ■ ADC ■ SPI ■ I2C ■ System Control ■ Debugging



# What we need to do for NEXT class

- How to load the MicroPython firmware onto a Raspberry Pi Pico?
- How to program a Raspberry Pi Pico using MicroPython?
- How to connect additional components to a Raspberry Pi Pico and write MicroPython programs to interact with them?



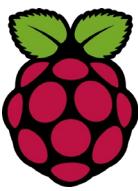
# QUIZ TIME???????

**1) How much memory does raspberry pi Pico have?**

- a) 12 MB
- b) 512 MB
- c) 1 MB
- d) 2 MB

**2) The clock speed of raspberry pi Pico is around \_\_\_\_\_**

- a) 125 MHz
- b) 512 MHz
- c) 256 KHz
- d) 1 GHz



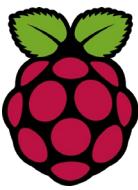
## QUIZ TIME

3) The input voltage for raspberry pi Pico is around \_\_\_\_\_

- a) 5 V
- b) 12 V
- c) 1 V
- d) 3.3 V

4) How many pins does raspberry pi Pico H contain?

- a) 32
- b) 40
- c) 20
- d) 57



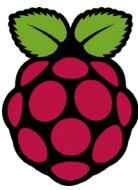
## QUIZ TIME

**5) In which year the raspberry pi Pico is launched?**

- a) January 2021
- b) February 2020
- c) January 2018
- d) January 2020

**6) The I2C pin on the raspberry pi board has \_\_\_\_\_ connections**

- a) one
- b) two
- c) three
- d) four



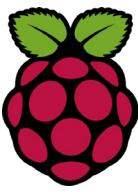
## QUIZ TIME

**7) How much RAM does raspberry pi Pico have?**

- a) 512 KB
- b) 128 KB
- c) 1 MB
- d) 256 KB

**8) Which SOC is used in raspberry pi Pico?**

- a) silicon RP2040
- b) Broadcom BCM2711
- c) Broadcom BCM2835
- d) silicon RP2004



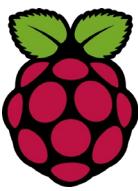
## QUIZ TIME

**9) What are the advantages of Raspberry Pi Pico?**

- a) Consumes less Power
- b) low cost
- c) Both a and b
- d) None of these

**10) How many exposed GPIO pins does Raspberry Pi Pico?**

- a) 25
- b) 26
- c) 27
- d) 29



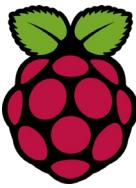
## QUIZ TIME

**11) Which cable is used to connect the PC to the Raspberry Pi Pico?**

- a) USB type A to A
- b) USB type A to B
- c) USB type A to Micro B
- d) USB type A to C

**12) What are the capabilities of raspberry pi?**

- a) Browsing the internet
- b) Making Spreadsheets
- c) Word Pressing
- d) All of the above



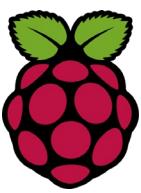
## QUIZ TIME

13) The software pulse width modulation in raspberry pi pico is available on \_\_\_\_\_ pins

- a) GPIO12
- b) GPIO18
- c) GPIO19
- d) All GPIO pins

14) What is the form factor of Raspberry Pi Pico?

- a) 51 x 21 mm
- b) 61 x 31 mm
- c) 61 x 21 mm
- d) 51 x 31 mm



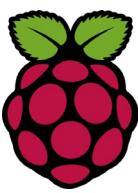
## QUIZ TIME

**15) What is the standard form of SPI pin?**

- a) Serial Parallel Input
- b) Serial Peripheral Interface
- c) Serial Parallel Interface
- d) None of the above

**16) How many PWM pins does Raspberry Pi Pico have?**

- a) 16
- b) 17
- c) 25
- d) 26



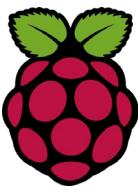
## QUIZ TIME

17) IOT stands for .....

- a) internet of telegram
- b) internet of things
- c) intelligent of things
- d) intercommunication of things

18) An equation of internet of things .....

- a) physical object + controller sensor and actuator + internet
- b) controller sensor and actuator + internet
- c) physical object + internet
- d) Physical object + controller + internet



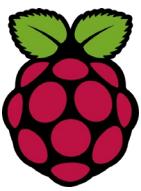
## QUIZ TIME

**19) A ..... tends to convert physical attribute to an electrical signal.**

- a) actuator
- b) compiler
- c) sensor
- d) motors

**20) A ..... tends to convert electrical signal to physical action .**

- a) actuator
- b) compiler
- c) sensor
- d) motors



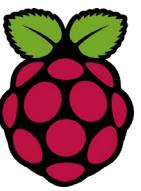
## QUIZ TIME

**21) choose correct principle of IOT.**

- a) focus on the value
- b) focus on the machine
- c) build a strong machine
- d) None of these

**22) ..... involves delivering different types of services over the Internet.**

- a) physical computing
- b) chemical computing
- c) mechanism
- d) cloud computing



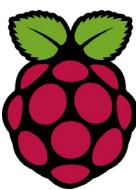
## QUIZ TIME

**23) ....... helps in collaborate in IOT development.**

- a) physical computing
- b) chemical computing
- c) mechanism
- d) cloud computing

**24) IOT and cloud computing has ....... relationship.**

- a) physically
- b) graphically
- c) complementary
- d) coding



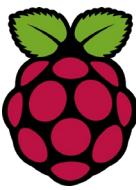
## QUIZ TIME

**25) .... uses certain protocols to aid sensors in connecting with real time machine to machine network.**

- a) real time analytics
- b) data collection
- c) device integration
- d) real time collection

**26) .....software supporting integration binds all system devices to create body of iot system.**

- a) real time analytics
- b) data collection
- c) device integration
- d) real time collection



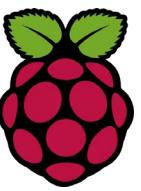
## QUIZ TIME

**27) The application data or input from various devices and convert it into viable actions are clear patterns human analysis is called .....**

- a) real time analytics
- b) data collection
- c) device integration
- d) real time collection

**28) A ..... is an established set of rules that determines how data is transmitted between different device in the same network.**

- a) network connection
- b) TCP IP protocol
- c) network protocol
- d) TCP protocol



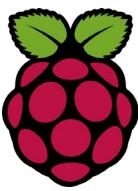
## QUIZ TIME

**29) TCP stands for .....**

- a) transmission control protocol
- b) telecommunication control protocol
- c) temperature control protocol
- d) transmission and communication protocol

**30) IP stands for .....**

- a) intelligent protocol
- b) internet protocol
- c) intercommunication protocol
- d) ideal protocol



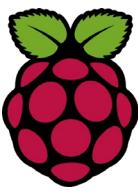
## QUIZ TIME

**31) DNS stands for .....**

- a) determine name system
- b) domain name system
- c) device name system
- d) development name system

**32) The process of building iot hardware and devices enhanced with smart sensors and embedded system using many of the shelf components like sensors , circuits and microcontrollers is called .....**

- a) prototyping
- b) casting
- c) protocasting
- d) protocol typing



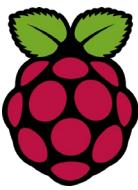
## QUIZ TIME

**33) SOC stands for ..... .**

- a) system on chip
- b) system on change
- c) source on chip
- d) source on change

**34) A ..... combined a required electronic circuit of various computer components onto a single integrated chip.**

- a) system on chip
- b) system on change
- c) source on chip
- d) Source on change



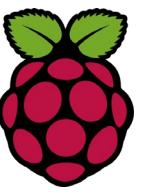
## QUIZ TIME

**35) ..... and ..... are main components of raspberry pi.**

- a) LED , USB
- b) USB , HDMI
- c) LED , HDMI
- d) USB , POWER

**36) ..... is a capable little device that enables people of all ages to explore computing and to learn how to program in languages like Scratch and Python.**

- a) raspberry pi
- b) python programming
- c) Linux
- d) web programming



## QUIZ TIME

**37) API stands for .....**

- a) application programming interface
- b) Android programming interface
- c) Arduino protocol information
- d) application protocol interface

**38) ..... is the process of making a physical representation of an idea.**

- a) physical proto casting
- b) physical prototyping
- c) type casting
- d) process interface