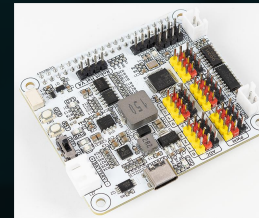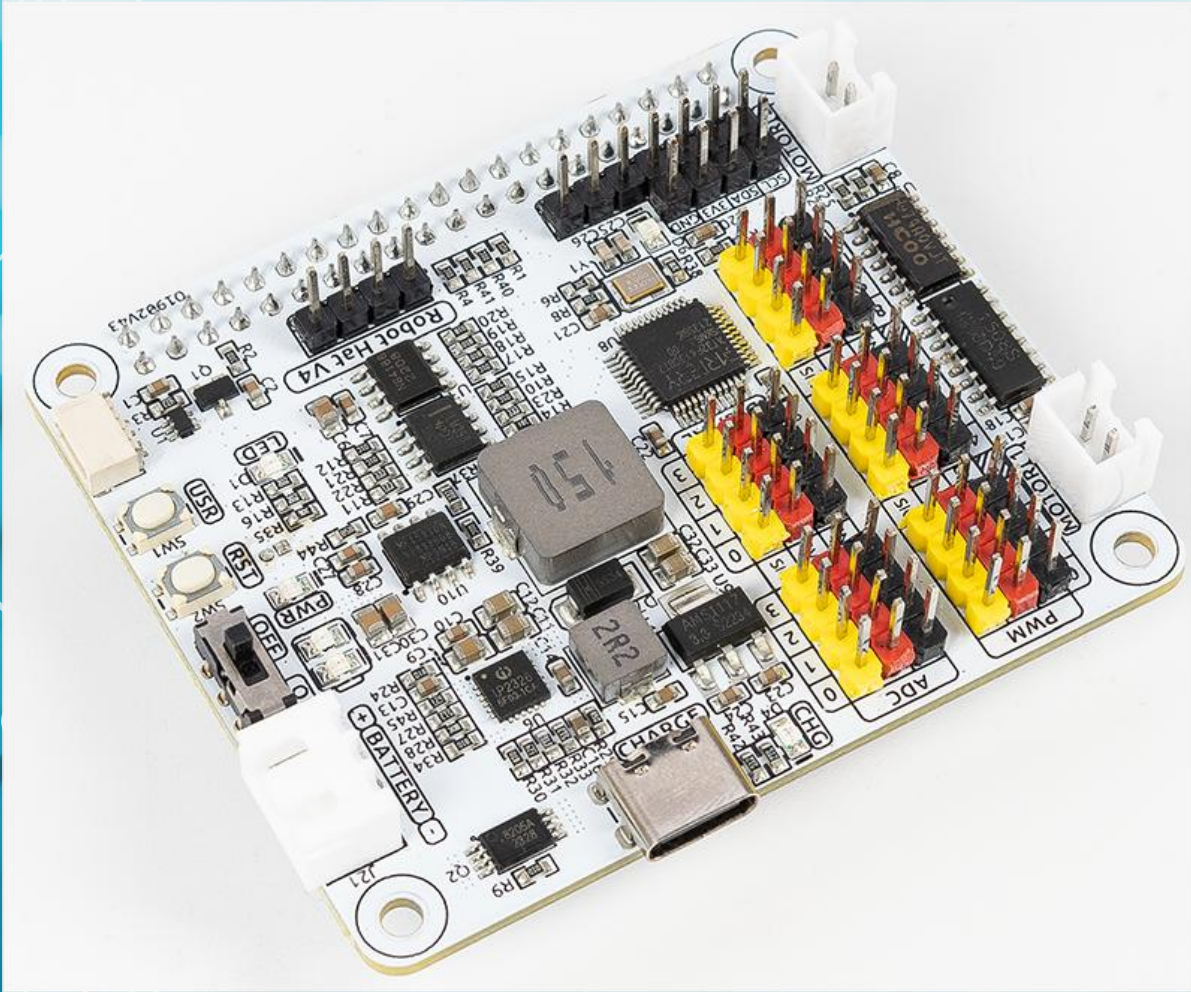# ROBOT HAT

HARDWARE OVERVIEW

RODRIGO SIERRA

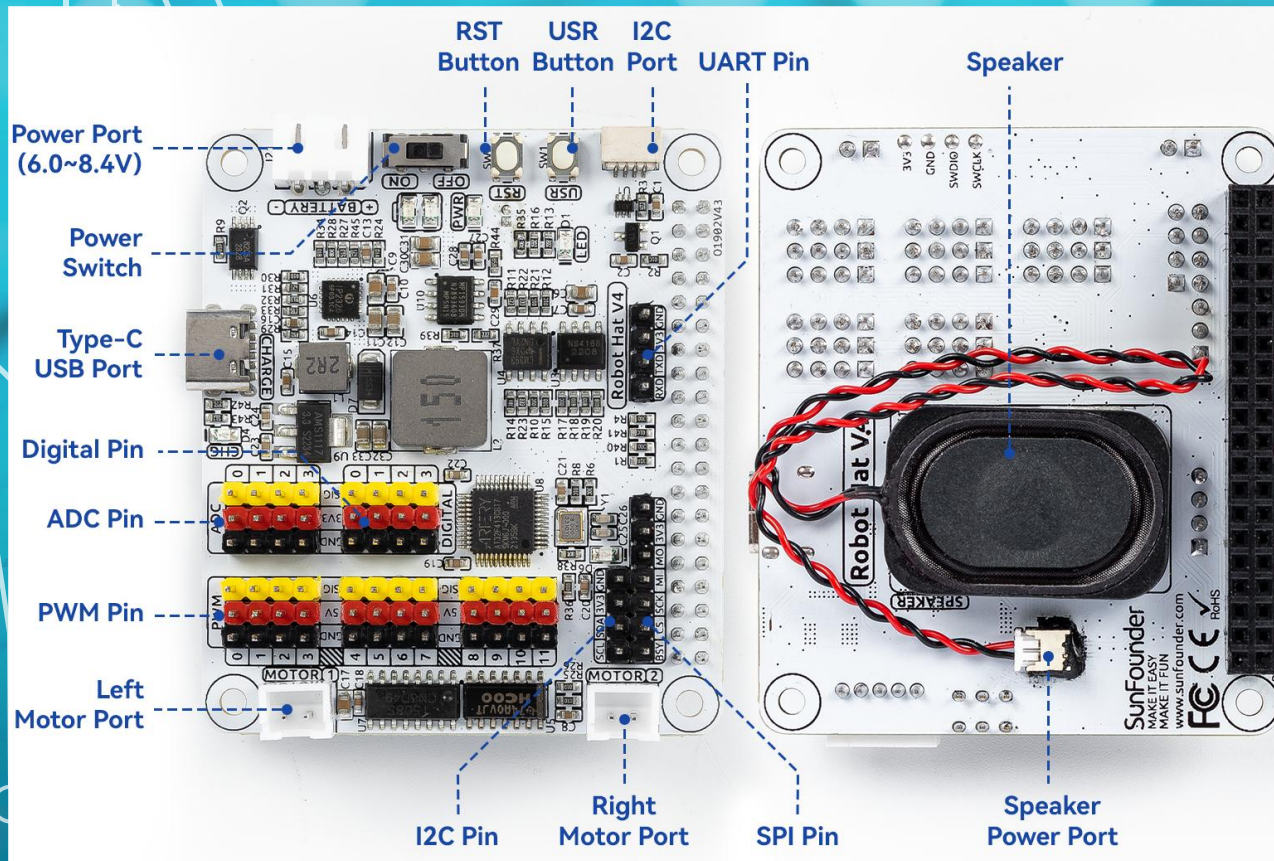2374 ROBOT OPERATING SYS & PLATFORM

TEACHER: SITARAM AYYAGARI

NOVEMBER 24 2025

WHAT IS ROBOT HAT?

Robot HAT is a versatile expansion board designed for Raspberry Pi. It allows simplify the process of building robotic projects because it comes with essential components like motor drivers, ADC, PWM, audio, and power management.

FEATURES?

Shutdown Current: < 0.5mA
Power Input: USB Type-C, 5V/2A
Charging Power: 5V/2A 10W
Output Power: 5V/3A
Included Batteries: 2 x 3.7V 18650 Lithium-ion
Batteries, XH2.54 3P Interface
Battery Protection: Reverse polarity protection
Charging Protection: Input undervoltage
protection, input overvoltage protection,
charging balance, overheat protection
Onboard Charging Indicator Light: CHG
Onboard Power Indicator Light: PWR
Onboard 2 Battery Level Indicator LEDs
Onboard User LED, 2 tactile switches
Motor Driver: 5V/1.8A x 2
4-channel 12-bit ADC
12-channel PWM
4-channel digital signals
Onboard SPI interface, UART interface, I2C
interface
Mono Speaker: 8Ω1W

| Electrical Characteristics				
Parameters:	Minimum Value:	Typical Value:	Maximum Value:	Unit:
Input Voltage:	4.25	5	8.4	V
Battery Input Voltage:	6	7.4	8.4	V
Overcharge Protection (Battery):		8.3		V
Input Undervoltage Protection:	4.15	4.25	4.35	V
Input Overvoltage Protection:	8.3	8.4	8.5	V
Charging Current (5V):			2	A
Output Current (5V):			3	A
Output Voltage:	5.166	5.246	5.327	V
Charging Overheat Protection:	125	135	145	°C
DC-DC Overheat Protection:	70	75	80	°C
Motor Output Current:			1.8	A

FEATURES?

The Robot HAT for the PiCar-X operates from a 6–8.4V battery input, provides a stable 5V power output up to 3A, and includes built-in protections for overvoltage, undervoltage, overcharge, and overheating. It also delivers up to 1.8A for the motor and safely manages battery charging at up to 2A.
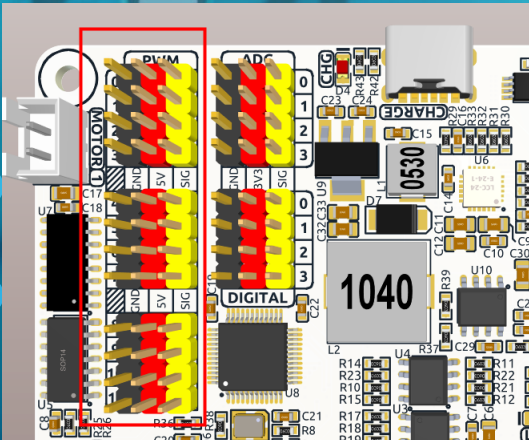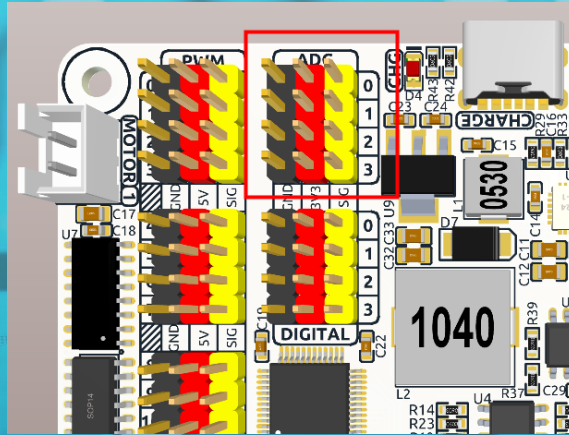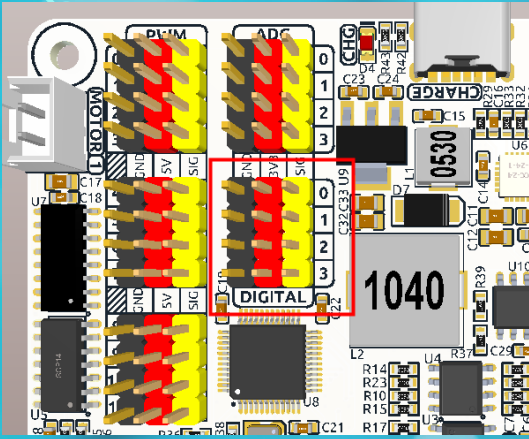
HARDWARE?

Power Port
This port uses a 3-pin XH2.54 connector and accepts a 6.0V–8.4V power source.
It supplies power to both the Raspberry Pi and the Robot HAT at once.

Power Switch
Use this switch to make the robot HAT start or stop working.

Type-C USB Port
Plug in a Type-C cable to fill the battery with power.
While it is charging, a red light will turn on.
The light turns off once the battery reaches full power.
If the cable stays connected for around 4 hours after it is full, the light will start blinking as a reminder.
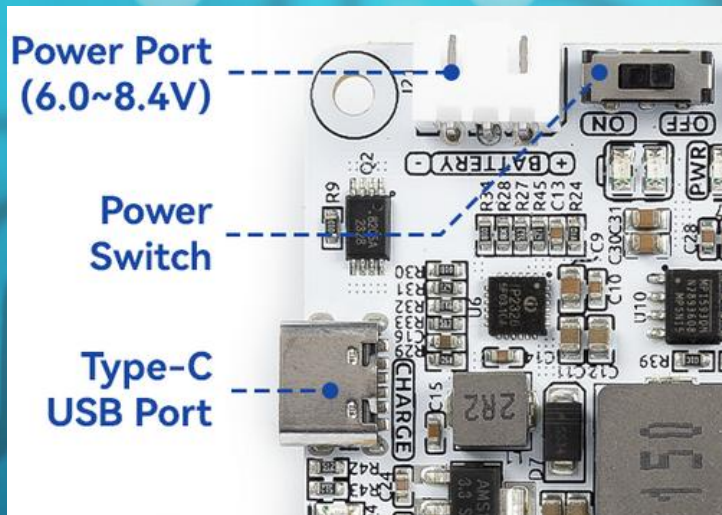
HARDWARE?

Digital Pin

There are four digital pins available, named D0 to D3.

These pins can send or receive simple on/off signals.

You can use them through the Pin class in the code.

ADC Pin

You get four ADC pins, labeled A0 through A3.

They are used to read analog values.

In the program, you work with them using the ADC class.

PWM Pin

There are twelve PWM pins, named P0 to P11.

These pins can create signals that change quickly to control things like motors or lights.

You can handle them in code with the PWM class.

HARDWARE?

Left/Right Motor Port
There are two motor connectors that use the XH2.54 type.
These ports are made for plugging in the motors.
In the motor module, number 1 controls the left port and number 2 controls the right port.

I2C Pin and I2C Port
The I2C pin uses a 4-pin P2.54 connector.
The I2C port uses a 4-pin SH1.0 connector and works with QWIIC and STEMMA QT devices.
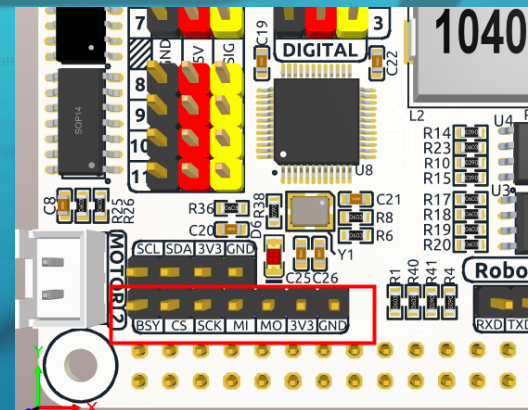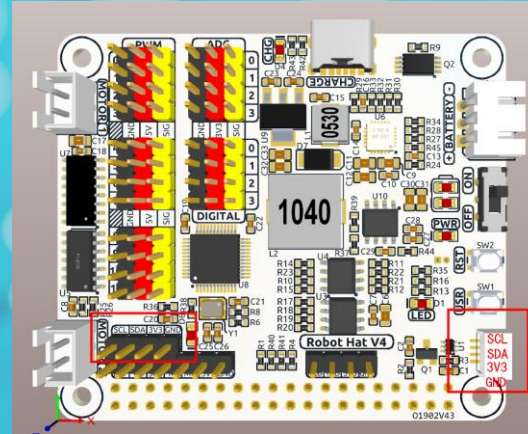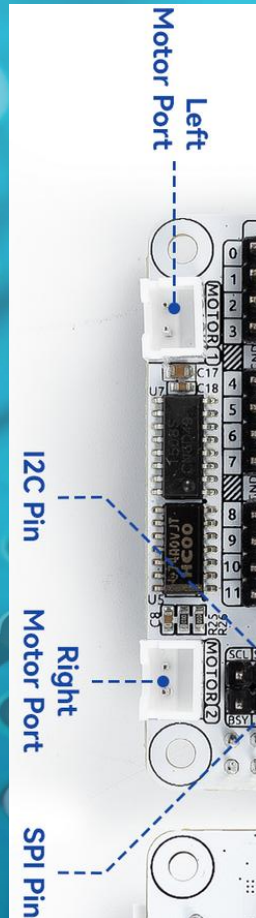Both of these connect to the Raspberry Pi's I2C lines through GPIO2 for SDA and GPIO3 for SCL.
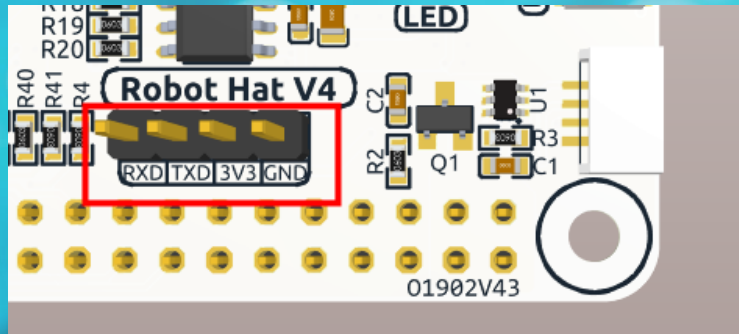They use the I2C type of connection, and you can control them with the I2C class in code.

SPI Pin
This uses a 7-pin connector with the P2.54 layout for SPI communication.
It works as an SPI connection.

HARDWARE?

UART Pin
This connector has four pins and uses the P2.54 layout.
It is used for UART communication.

RST Button
If you are not using Ezblock, the button has no set action, and you can program it to do whatever you want.
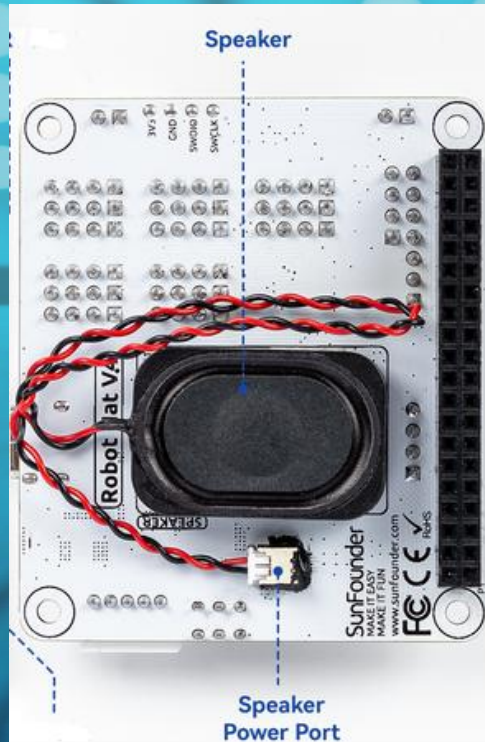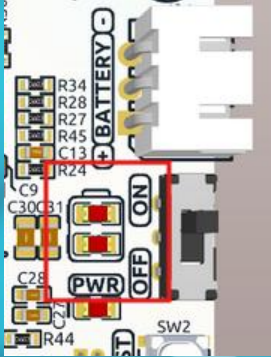It is treated as a button pin and can be used through the Pin class.

USR Button
You can program the USR button to do any function you want.
When you press it, it gives a "0" signal; when you release it, it gives a "1" signal.
It is a button pin and can be controlled in code using Pin("SW").

HARDWARE?

Battery Indicator
Two LEDs turn on when the battery is above 7.6V.
One LED turns on if the battery is between 7.15V and 7.6V.
Both LEDs turn off when the battery is below 7.15V.
This shows the battery level.

Speaker and Speaker Port
The speaker is a 2030 audio chamber type.
The Robot HAT has a built-in I2S audio output and the 2030 speaker, giving mono sound.
It is treated as a speaker pin and can be used with the Music class.

REFERENCES

- https://docs.sunfounder.com/projects/picar-x-v20/en/latest/hardware/cpn_robot_hat.html#robot-hat

- https://docs.sunfounder.com/projects/robot-hat-v4/en/latest/

- https://docs.sunfounder.com/projects/robot-hat-v4/en/latest/features.html

- https://docs.sunfounder.com/projects/robot-hat-v4/en/latest/hardware_introduction.html