Bella Hat Documentation

version

2024, Sunfounder

■■ 12, 2024

Contents

Bella Hat documentation

Bella Hat Library

Install

1. Update your system.

   Make sure you are connected to the Internet and update your system:

   ```
   sudo apt update
   ```

   > **Note**
   >
   > Python3 related packages must be installed if you are installing the **Lite** version OS.
   >
   > ```
   > sudo apt install git python3-pip python3-setuptools python3-smbus
   > ```

2. Download the source code.

   ```
   git clone https://github.com/sunfounder/bella-hat.git
   ```

3. Install the package.

   It is recommended to install within a Python virtual environment.

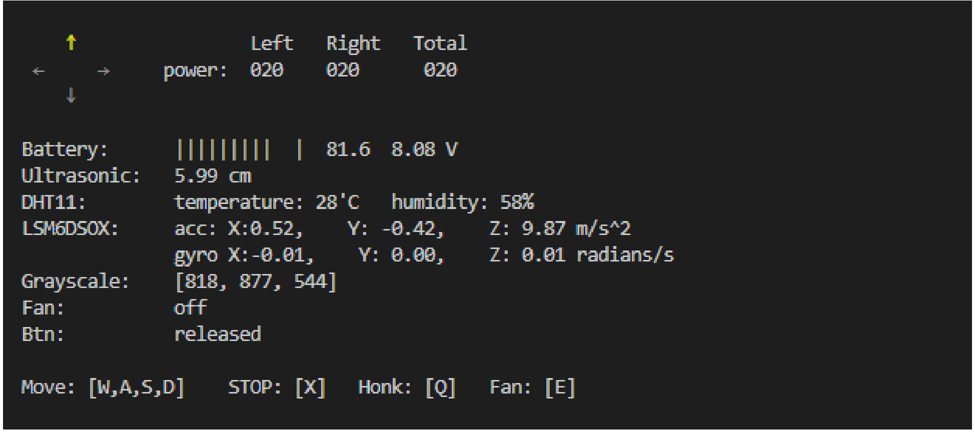
   ```
   cd bella-hat
   pip3 install ./
   ```

   > **Note**
   >
   > if you want to install in system environment. You need add parameter “–break-system-packages”
   >
   > ```
   > pip3 install ./ --break-system-packages
   > ```

Examples

Basic test

```
cd bella-hat
python3 examples/basic_test.py
```



```
    ↑               Left   Right   Total
 ←     →    power:  020    020      020
    ↓

Battery:       |||||||||  |  81.6  8.08 V
Ultrasonic:    5.99 cm
DHT11:         temperature: 28'C   humidity: 58%
LSM6DSOX:      acc: X:0.52,    Y: -0.42,    Z: 9.87 m/s^2
               gyro X:-0.01,    Y: 0.00,    Z: 0.01 radians/s
Grayscale:     [818, 877, 544]
Fan:           off
Btn:           released

Move: [W,A,S,D]    STOP: [X]   Honk: [Q]   Fan: [E]
```

Reset MCU

Reset the MCU on the Bella HAT.

```
bella-hat reset_mcu
```

Reference

class Bella

The class `Bella` encapsulates the usage functions of all physical interfaces on the Bella HAT and presets the corresponding pin numbers. For a more detailed example, you can refer to the examples/basic_test.py file.

Example

```
from bella_hat.bella import Bella

bella = Bella()
bellas.et_motors_reverse(True, False)

bella.set_eyes_led(80, 80)
bella.set_motors(20, 20)
bella.fan_on()

batVolt = bella.get_battery_voltage()
batPerc = bella.get_battery_percentage()
distance = bella.get_ultrasonic_distance()
temp = bella.get_temperature()
hum = bella.get_humidity()
grayscale = bella.get_grayscales()
acc = bella.get_acc()
gyro = bella.get_gyro()
btn_state = bella.read_btn()
print(f'''
Battery:      {batPerc:.1f}  {batVolt:.2f} V
Ultrasonic:   {distance} cm
DHT11:        temperature: {temp}'C   humidity: {hum}%
LSM6DSOX:     acc: X:{acc[0]:.2f},    Y: {acc[1]:.2f},    Z: {acc[2]:.2f} m/s^2
              gyro X:{gyro[0]:.2f},    Y: {gyro[1]:.2f},    Z: {gyro[2]:.2f} radians/s
Grayscale:    {grayscale}
Fan:          {"on" if bella.fan_state else "off"}
Btn:          {"pressed" if btn_state else "released"}
''')
```

API

class `bella_hat.bella.`**`Bella`**(*`*args`*, *`**kwargs`*)

Bases: **`_Basic_class`**

`__init__`(*`*args`*, *`**kwargs`*)

Initialize the basic class

Parameters: **debug_level** (*str/int*) – debug level, 0(critical), 1(error), 2(warning), 3(info) or 4(debug)

`get_battery_voltage`()

‘ Get the battery voltage.
return: float - Battery voltage in volts.

`get_battery_percentage`()

Get the battery percentage.
return: float - Battery percentage.

`get_ultrasonic_distance` ()

Get the distance from the ultrasonic sensor.

return: float - Distance in cm.

-1, timeout -2, distance limit exceeded

`get_temperature` ()

Get the temperature from the DHT11 sensor.
return: float - Temperature in Celsius.

`get_humidity` ()

Get the humidity from the DHT11 sensor.
return: float - Humidity in percentage.

`get_grayscales` ()

Get the grayscale sensor values.
return: list - Grayscale sensor values.

`set_motors` (`leftPercent`**,** `rightPercent`**)**

Set the motor percentage for left and right motors
leftPercent: int - Motor percentage for left motor, -100 to 100 rightPercent: int - Motor percentage for right motor, -100 to 100

`set_motors_reverse` (`left_reverse`**,** `right_reverse`**)**

Set the motors is reversed or not
left_reverse: bool - set left motor is reversed or not right_reverse: bool - set right motor is reversed or not

`get_acc` ()

Get acceleration data of lsm6dsox sensor.
return: list - [acc_x, acc_y, acc_z].

`get_gyro` ()

Get gyro data of lsm6dsox sensor.
return: list - [gyro_x, gyro_y, gyro_z].

`fan_on` ()

Open the fan on Bella HAT.

`fan_off` ()

Close the fan on Bella HAT.

`read_btn` ()

Read the state of btn on Bella HAT.

`set_eyes_led` (`left_brightness`**,** `right_brightness`**)**

Set the front board LEDs brightness.
left_brightness: int - brightness for left LEDs, 0 to 100 right_brightness: int - brightness for right LEDs, 0 to 100

class Pin

Example

Simple read or control pin:

```
# Import Pin class
from robot_hat import Pin

# Create Pin object with numeric pin numbering and default input pullup enabled
d0 = Pin(16, Pin.IN, Pin.PULL_UP)
# Create Pin object with named pin numbering
d1 = Pin(25)
```

```
# read value
value0 = d0.value()
value1 = d1.value()
print(value0, value1)

# write value
d0.value(1) # force input to output
d1.value(0)

# set pin high/low
d0.high()
d1.off()
```

Interrupt:

```
# Import Pin class
from bella_hat.pin import Pin

# set interrupt
led = Pin(16, Pin.OUT)
switch = Pin(25, Pin.IN, Pin.PULL_DOWN)
def onPressed(chn):
    led.value(not switch.value())
switch.irq(handler=onPressed, trigger=Pin.IRQ_RISING_FALLING)

while True:
    pass
```

API

class `bella_hat.pin.`**`Pin`** (`pin`, `mode`=None, `pull`=None, `*args`, `**kwargs`)

Bases: `_`**`Basic_class`**

Pin manipulation class

`OUT` = *1*

Pin mode output

`IN` = *2*

Pin mode input

`PULL_UP` = *17*

Pin internal pull up

`PULL_DOWN` = *18*

Pin internal pull down

`PULL_NONE` = *None*

Pin internal pull none

`IRQ_FALLING` = *33*

Pin interrupt falling

`IRQ_RISING` = *34*

Pin interrupt falling

`IRQ_RISING_FALLING` = *35*

Pin interrupt both rising and falling

`__init__` **(**`pin`, `mode`=None, `pull`=None, `*args`, `**kwargs`**)**

Initialize a pin

Parameters:

- **pin** (*int/str*) – pin number of Raspberry Pi
- **mode** (*int*) – pin mode(IN/OUT)
- **pull** (*int*) – pin pull up/down(PUD_UP/PUD_DOWN/PUD_NONE)

`setup` **(**`mode`**,** `pull`=None**)**

Setup the pin

Parameters:

- **mode** (*int*) – pin mode(IN/OUT)
- **pull** (*int*) – pin pull up/down(PUD_UP/PUD_DOWN/PUD_NONE)

`dict` **(**`_dict`=None**)**

Set/get the pin dictionary

Parameters: **_dict** (*dict*) – pin dictionary, leave it empty to get the dictionary

Returns: pin dictionary

Return type: dict

__`call`__ **(**`value`**)**

Set/get the pin value

Parameters: **value** (*int*) – pin value, leave it empty to get the value(0/1)

Returns: pin value(0/1)

Return type: int

`value` **(**`value: bool = None`**)**

Set/get the pin value

Parameters: **value** (*int*) – pin value, leave it empty to get the value(0/1)

Returns: pin value(0/1)

Return type: int

on ()

Set pin on(high)

Returns: pin value(1)

Return type: int

`off` **()**

Set pin off(low)

Returns: pin value(0)

Return type: int

`high` **()**

Set pin high(1)

Returns: pin value(1)

Return type: int

`low` **()**

Set pin low(0)

Returns: pin value(0)

Return type: int

`irq` **(**`handler`**,** `trigger`**,** `bouncetime`=200**,** `pull`=None**)**

Set the pin interrupt

Parameters:

- **handler** (*function*) – interrupt handler callback function
- **trigger** (*int*) – interrupt trigger(RISING, FALLING, RISING_FALLING)
- **bouncetime** (*int*) – interrupt bouncetime in miliseconds

name ()

Get the pin name

Returns: pin name

Return type: str

class ADC

Example

```
# Import ADC class
from bella_hat.adc import ADC

# Create ADC object with numeric pin numbering
a0 = ADC(0)
# Create ADC object with named pin numbering
a1 = ADC('A1')

# Read ADC value
value0 = a0.read()
value1 = a1.read()
voltage0 = a0.read_voltage()
voltage1 = a1.read_voltage()
print(f"ADC 0 value: {value0}")
print(f"ADC 1 value: {value1}")
print(f"ADC 0 voltage: {voltage0}")
print(f"ADC 1 voltage: {voltage1}")
```

Read Battery voltage on Bella bella-hat:

The battery voltage measurement terminal is connected to ADC channel 4 and divided by 3 times

```
# Import ADC class
from bella_hat.adc import ADC

BAT_VOLT_GAIN = 3
bat = ADC('A4')

bat_value = bat.read()
bat_voltage = bat.read_voltage() * BAT_VOLT_GAIN
print(f"Battery adc value: {bat_value}, voltage: {bat_voltage:.2f} V")
```

API

class `bella_hat.adc.`**`ADC`** (chn, address=None, *args, **kwargs)

Bases: **`I2C`**

Analog to digital converter

`__init__` **(**chn**,** address=None**,** *args**,** **kwargs**)**

Analog to digital converter

Parameters: **chn** (*int/str*) – channel number (0-7/A0-A7)

read ()

Read the ADC value

Returns: ADC value(0-4095)

Return type: int

`read_voltage` ()

Read the ADC value and convert to voltage

Returns: Voltage value(0-3.3(V))

Return type: float

class PWM

Example

```
# Import PWM class
from bella_hat.pwm import PWM

# Create PWM object with numeric pin numbering and default input pullup enabled
p0 = PWM(0)
# Create PWM object with named pin numbering
p1 = PWM('P1')


# Set frequency will automatically set prescaller and period
# This is easy for device like Buzzer or LED, which you care
# about the frequency and pulse width percentage.
# this usually use with pulse_width_percent function.
# Set frequency to 1000Hz
p0.freq(1000)
print(f"Frequence: {p0.freq()} Hz")
print(f"Prescaler: {p0.prescaler()}")
print(f"Period: {p0.period()}")
# Set pulse width to 50%
p0.pulse_width_percent(50)

# Or set prescaller and period, will get a frequency from:
# frequency = PWM.CLOCK / prescaler / period
# With this setup you can tune the period as you wish.
# set prescaler to 64
p1.prescaler(64)
# set period to 4096 ticks
p1.period(4096)
print(f"Frequence: {p1.freq()} Hz")
print(f"Prescaler: {p1.prescaler()}")
print(f"Period: {p1.period()}")
# Set pulse width to 2048 which is also 50%
p1.pulse_width(2048)
```

API

class `bella_hat.pwm.`**`PWM`** (`channel`, `address=None`, `*args`, `**kwargs`)

Bases: **`I2C`**

Pulse width modulation (PWM)

`REG_CHN` = *32*

Channel register prefix

`REG_PSC` = *64*

Prescaler register prefix

`REG_ARR` = *68*

Period registor prefix

REG_PSC2 = *80*
Prescaler register prefix

REG_ARR2 = *84*
Period registor prefix

CLOCK = *72000000.0*
Clock frequency

__init__ (channel, address=None, *args, **kwargs)
Initialize PWM

Parameters: **channel** (*int/str*) – PWM channel number(0-13/P0-P13)

freq (freq=None)
Set/get frequency, leave blank to get frequency

Parameters: **freq** (*float*) – frequency(0-65535)(Hz)
Returns: frequency
Return type: float

prescaler (prescaler=None)
Set/get prescaler, leave blank to get prescaler

Parameters: **prescaler** (*int*) – prescaler(0-65535)
Returns: prescaler
Return type: int

period (arr=None)
Set/get period, leave blank to get period

Parameters: **arr** (*int*) – period(0-65535)
Returns: period
Return type: int

pulse_width (pulse_width=None)
Set/get pulse width, leave blank to get pulse width

Parameters: **pulse_width** (*float*) – pulse width(0-65535)
Returns: pulse width
Return type: float

pulse_width_percent (pulse_width_percent=None)
Set/get pulse width percentage, leave blank to get pulse width percentage

Parameters: **pulse_width_percent** (*float*) – pulse width percentage(0-100)
Returns: pulse width percentage
Return type: float

module motor

class Motors

Example

Initilize

```
# Import Motor class
from bella_hat.motor import Motors
```

```
# Create Motor object
motors = Motors()
# Create Motor object with setting motors direction
# motors = Motors(left_reversed=True, right_reversed=False)
```

Control motors power.

```
#
motors.speed([50, 50])
# stop
motors.stop()
```

Setup motor direction.

```
# Go forward and see if both motor directions are correct
motors.forward(100)
# if you found a motor is running in the wrong direction
# Use these function to correct it
motors.reverse(True, True) # [left_reverse, right_reverse]
# Run forward again and see if both motor directions are correct
motors.forward(100)
```

Move functions

```
import time

motors.forward(100)
time.sleep(1)
motors.backward(100)
time.sleep(1)
motors.turn_left(100)
time.sleep(1)
motors.turn_right(100)
time.sleep(1)
motors.stop()
```

API

class `bella_hat.motor.`**`Motors`** (`left_motor_pwma`=18, `left_motor_pwmb`=19, `right_motor_pwma`=16, `right_motor_pwmb`=17, `left_reversed`=False, `right_reversed`=False, `*args`, `**kwargs`)

Bases: `_Basic_class`

`__init__` **(**`left_motor_pwma`=18**,** `left_motor_pwmb`=19**,** `right_motor_pwma`=16**,** `right_motor_pwmb`=17**,** `left_reversed`=False**,** `right_reversed`=False**,** `*args`**,** `**kwargs`**)**

Initialize motors with bella_hat.motor.Motor

Parameters:

- **left_motor_pwma** (*int, pin number*) – pwma input for left motor
- **left_motor_pwmb** (*int, pin number*) – pwmb input for left motor
- **right_motor_pwma** (*int, pin number*) – pwma input for right motor
- **right_motor_pwmb** (*int, pin number*) – pwmb input for right motor
- **left_reversed** (*bool*) – whether to reverse left motor
- **right_reversed** (*bool*) – whether to reverse right motor

`stop` **()**

Stop all motors

`brake` **()**

Brake

`reverse` **(**`reverse`=None**)**

Get or set motors is reversed or not

Parameters: **reverse** (*[bool, bool]*) – [left_reverse, right_reverse]

speed (`speed=None`)

Get or Set motors speed

Parameters: **speed** (*[float/int, float/int]*) – [left_speed, right_speed] (-100.0~100.0)

`forward` (`speed`)

Forward

Parameters: **speed** (*float*) – Motor speed(-100.0~100.0)

`backward` (`speed`)

Backward

Parameters: **speed** (*float*) – Motor speed(-100.0~100.0)

`turn_left` (`speed`)

Left turn

Parameters: **speed** (*float*) – Motor speed(-100.0~100.0)

`turn_right` (`speed`)

Right turn

Parameters: **speed** (*float*) – Motor speed(-100.0~100.0)

class Motor

Example

```
# Import Motor class
from bella_hat.motor import Motor, PWM, Pin

# Create Motor object
motor = Motor(18, 19) # pwma, pwmb

# Motor clockwise at 100% speed
motor.speed(100)
# Motor counter-clockwise at 100% speed
motor.speed(-100)

# If you like to reverse the motor direction
motor.reverse(True)
```

API

class `bella_hat.motor.`**`Motor`** (pwma, pwmb, `reversed=False`)

Bases: **`object`**

`__init__` (pwma, pwmb, `reversed=False`)

Initialize a motor

Parameters:

- **pwma** (*pin number*) – Motor speed control pwm input A pin
- **pwmb** (*pin number*) – Motor speed control pwm input B pin

Reversed: Whether to reverse the direction of motor rotation

speed (`speed=None`)

Get or set motor speed

Parameters: **speed** (*int or float*) – Motor speed(-100.0~100.0)

reverse (reverse=None)

Get or set motor is reversed or not

Parameters: **reverse** (*bool*) – True or False

brake ()

stop ()

class I2C

Example

```
# Import the I2C class
from bella_hat.i2c import I2C

# You can scan for available I2C devices
print([f"0x{addr:02X}" for addr in I2C().scan()])
# You should see at least one device address 0x14, which is the
# on board MCU for PWM and ADC

# Initialize a I2C object with device address, for example
# to communicate with on board MCU 0x14
mcu = I2C(0x14)
# Send ADC channel register to read ADC, 0x10 is Channel 0, 0x11 is Channel 1, etc.
mcu.write([0x10, 0x00, 0x00])
# Read 2 byte for MSB and LSB
msb, lsb = mcu.read(2)
# Convert to integer
value = (msb << 8) + lsb
# Print the value
print(value)
```

For more information on the I2C protocol, see checkout adc.py and pwm.py

API

class bella_hat.i2c.**I2C** (address=None, bus=1, *args, **kwargs)

Bases: **_Basic_class**

I2C bus read/write functions

__init__ (address=None, bus=1, *args, **kwargs)

Initialize the I2C bus

Parameters:

- **address** (*int*) – I2C device address
- **bus** (*int*) – I2C bus number

static **scan** (busnum=1, force=False)

Scan the I2C bus for devices

Returns: List of I2C addresses of devices found

Return type: list

write (data)

Write data to the I2C device

Parameters: **data** (*int/list/bytearray*) – Data to write

Raises: ValueError if write is not an int, list or bytearray

read (length=1)
Read data from I2C device

Parameters: **length** (*int*) – Number of bytes to receive
Returns: Received data
Return type: list

mem_write (data, memaddr)
Send data to specific register address

Parameters:
- **data** (*int/list/bytearray*) – Data to send, int, list or bytearray
- **memaddr** (*int*) – Register address

Raises: **ValueError** – If data is not int, list, or bytearray

mem_read (length, memaddr)
Read data from specific register address

Parameters:
- **length** (*int*) – Number of bytes to receive
- **memaddr** (*int*) – Register address

Returns: Received bytearray data or False if error
Return type: list/False

is_avaliable ()
Check if the I2C device is avaliable

Returns: True if the I2C device is avaliable, False otherwise
Return type: bool

module modules

class Ultrasonic

Example

```python
# Import Ultrasonic and Pin class
from bella_hat.modules import Ultrasonic, Pin

# Create Motor object
us = Ultrasonic(Pin(20), Pin(21))

# Read distance
distance = us.read()
print(f"Distance: {distance}cm")
```

API

class bella_hat.modules.**Ultrasonic** (trig, echo, timeout=0.02)

__init__ (trig, echo, timeout=0.02)
Initialize an ultrasonic distance sensor

Parameters:
- **trig** (*pin number*) – tring pin
- **echo** (*pin number*) – echo pin
- **timeout** (*float, seconds*) – set the timeout for detecting the return of sound waves

read (times=10**)**
Read the distance

Parameters: **times** (*int*) – retry times

Returns: float, distance in centimeter 1, timeout or error

class Grayscale_Module

Example

```
# Import Grayscale_Module and ADC class
from bella_hat.modules import Grayscale_Module, ADC

# Create Grayscale_Module object, reference should be calculate from the value reads on w
# and black ground, then take the middle as reference
gs = Grayscale_Module(ADC(0), ADC(1), ADC(2), reference=[1000, 900, 1000])

# Read Grayscale_Module datas
datas = gs.read()
print(f"Grayscale Module datas: {datas}")
# or read a specific channel
l = gs.read(gs.LEFT)
m = gs.read(gs.MIDDLE)
r = gs.read(gs.RIGHT)
print(f"Grayscale Module left channel: {l}")
print(f"Grayscale Module middle channel: {m}")
print(f"Grayscale Module right channel: {r}")

# Read Grayscale_Module simple states
state = gs.read_status()
print(f"Grayscale_Module state: {state}")
```

API

class bella_hat.modules.**Grayscale_Module** (pin0: ADC, pin1: ADC, pin2: ADC, reference: int = None)
3 channel Grayscale Module

LEFT = *2*
Left Channel

MIDDLE = *1*
Middle Channel

RIGHT = *1*
Right Channel

__init__ (pin0: ADC, pin1: ADC, pin2: ADC, reference: int = None**)**
Initialize Grayscale Module

Parameters:

- **pin0** (*bella_hat.ADC/int*) – ADC object or int for channel 0
- **pin1** (*bella_hat.ADC/int*) – ADC object or int for channel 1
- **pin2** (*bella_hat.ADC/int*) – ADC object or int for channel 2
- **reference** (*1*3 list, [int, int, int]*) – reference voltage

reference (ref: list = None**)** → list
Get Set reference value

Parameters: **ref** (*list*) – reference value, None to get reference value

Returns: reference value

Return type: list

read_status (datas: list = None) → list

Read line status

Parameters: **datas** (*list*) – list of grayscale datas, if None, read from sensor

Returns: list of line status, 0 for white, 1 for black

Return type: list

read (channel: int = None) → list

read a channel or all datas

Parameters: **channel** (*int/None*) – channel to read, leave empty to read all. 0, 1, 2 or Grayscale_Module.LEFT, Grayscale_Module.CENTER, Grayscale_Module.RIGHT

Returns: list of grayscale data

Return type: list

class DHT11

Example

```
# Import DHT11 class
from bella_hat.modules import DHT11

# Create DHT11 object
dht11 = DHT11(19)

# Read DHT11 datas
temperature = dht11.temperature
humidity = dht11.humidity
print(f"Temperature: {temperature}'C, Humidity: {humidity}%")
```

API

class bella_hat.modules.**DHT11** (pin)

__init__ (pin)

Initialize DHT11 Module

Parameters: **pin** (*pin number*) – DHT11 data pin

property **temperature**

Temperature

property **humidity**

Humidity

class LSM6DSOX

Example

```
# Import LSM6DSOX class
from bella_hat.modules import LSM6DSOX

# Create LSM6DSOX object
lsm6dsox = LSM6DSOX()

# Read LSM6DSOX datas
acc = lsm6dsox.acc
```

```
gyro = lsm6dsox.gyro
print(f"acc: X:{acc[0]:.2f},    Y: {acc[1]:.2f},    Z: {acc[2]:.2f} m/s^2")
print(f"gyro X:{gyro[0]:.2f},    Y: {gyro[1]:.2f},    Z: {gyro[2]:.2f} radians/s")
```

API

class `bella_hat.modules.`**`LSM6DSOX`**

`__init__`()
Initialize LSM6DSOX Module

property **`acc`**
Acceleration

property **`gyro`**
Gyro

class `Music`

Example

Initialize

```
# Import Music class
from bella_hat.music import Music

# Create a new Music object
music = Music()
```

Play sound

```
# Play a sound
music.sound_play("file.wav", volume=50)
# Play a sound in the background
music.sound_play_threading("file.wav", volume=80)
# Get sound length
music.sound_length("file.wav")
```

Play Music

```
# Play music
music.music_play("file.mp3")
# Play music in loop
music.music_play("file.mp3", loop=0)
# Play music in 3 times
music.music_play("file.mp3", loop=3)
# Play music in starts from 2 second
music.music_play("file.mp3", start=2)
# Set music volume
music.music_set_volume(50)
# Stop music
music.music_stop()
# Pause music
music.music_pause()
# Resume music
music.music_resume()
```

API

class `bella_hat.music.`**`Music`**
Bases: **`_Basic_class`**
Play music, sound affect and note control

`NOTE_BASE_FREQ` = *440*

Base note frequency for calculation (A4)

`NOTE_BASE_INDEX` = *69*

Base note index for calculation (A4) MIDI compatible

`NOTES` = *[None, 'A0', 'A#0', 'B0', 'C1', 'C#1', 'D1', 'D#1', 'E1', 'F1', 'F#1', 'G1', 'G#1', 'A1', 'A#1', 'B1', 'C2', 'C#2', 'D2', 'D#2', 'E2', 'F2', 'F#2', 'G2', 'G#2', 'A2', 'A#2', 'B2', 'C3', 'C#3', 'D3', 'D#3', 'E3', 'F3', 'F#3', 'G3', 'G#3', 'A3', 'A#3', 'B3', 'C4', 'C#4', 'D4', 'D#4', 'E4', 'F4', 'F#4', 'G4', 'G#4', 'A4', 'A#4', 'B4', 'C5', 'C#5', 'D5', 'D#5', 'E5', 'F5', 'F#5', 'G5', 'G#5', 'A5', 'A#5', 'B5', 'C6', 'C#6', 'D6', 'D#6', 'E6', 'F6', 'F#6', 'G6', 'G#6', 'A6', 'A#6', 'B6', 'C7', 'C#7', 'D7', 'D#7', 'E7', 'F7', 'F#7', 'G7', 'G#7', 'A7', 'A#7', 'B7', 'C8']*

Notes name, MIDI compatible

`__init__` **()**

Initialize music

`time_signature` **(**`top: int =` None**,** `bottom: int =` None**)**

Set/get time signature

Parameters:
- **top** (*int*) – top number of time signature
- **bottom** (*int*) – bottom number of time signature

Returns: time signature

Return type: tuple

`key_signature` **(**`key: int =` None**)**

Set/get key signature

Parameters: **key** (*int/str*) – key signature use KEY_XX_MAJOR or String “#”, “##”, or “bbb”, “bbbb”

Returns: key signature

Return type: int

`tempo` **(**`tempo`=None**,** `note_value`=0.25**)**

Set/get tempo beat per minute(bpm)

Parameters:
- **tempo** (*float*) – tempo
- **note_value** – note value(1, 1/2, Music.HALF_NOTE, etc)

Returns: tempo

Return type: int

`beat` **(**`beat`**)**

Calculate beat delay in seconds from tempo

Parameters: **beat** (*float*) – beat index

Returns: beat delay

Return type: float

`note` **(**`note`**,** `natural`=False**)**

Get frequency of a note

Parameters:
- **note_name** (*string*) – note name(See NOTES)
- **natural** (*bool*) – if natural note

Returns: frequency of note

Return type: float

`sound_play` **(**`filename`**,** `volume`=None**)**

Play sound effect file

Parameters: **filename** (*str*) – sound effect file name

`sound_play_threading` **(**`filename`**,** `volume=None`**)**

Play sound effect in thread(in the background)

Parameters:
- **filename** (*str*) – sound effect file name
- **volume** (*int*) – volume 0-100, leave empty will not change volume

`music_play` **(**`filename`**,** `loops=1`**,** `start=0.0`**,** `volume=None`**)**

Play music file

Parameters:
- **filename** (*str*) – sound file name
- **loops** (*int*) – number of loops, 0:loop forever, 1:play once, 2:play twice, …
- **start** (*float*) – start time in seconds
- **volume** (*int*) – volume 0-100, leave empty will not change volume

`music_set_volume` **(**`value`**)**

Set music volume

Parameters: **value** (*int*) – volume 0-100

`music_stop` **()**

Stop music

`music_pause` **()**

Pause music

`music_resume` **()**

Resume music

`music_unpause` **()**

Unpause music(resume music)

`sound_length` **(**`filename`**)**

Get sound effect length in seconds

Parameters: **filename** (*str*) – sound effect file name

Returns: length in seconds

Return type: float

`get_tone_data` **(**`freq: float`**,** `duration: float`**)**

Get tone data for playing

Parameters:
- **freq** (*float*) – frequency
- **duration** (*float*) – duration in seconds

Returns: tone data

Return type: list

`play_tone_for` **(**`freq`**,** `duration`**)**

Play tone for duration seconds

Parameters:
- **freq** (*float*) – frequency, you can use NOTES to get frequency
- **duration** (*float*) – duration in seconds

module utils

`bella_hat.utils.`**`set_volume`** (`value`)

Set volume

Parameters: **value** (*int*) – volume(0~100)

`bella_hat.utils.`**`run_command`** (`cmd`)

Run command and return status and output

Parameters: **cmd** (*str*) – command to run

Returns: status, output

Return type: tuple

`bella_hat.utils.`**`is_installed`** (`cmd`)

Check if command is installed

Parameters: **cmd** (*str*) – command to check

Returns: True if installed

Return type: bool

`bella_hat.utils.`**`mapping`** (`x`, `in_min`, `in_max`, `out_min`, `out_max`)

Map value from one range to another range

Parameters:

- **x** (*float/int*) – value to map
- **in_min** (*float/int*) – input minimum
- **in_max** (*float/int*) – input maximum
- **out_min** (*float/int*) – output minimum
- **out_max** (*float/int*) – output maximum

Returns: mapped value

Return type: float/int

`bella_hat.utils.`**`get_ip`** (`ifaces=`['wlan0', 'eth0'])

Get IP address

Parameters: **ifaces** (*list*) – interfaces to check

Returns: IP address or False if not found

Return type: str/False

`bella_hat.utils.`**`reset_mcu`** ()

Reset mcu on BL100 Hat.

This is helpful if the mcu somehow stuck in a I2C data transfer loop, and Raspberry Pi getting IOError while Reading ADC, manipulating PWM, etc.

`bella_hat.utils.`**`get_battery_voltage`** ()

Get battery voltage

Returns: battery voltage(V)

Return type: float

class _Basic_class

`_Basic_class` is a logger class for all class to log, so if you want to see logs of a class, just add a debug argument to it.

Example

```
# See PWM log
from bella_hat.pwm import PWM

# init the class with a debug argument
```

```
pwm = PWM(0, debug_level="debug")

# run some functions and see logs
pwm.freq(1000)
pwm.pulse_width_percent(100)
```

API

class `bella_hat.basic.`**`_Basic_class`** (`debug_level`='warning')

Basic Class for all classes
with debug function

`DEBUG_LEVELS` = *{'critical': 50, 'debug': 10, 'error': 40, 'info': 20, 'warning': 30}*

Debug level

`DEBUG_NAMES` = *['critical', 'error', 'warning', 'info', 'debug']*

Debug level names

`__init__` **(**`debug_level`='warning'**)**

Initialize the basic class

Parameters: **debug_level** (*str/int*) – debug level, 0(critical), 1(error), 2(warning), 3(info) or 4(debug)

property **`debug_level`**

Debug level

Index

Python Module Index