```c
/**
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 */

#include <stdio.h>
#include <stdlib.h>

#include "pico/stdlib.h"
#include "hardware/pio.h"
#include "hardware/clocks.h"
#include "ws2812.pio.h"

#define IS_RGBW true
#define NUM_PIXELS 150

#ifdef PICO_DEFAULT_WS2812_PIN
#define WS2812_PIN PICO_DEFAULT_WS2812_PIN
#else
// default to pin 2 if the board doesn't have a default WS2812 pin defined
#define WS2812_PIN 2
#endif

static inline void put_pixel(uint32_t pixel_grb) {
    pio_sm_put_blocking(pio0, 0, pixel_grb << 8u);
}

static inline uint32_t urgb_u32(uint8_t r, uint8_t g, uint8_t b) {
    return
            ((uint32_t) (r) << 8) |
            ((uint32_t) (g) << 16) |
            (uint32_t) (b);
}

void pattern_snakes(uint len, uint t) {
    for (uint i = 0; i < len; ++i) {
        uint x = (i + (t >> 1)) % 64;
        if (x < 10)
            put_pixel(urgb_u32(0xff, 0, 0));
        else if (x >= 15 && x < 25)
            put_pixel(urgb_u32(0, 0xff, 0));
        else if (x >= 30 && x < 40)
            put_pixel(urgb_u32(0, 0, 0xff));
        else
            put_pixel(0);
    }
}
```

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```

Standard C lib.

Standard C from Pico chip lib.

chip lib.

Autogenerated lib from Pioasm.

Signal pin (default)

We define pin2 (default).

(31) from each LED function.

put GRB to OSR (blocking mode)

(32) used in pattern_snakes.

left shift 8 bit

left shift 16 bit

⇒ result: change RGB to GRB by changing bits

(30) Create a LED function called Snake

is include in table.

```
void pattern_random(uint len, uint t) {
    if (t % 8)
        return;
    for (int i = 0; i < len; ++i)
        put_pixel(rand());
}
```

Create a LED function called random

(31) put_pixel(rand());

(30) is include in table.

```
void pattern_sparkle(uint len, uint t) {
    if (t % 8)
        return;
    for (int i = 0; i < len; ++i)
        put_pixel(rand() % 16 ? 0 : 0xffffffff);
}
```

Create a LED function called Sparkle.

(31) put_pixel(rand() % 16 ? 0 : 0xffffffff);

(30) is included in table.

```
void pattern_greys(uint len, uint t) {
    int max = 100; // let's not draw too much current!
    t %= max;
    for (int i = 0; i < len; ++i) {
        put_pixel(t * 0x10101);
        if (++t >= max) t = 0;
    }
}
```

Create a LED function called greys.

(31) put_pixel(t * 0x10101);

```
typedef void (*pattern)(uint len, uint t);
const struct {
    pattern pat;
    const char *name;
} pattern_table[] = {
        {pattern_snakes,  "Snakes!"},
        {pattern_random,  "Random data"},
        {pattern_sparkle, "Sparkles"},
        {pattern_greys,   "Greys"},
};
```

a printer function pointing to LED functions above.

(29) pattern_table[] — from the main function

(30) {pattern_sparkle, "Sparkles"}

LED functions table. Including all four LED functions above.

```
int main() {
    //set_sys_clock_48();
    stdio_init_all();
    printf("WS2812 Smoke Test, using pin %d", WS2812_PIN);

    // todo get free sm
    PIO pio = pio0;
    int sm = 0;
    uint offset = pio_add_program(pio, &ws2812_program);

    ws2812_program_init(pio, sm, offset, WS2812_PIN, 800000, IS_RGBW);

    int t = 0;
```

(1) stdio_init_all(); — Initialize the board.

(2) printf(...) — print pin #

(3) PIO pio = pio0; — Initialize PIO module # (used for sending color to WS2812)

(4) int sm = 0; — Initialize sm (State machine)

(5) uint offset = pio_add_program(pio, &ws2812_program); — Initialize PIO

(6) ws2812_program_init(...) — Initialize WS2812 program.

(22) int t = 0;

```
while (1) {
    int pat = rand() % count_of(pattern_table);
    int dir = (rand() >> 30) & 1 ? 1 : -1;
    puts(pattern_table[pat].name);
    puts(dir == 1 ? "(forward)" : "(backward)");
    for (int i = 0; i < 1000; ++i) {
        pattern_table[pat].pat(NUM_PIXELS, t);
        sleep_ms(10);
        t += dir;
    }
  }
}
```

while true.

randomly choose one function

print mode info.

choose one. LED functions

t = t + dir