

Experiment: Control LED and Measure Analog Value using RP2040 (C Program)

Aim: To control LED brightness and measure analog input value using ADC on RP2040 using C.

Theory: RP2040 includes a 12-bit ADC that converts analog voltage to a digital value. PWM varies LED brightness based on duty cycle.

Procedure:

1. Connect the potentiometer middle terminal to GP26 (ADC0).
2. Connect the side terminals to 3.3V and GND.
3. Write the C program in Pico SDK environment.
4. Compile and generate .uf2 file.
5. Flash it to Raspberry Pi Pico.
6. Rotate the potentiometer and observe LED brightness variation.

C Program:

```
#include "pico/stdc.h"
#include "hardware/pwm.h"
#include "hardware/adc.h"

int main() {
    stdio_init_all();
    adc_init();
    adc_gpio_init(26);
    adc_select_input(0);

    gpio_set_function(25, GPIO_FUNC_PWM);
    uint slice = pwm_gpio_to_slice_num(25);
    pwm_set_clkdiv(slice, 4.0f);
    pwm_set_wrap(slice, 65535);
    pwm_set_enabled(slice, true);

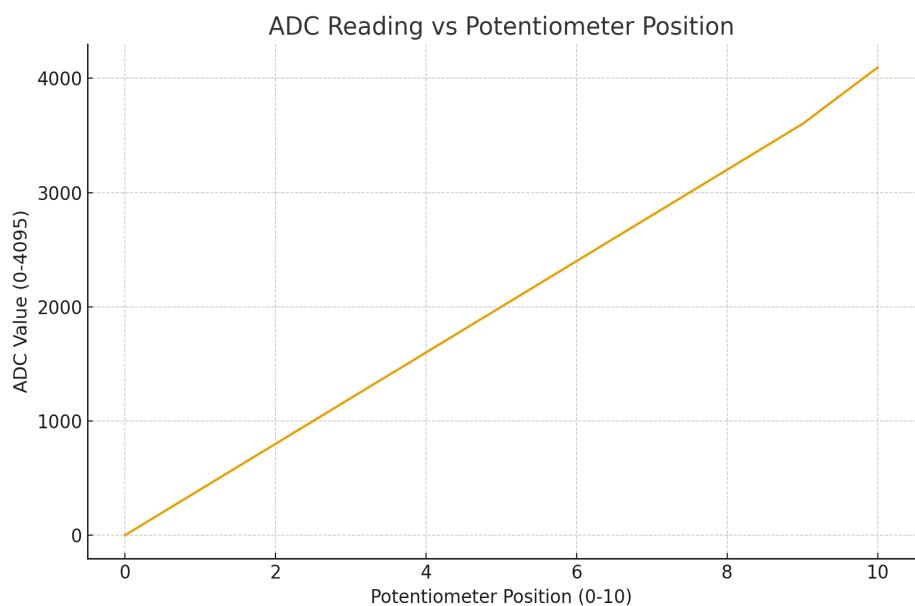
    while (1) {
        uint16_t adc_value = adc_read();
        uint16_t pwm_value = adc_value * 16;
        pwm_set_gpio_level(25, pwm_value);
        sleep_ms(50);
    }
}
```

Observation Table:

| <i>Position</i> | <i>ADC Value</i> | <i>LED Brightness</i> |
|-----------------|------------------|-----------------------|
| 0 | 0 | Low |
| 1 | 400 | Low |
| 2 | 800 | Low |

| | | |
|----|------|---------------|
| 3 | 1200 | <i>Low</i> |
| 4 | 1600 | <i>Medium</i> |
| 5 | 2000 | <i>Medium</i> |
| 6 | 2400 | <i>Medium</i> |
| 7 | 2800 | <i>Medium</i> |
| 8 | 3200 | <i>High</i> |
| 9 | 3600 | <i>High</i> |
| 10 | 4095 | <i>High</i> |

Graph:



Output:

Sample Output:

ADC Value changes with potentiometer movement.

LED brightness increases as ADC value increases.

Result: The LED brightness varied according to the analog input confirming correct ADC and PWM operation.