

Actuators Overview

This section details the actuators used in the **CoffeeTime** project, including **LED indicators, servo motors, a stepper motor, and a buzzer** for various control functions.

Components & Pin Configuration

| Actuator | Pin(s) | Function |
|---------------|--------------------------------------|----------------------------|
| Green LED | 7 | System ON indicator |
| Red LED | 12 | Machine refill alert |
| Blue LED | 13 | Active brewing process |
| LED Bar (10x) | 6, 9, 15, 22, 21, 20, 19, 18, 17, 16 | Coffee strength indication |
| Servo 1 | 11 | Coffee bean dispenser |
| Servo 2 | 10 | Ground coffee dispenser |
| Stepper Motor | 2 (DIR), 3 (STEP) | Grinder mechanism |
| Buzzer | 14 | Sound notifications |

LED Control

- System Indicators:** Green, Red, and Blue LEDs provide machine status feedback.
- LED Bar for Coffee Strength:** Displays the selected coffee strength visually.

Functions:

- `init_leds()`: Initializes system LEDs.
- `init_led_bar()`: Initializes LED bar.
- `update_led_bar(strength)`: Updates LED bar brightness based on strength.
- `blink_led_bar(times, interval)`: Blinks the LED bar for alerts.

Servo Motor Control

Functionality:

- Servo 1 controls the coffee bean release mechanism.
- Servo 2 controls the ground coffee dispensing.

Functions:

- `servo_init()`: Initializes servo motors.
- `servo1_move(angle)`: Moves Servo 1 to a specified angle.
- `servo2_move(angle)`: Moves Servo 2 to a specified angle.
- `servo1_motion()`: Executes full Servo 1 movement cycle.
- `servo2_motion()`: Executes full Servo 2 movement cycle.

Stepper Motor Control

Functionality: The stepper motor is responsible for grinding coffee beans.

Functions:

- `stepper_init()`: Initializes the stepper motor.
- `stepper_rotate(direction, duration, step_delay)`: Controls rotation.

Buzzer Alerts

Used for: Error notifications, brewing completion, and system feedback.

Functions:

- `play_error_tone()`: Alert tone for errors.
- `play_success_tone()`: Confirmation tone for successful actions.
- `play_coffee_ready()`: Melody played when coffee is ready.

This section describes the actuators used in CoffeeTime, ensuring proper hardware functionality and user feedback mechanisms.