Lab-6 Group -4 report

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Objective

The objective of this project was to implement a Pulse Width Modulation (PWM) waveform generator with a frequency of 100 kHz and a variable duty cycle. The system should start with a duty cycle of 50%. Additionally, the functionality was extended to allow adjustment of the duty cycle using a single switch, where a short press increases the duty cycle and a long press decreases it.

Part 1: PWM Waveform Generation

In the first part, the goal was to create a PWM waveform with specific characteristics:

- Frequency: The PWM frequency was set to 100 kHz, which corresponds to a period of 10 microseconds.
- Duty Cycle: The initial duty cycle was configured at 50%, meaning the output signal would be high for 5 microseconds and low for the remaining 5 microseconds.
- Switches for Control: Two switches were implemented:
  - Switch 1 (SW1): Increases the duty cycle by 5% when pressed.
  - Switch 2 (SW2): Decreases the duty cycle by 5% when pressed.

The system continuously monitors the state of the switches and adjusts the duty cycle accordingly, allowing for real-time modifications to the PWM output.

Part 2: Enhanced Duty Cycle Control with a Single Switch

In the second part of the project, the implementation was modified to simplify user interaction by using only one switch. This switch would have dual functionality based on the duration of the press:

- Short Press: A brief press of the switch increases the duty cycle by 5%.
- Long Press: Holding the switch down for a longer duration decreases the duty cycle by 5%.

This change aimed to enhance usability while maintaining the same underlying functionality of PWM signal generation. The system effectively differentiates between short and long presses using timing mechanisms, allowing for intuitive control of the duty cycle.

Approach

The implementation utilized the Tiva C Series microcontroller, which provided the necessary hardware capabilities for PWM generation and switch handling. The primary components included:

- GPIO Configuration: General Purpose Input/Output pins were configured to manage the state of the switches and control the PWM output.
- Interrupt Handling: Interrupts were employed to respond to switch presses, ensuring immediate reaction to user input while maintaining the main loop's PWM generation.
- Timing Mechanisms: Accurate timing was crucial for generating the PWM signal and differentiating between short and long presses.

Results

The final implementation successfully generated a PWM signal at the desired frequency with adjustable duty cycles. The system responded accurately to both two-switch and single-switch configurations, demonstrating flexibility and user-friendliness.

Conclusion

This project effectively achieved its objectives of creating a PWM waveform generator with variable duty cycles. The transition from a dual-switch system to a single-switch system not only simplified user interaction but also showcased the versatility of PWM in practical applications. Future work could explore additional features such as integrating more switches for finer control or implementing a graphical interface for easier manipulation of the duty cycle.