

TED UNIVERSITY

2023 Fall

CMPE 453 Embedded Systems

LAB REPORT # 5

**Lab Name:** Interrupt Handling using Atmega328p  
Microcontroller

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**Section:** 2

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## **I. Tasks**

The purpose of this lab activity is to understand the mechanism of interrupt handling by the microcontroller. The microcontroller was configured to handle interrupts triggered by a push button. INT0 was set as an input with an internal pull-up resistor, and the interrupt was initialized to respond to any logical change. LED were toggled in both the main loop and the ISR, providing visual feedback for interrupt handling. Inside the main loop, LED were toggled every 3 seconds. The ISR for the push button, which toggled the LED four times at one-second intervals.

## **II. Hardware Implementation**

A push button (PB1) was connected to the INT0 pin of the Arduino Uno Board, ensuring that pressing the button generates a "LOW" voltage level. LEDs, along with suitable resistors, were connected to other general-purpose I/O pins of the Arduino Uno Board for visual feedback during interrupt handling.

### **Push Button Connection to INT0**

- Push Button is an input device generating a signal when pressed.
- Connected a push button (PB1) to the Arduino Uno Board.
- Ensured that pressing the button results in a "LOW" voltage level at the INT0 pin.

### **LED Connection**

- Connected an LED with an appropriate resistor.
- LED were connected to general-purpose I/O pins of the Arduino Uno Board.

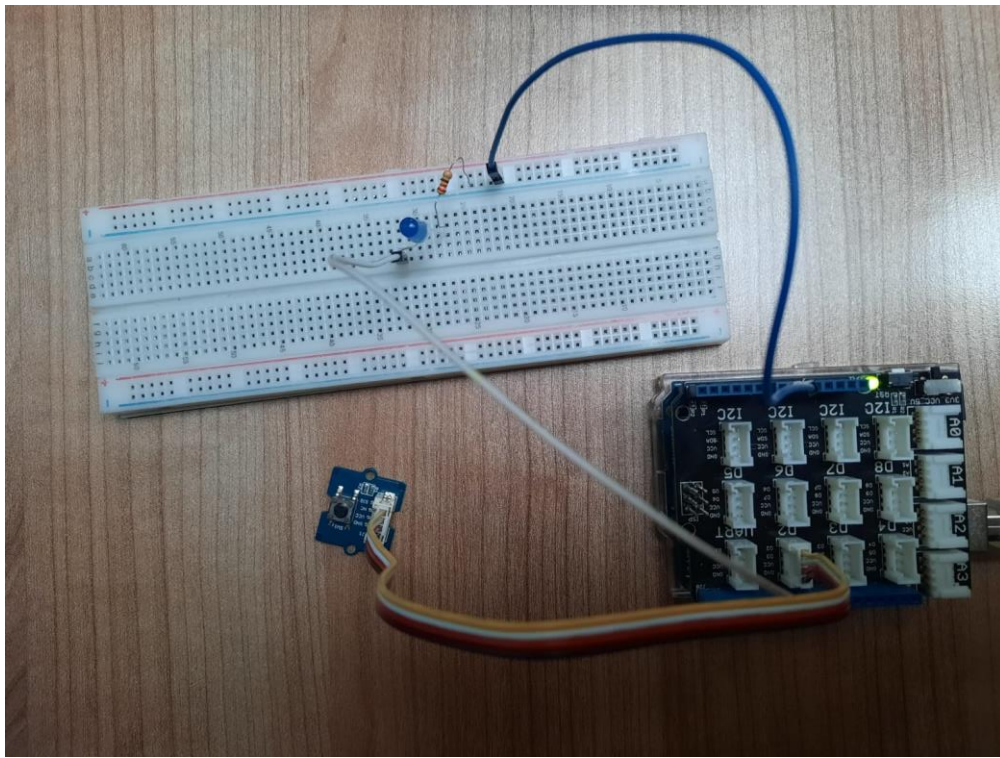


Figure 1 – Arduino, Arduino base shield, Grove button, Breadboard and LED with Resistor with the necessary connections provided and working as desired. ( December 4, 2023 Lab-5)

### III. Code

#### Preamble

- Includes necessary libraries (avr/io.h, util/delay.h, avr/interrupt.h).

#### ISR (Interrupt Service Routine)

- The ISR for INT0 is implemented to toggle LED0 four times with a 250ms delay for each toggle when the interrupt is triggered.

#### initInterrupt0 Function

- Initializes the INT0 interrupt.
- Enables the INT0 external interrupt.
- Configures INT0 to trigger on any logical change.
- Enables global interrupts.

#### setup Function

- Sets the direction of LEDs (LED\_DDR) as output, making them active.
- Enables the internal pull-up resistor for the push button (BUTTON\_PORT).
- Calls the initInterrupt0 function to initialize the interrupt.
- Enters a continuous loop (while (1)) where LEDs are toggled every 3 seconds.

#### **IV. Critical Analysis / Conclusion**

In conclusion, the lab effectively demonstrated interrupt handling with the Atmega328p microcontroller. The hardware setup, consisting of an Arduino Uno Board, push button, LEDs, and connecting wires, facilitated practical implementation. The code configuration allowed the microcontroller to respond to push button interrupts, achieving the objective of the lab.