Lab-8 Group -4 report

(210020050,210020007)

Objective

Configure and use UART communication on the Tiva C Series TM4C123GH6PM microcontroller to communicate with a computer and control LEDs based on received data.

Program the microcontroller to communicate serially with a computer.

When a specific character is received by the microcontroller:

- If 'R' is received, turn on the **Red** LED.
- If 'B' is received, turn on the **Blue** LED.
- If 'G' is received, turn on the **Green** LED.
- If any other character is received, turn off all LEDs.

The received character should be echoed back to the computer.

Approach

Initialization:

- UART0_INT_HANDLER: This function is an interrupt handler for UART0. It receives a character, checks it, and controls the LEDs accordingly. It also sends the received character back over UART to the computer.
- main(): Configures UART0 for serial communication on Port A (PA0 and PA1) and enables the required clocks and interrupts for UART and GPIO ports.

LED Control: When a specific character is received:

```
void UART0_INT_HANDLER(void)
{
  char rx;
  rx = UART0_Receiver();
  if (rx=='R')
  {
    GPIO_PORTF_DATA_R = 0x02;
```

```
  }
  else if (rx =='G')
  {
    GPIO_PORTF_DATA_R = 0x08;
  }
  else if (rx == 'B')
  {
    GPIO_PORTF_DATA_R = 0x04;
  }
  else{
    GPIO_PORTF_DATA_R = 0x00;
  }
  UART0_Transmitter(rx);
  UART0_ICR_R|=0x10;
}
```

- 'R': Turns on the Red LED by setting GPIO_PORTF_DATA_R to 0x02.
- 'G': Turns on the Green LED by setting GPIO_PORTF_DATA_R to 0x08.
- 'B': Turns on the Blue LED by setting GPIO_PORTF_DATA_R to 0x04.
- Any other character: Turns off all LEDs by setting GPIO_PORTF_DATA_R to 0x00.

Data Transmission:

```
void UART0_Transmitter(char data)
{
  while ((UART0_FR_R & (1 << 5)) != 0)
    ;
  UART0_DR_R = data;
  check = check + 1;
}
char UART0_Receiver(void)
{
  char data;
  while ((UART0_FR_R & (1 << 4)) != 0)
    ;
  data = UART0_DR_R;
  start = start + 1;
  return data;
}
```

- UART0_Transmitter: Sends data back to the computer.
- UART0_Receiver: Waits for and receives data from the computer.

Observations

When characters 'R', 'G', or 'B' are sent to the microcontroller, the corresponding LED on the Tiva C Series board lights up as expected. Any other character turns off all LEDs. The characters are successfully echoed back to the computer, confirming the UART communication.

Conclusion

This lab successfully demonstrates UART configuration and communication on the Tiva C Series microcontroller, as well as its use in controlling external peripherals (LEDs) based on data received serially. The code effectively processes incoming characters, controls GPIO outputs, and sends data back over UART. This forms the basis for serial communication and peripheral control in embedded applications.