2.4 INTERFACING DC MOTOR WITH LPC1768 MICROCONTROLLER

Learning Outcomes:

After studying this interfacing project, learners will be able to:

Learn to Interface a DC Motor with LPC1768.

Understand and Implement Manual PWM Generation in Embedded C.

Understand how varying the duty cycle affects the motor speed.

2.4.1 INTERFACING DIAGRAM

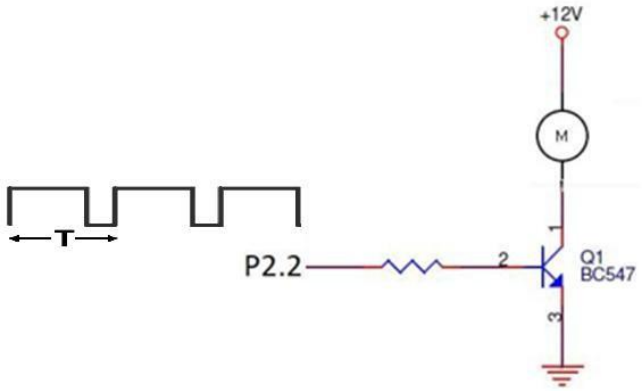

Fig.: Interfacing DC Motor with LPC1768 Microcontroller

Working of the Circuit

- PWM Signal from LPC1768 (P2.2) ○ **P2.2 is HIGH (PWM ON):**The transistor turns ON (saturation mode). The motor receives +12V and runs.
    - **P2.2 is LOW (PWM OFF):** The transistor turns OFF (cut-off mode). The motor stops (no current flow).

- **Role of the Transistor (BC547)** ○ Acts as a **switch** to handle the high **current** required by the motor.
    - The **microcontroller cannot directly drive the motor**, as it operates at **3.3V/5V**, whereas the motor needs **12V**. ○ The **transistor amplifies the current** from the microcontroller to control the motor.

- **Role of PWM in Speed Control** ○ The **duty cycle** of the PWM signal determines the **speed** of the motor.
    - **Higher duty cycle** → More ON time → **Faster motor speed**.
    - **Lower duty cycle** → Less ON time → **Slower motor speed**.

2.4.2 EXAMPLE CODES

Write a C program to generate a PWM signal manually using GPIO pins on an LPC1768 microcontroller. The PWM signal should control a motor with a defined duty cycle and period.

```
#include <lpc17xx.h>

#define PWM_PIN     2             // P2.2 as output
#define DutyCycle  20           // Define Duty Cycle (0-100%)
#define Period      100         //Define the Period of Waveform
 int
main(void)
{     unsigned int
i;
       unsigned int
ON_TIME;     unsigned int
OFF_TIME;

     // Configure P2.2 as GPIO output
     LPC_GPIO2->FIODIR |= (1<<PWM_PIN);

     ON_TIME  = (Period * DutyCycle) / 100;
     OFF_TIME = Period - ON_TIME;

     while(1)
     {
         // Generate PWM signal manually
LPC_GPIO2->FIOSET = (1<<PWM_PIN);             for
(i = 0; i < ON_TIME; i++);

          LPC_GPIO2->FIOCLR = (1<<PWM_PIN);
     for (i = 0; i < OFF_TIME; i++);
     }
}
```

Further exploration:

Use internal PWM of LPC1768.