Lab Manual for Embedded System Design

Lab No. 13

Raspberry PI Hardware Applications

Objectives

Design and Interface Raspberry-PI Hardware Applications. Design Traffic Lights and Pulse Width Modulation (PWM) circuits.

LAB # 13
Raspberry PI Hardware Applications

Introduction

Raspberry – Pi GPIO Controller:

- The R-Pi GPIO connector actually has a number of different types of connection on them. There are:
- True GPIO (General Purpose Input Output) pins that you can use to turn LEDs on and off etc.
- I2C interface pins that allow you to connect hardware modules with just two control pins
- SPI interface with SPI devices, a similar concept to I2C but a different standard
- Serial Rx and Tx pins for communication with serial peripherals
- In addition, some of the pins can be used for PWM (pulse Width Modulation) for power control and another type of pulse generation for controlling servo motors called PPM (Pulse Position Modulation).

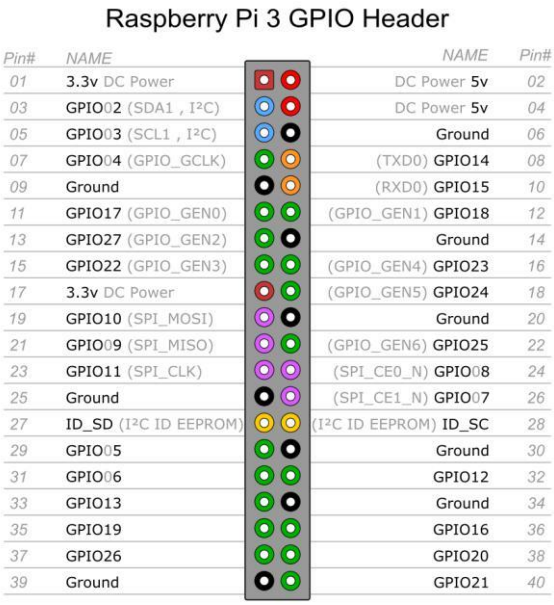
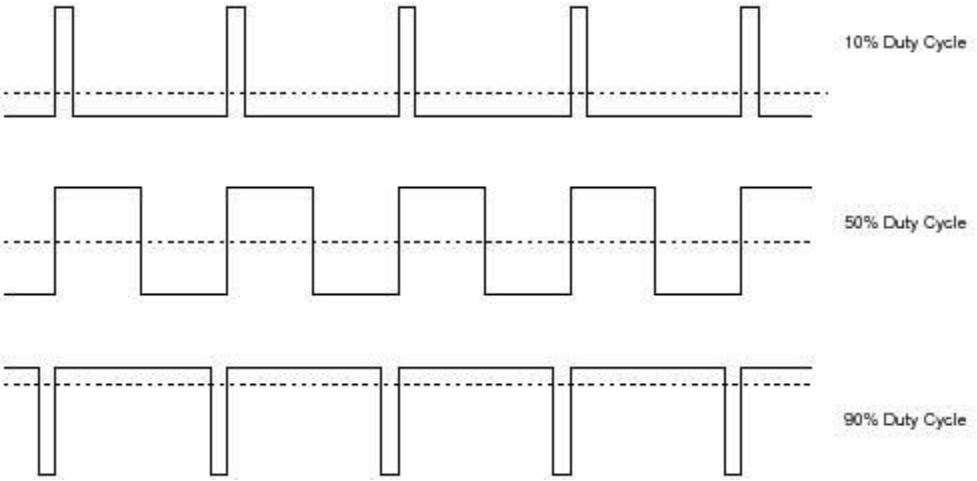


Fig. 9.1: GPIO Inputs

PWM:

Pulse width modulation (PWM) is a powerful technique for controlling analog circuits with a microprocessor's digital outputs.



Time Boxing

Activity Name	Activity Time	Total Time
Login Systems + Setting up Raspberry PI Environment	3 mints + 5 mints	8 mints
Walk through Theory & Tasks	60 mints	60 mints
Implement Tasks	80 mints	80 mints
Evaluation Time	30 mints	30 mints
	Total Duration	178 mints

Objectives

1. Design and Interface Raspberry-PI Hardware Applications.

2. Design Traffic Lights and Pulse Width Modulation (PWM) circuits.

Lab Tasks/Practical Work

1. In this task we will write a simple Python script in LXTerminal to glow LED using GPIO 7 of Raspberry-Pi.

```
import RPi.GPIO as GPIO
GPIO.setmode (GPIO.BOARD)
GPIO.setup (7, GPIO.OUT)
GPIO.output (7, True)
```

2. In this task we will write a simple Python script in LXTerminal to blink single LED using a GPIO 7 of Raspberry-Pi.

```
import RPi.GPIO as GPIO
import time
GPIO.setmode (GPIO.BOARD)
GPIO.setup (7, GPIO.OUT)
While True:
    GPIO.output (7, True)
    time.sleep (0.5)
    GPIO.output (7, False)
    time.sleep (0.5)
```

3. In this task we will write a simple Python script to control LED using GPIOs as PWM application.

```
import RPi.GPIO as GPIO
GPIO.setmode(GPIO.BOARD)
GPIO.setup(7, GPIO.OUT)
pwm_led = GPIO.PWM(7, 500)
pwm_led.start(100)
while True:
    duty_s = input("Enter Brightness (0 to 100):")
    duty = int(duty_s)
    pwm_led.ChangeDutyCycle(duty)
```

4. In this task we will write a simple Python script for Traffic control signals using various GPIOs.

```
import RPi.GPIO as GPIO
 import time
GPIO.cleanup()


GPIO.setmode(GPIO.BOARD)
GPIO.setup(3,GPIO.OUT)
GPIO.setup(5,GPIO.OUT)
GPIO.setup(7,GPIO.OUT)
GPIO.setwarnings(False)
while True:
        GPIO.output(7,GPIO.HIGH)
        time.sleep(5)
        GPIO.output(5,GPIO.HIGH)
        time.sleep(2)
        GPIO.output(7,GPIO.LOW)
        GPIO.output(5,GPIO.LOW)
        GPIO.output(3,GPIO.HIGH)
        time.sleep(10)
        GPIO.output(3,GPIO.LOW)
        GPIO.output(5,GPIO.HIGH)
```

4. Write a simple Python script to drive dc motors in both directions.