PWM DRAWER

AMIT - Graduation Project
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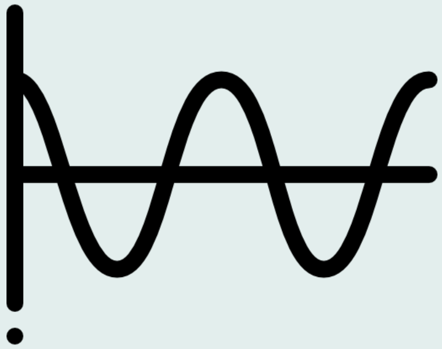
01

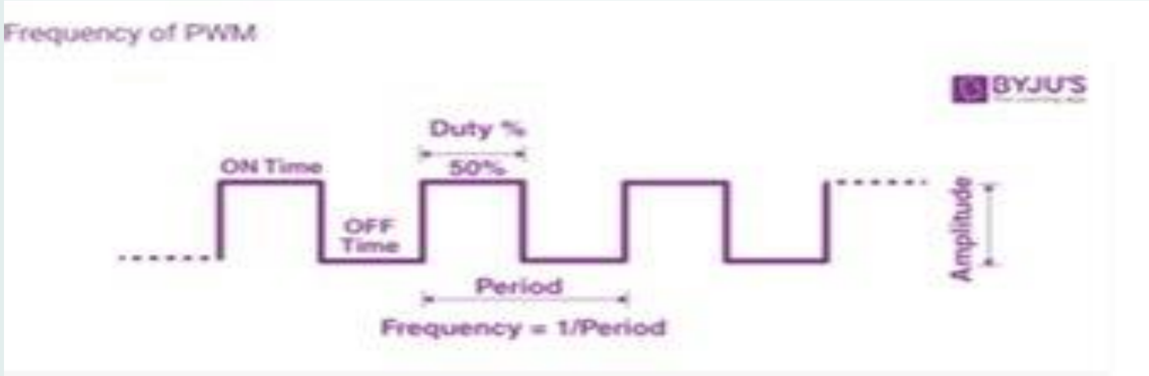
INTRODUCTION

01 - INTRODUCTION

Pulse width modulation is an effective technique that is used to control semiconductor devices. Pulse width modulation or PWM is a commonly used control technique that generates analog signals from digital devices such as microcontrollers. The signal thus produced will have a train of pulses, and these pulses will be in the form of square waves. Thus, at any given time, the wave will either be high or low.



Parameters of PWM



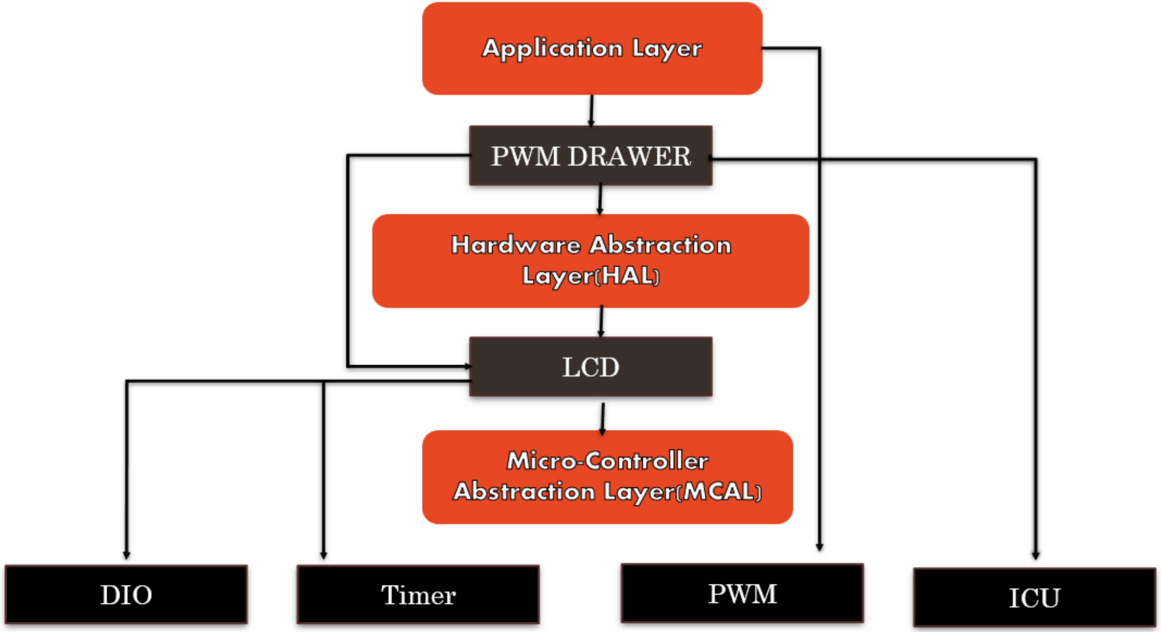
Duty factor

Time on/ Total period

Frequency

1/Period

02
LAYERED ARCHITECTURE



Application Layer

PWM DRAWER

Hardware Abstraction Layer(HAL)

LCD

Micro-Controller Abstraction Layer(MCAL)

DIO

Timer

PWM

ICU

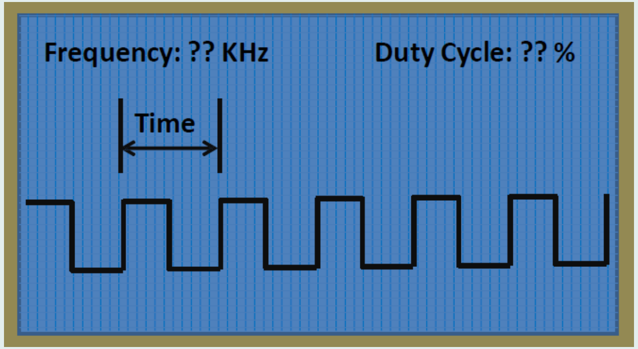
03

STEPS OF THE PROJECT

GRAPHICAL SPECIFICATIONS OF THE LCD

The following can be shown on the graphical LCD:

- The PWM shape, whether it was generated internally or from sources outside.
- The generated wave's frequency, which is displayed in KHz on the LCD's upper left side.
- The generated wave duty cycle, which is displayed on the LCD's upper right side.
- The duration of one cycle.



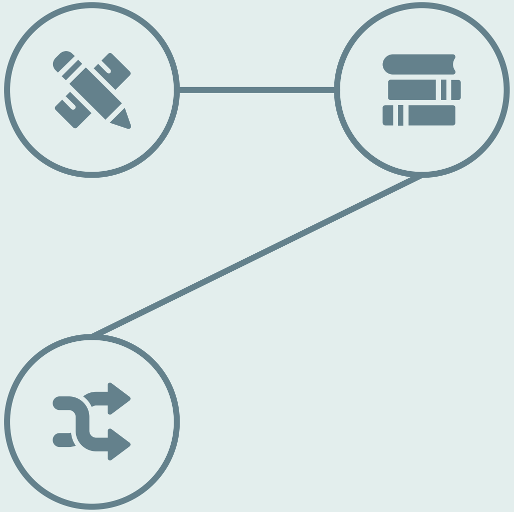
METHODOLOGY

01

ALGORITHM

02

OPERATION



03

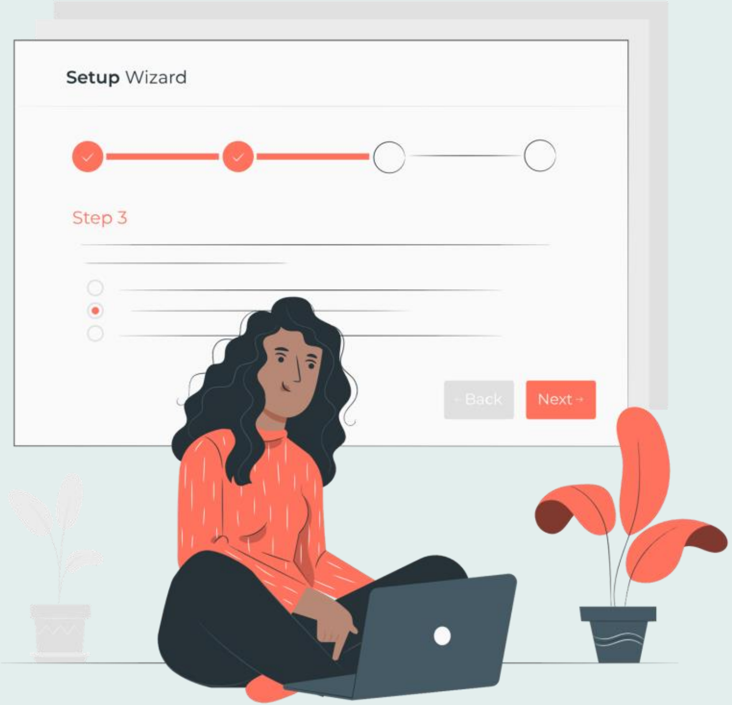
FLOWCHART

01- ALGORITHM

Started by planning the project by writing paper algorithms, and writing down the needed modules, and functions.

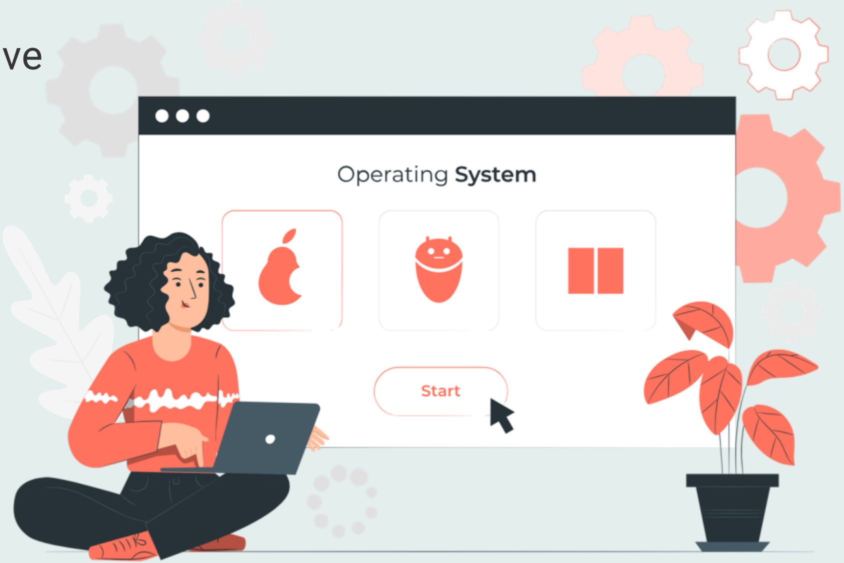
Did a research on PWM and watched similar projects

Used the datasheet to know the function of each register, pin and port, to know which ones to use.

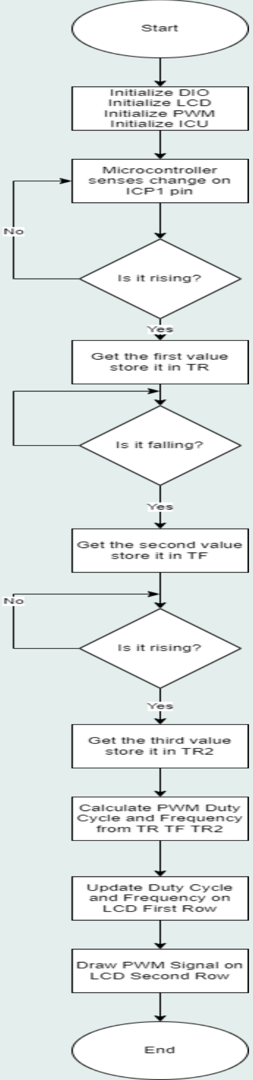


02- OPERATION

- Collected the DIO, Timer, and LCD modules we wrote in the course
- Write the LCD functions and define each pin
- Write the PWM function that calculates the frequency and the duty cycle and update the value on the LCD
- Write the PWM Drawer function that draws wave
- Check for errors and debug
- Flash the project on the microcontroller



03- FLOWCHART



Start

Initialize DIO
Initialize LCD
Initialize PWM
Initialize ICU

Microcontroller senses change on ICP1 pin

Is it rising?

No

Yes

Get the first value store it in TR

Is it falling?

Yes

Get the second value store it in TF

No

Is it rising?

Yes

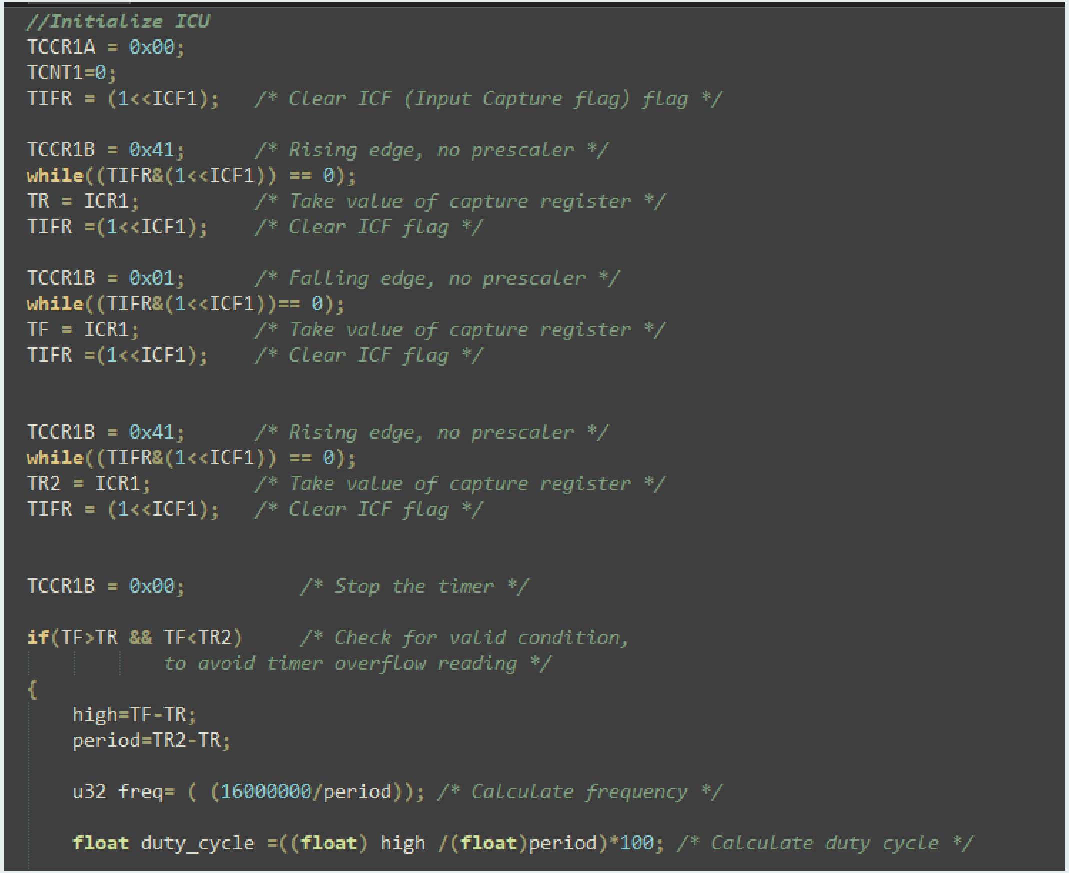
Get the third value store it in TR2

Calculate PWM Duty Cycle and Frequency from TR TF TR2

Update Duty Cycle and Frequency on LCD First Row

Draw PWM Signal on LCD Second Row

End



```
//Initialize ICU
TCCR1A = 0x00;
TCNT1=0;
TIFR = (1<<ICF1);   /* Clear ICF (Input Capture flag) flag */

TCCR1B = 0x41;      /* Rising edge, no prescaler */
while((TIFR&(1<<ICF1)) == 0);
TR = ICR1;          /* Take value of capture register */
TIFR =(1<<ICF1);    /* Clear ICF flag */

TCCR1B = 0x01;      /* Falling edge, no prescaler */
while((TIFR&(1<<ICF1))== 0);
TF = ICR1;          /* Take value of capture register */
TIFR =(1<<ICF1);    /* Clear ICF flag */


TCCR1B = 0x41;      /* Rising edge, no prescaler */
while((TIFR&(1<<ICF1)) == 0);
TR2 = ICR1;         /* Take value of capture register */
TIFR = (1<<ICF1);   /* Clear ICF flag */


TCCR1B = 0x00;          /* Stop the timer */

if(TF>TR && TF<TR2)     /* Check for valid condition,
            to avoid timer overflow reading */
{
    high=TF-TR;
    period=TR2-TR;

    u32 freq= ( (16000000/period)); /* Calculate frequency */

    float duty_cycle =((float) high /(float)period)*100; /* Calculate duty cycle */
```

THANKS!

Do you have any questions?