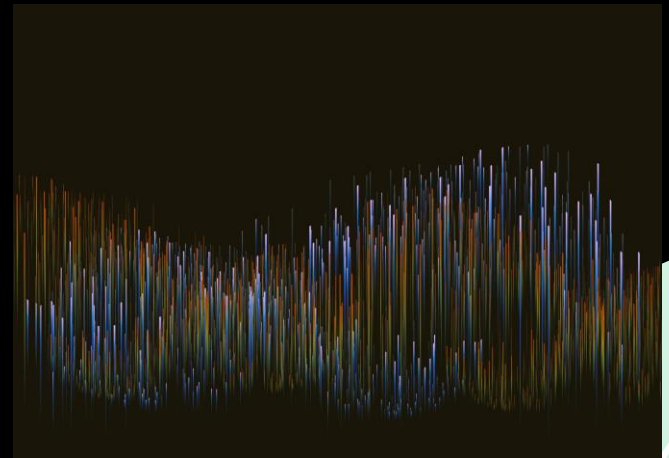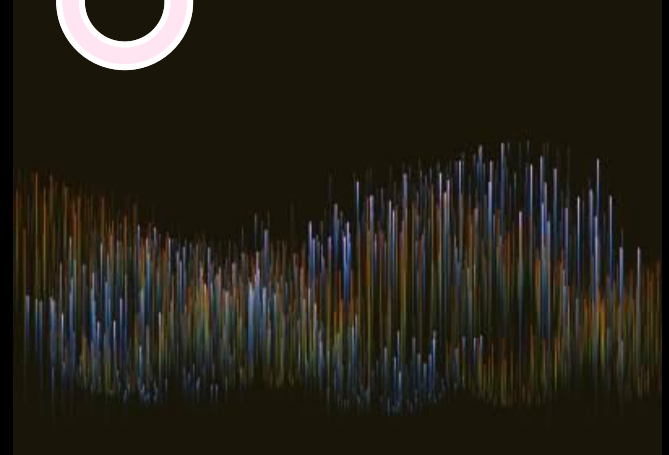# GRADUATION PROJECT

APPLICATION: PWM DRAWER

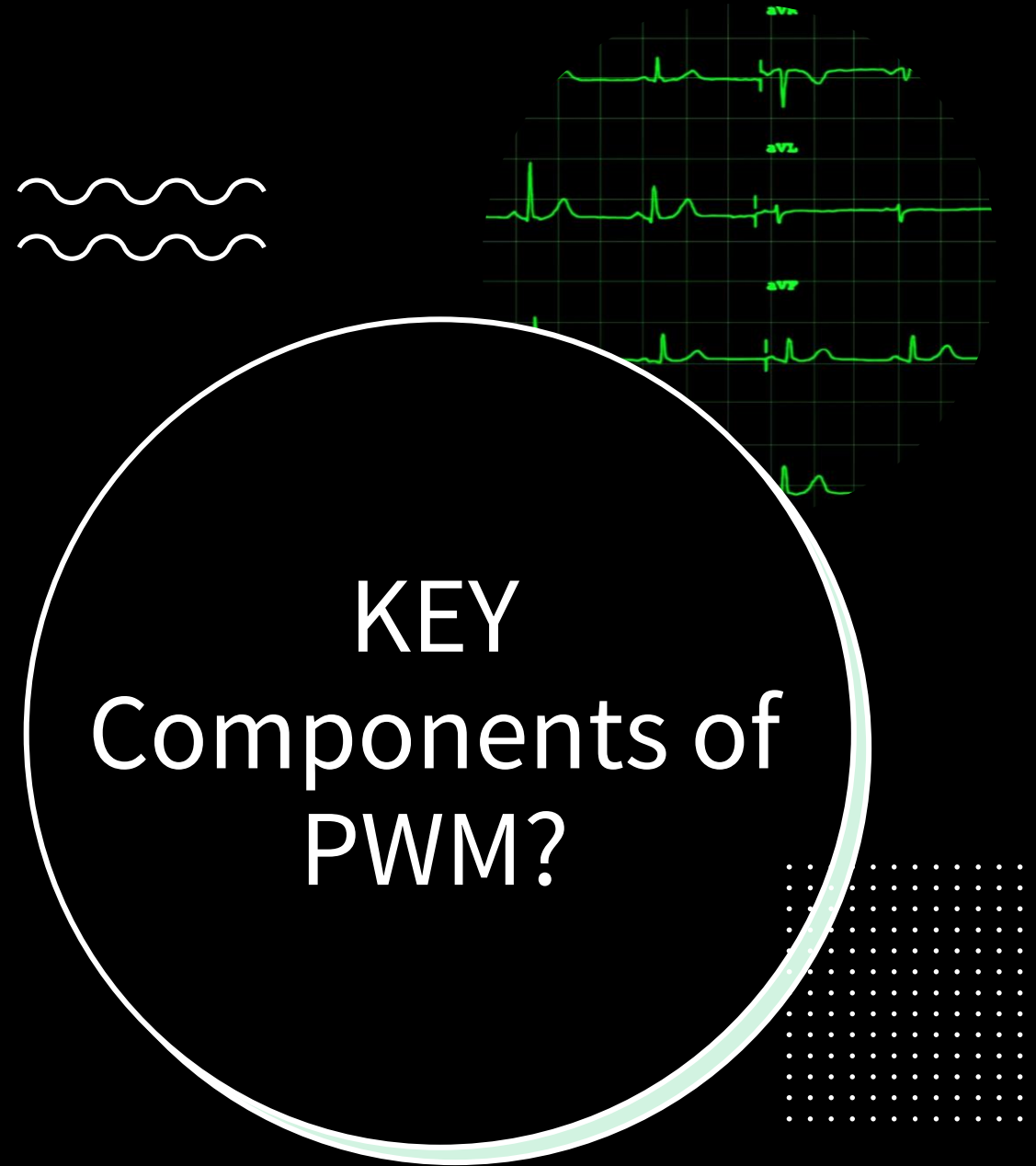PROJECT BY: SALMA WALIED YOUNES

Project Description

- PWM drawer works as a mini oscilloscope that is responsible for printing the frequency and the waveform of the generated PWM signal.

- The generated wave came from two sources, external sources (e.g. generated PWM from other MCs), or internal source of the Microcontroller of the project itself.

What is PWM?
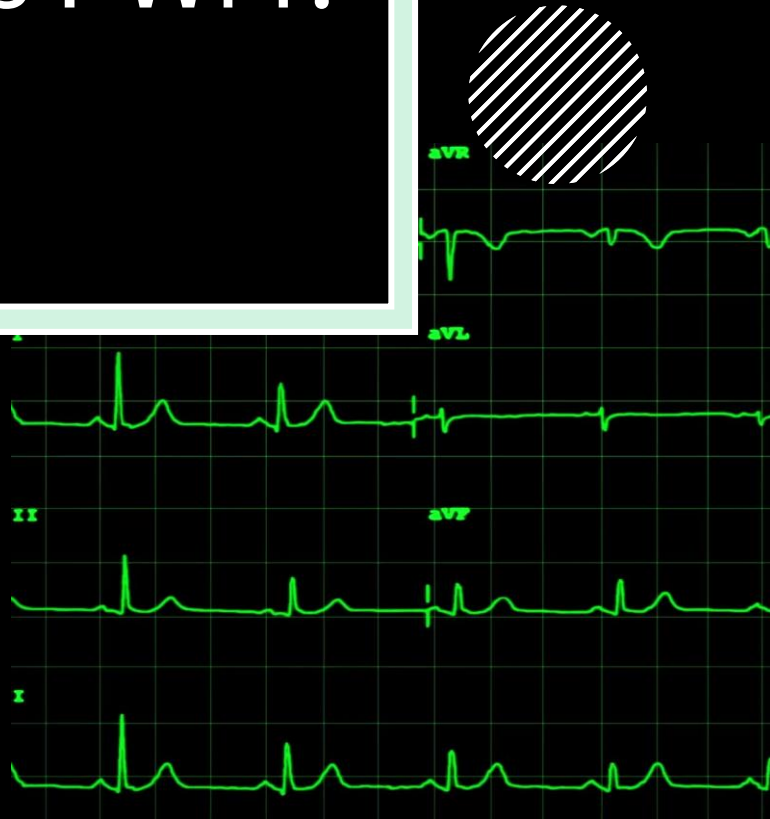
PWM stands for Pulse Width Modulation. It is a technique used to control the average power delivered to a load by varying the width (duration) of a series of pulses of a fixed amplitude and frequency. In PWM, the signal is typically a square wave with a fixed period and varying duty cycle.

KEY Components of PWM?

1. Duty Cycle: The duty cycle represents the ratio of the ON time to the total period of the signal. It is usually expressed as a percentage. For example, a duty cycle of 50% means the signal is ON for half of the period.

2. Frequency: The frequency of the PWM signal determines how often the pulses occur within a given time period. It is typically measured in Hertz (Hz), indicating the number of pulses per second.

3. Average Power Control: By varying the duty cycle of the PWM signal, the average power delivered to a load can be controlled. A higher duty cycle results in more power being delivered, while a lower duty cycle reduces the average power.

PWM Application

- Motor Speed Control: PWM is commonly used to control the speed of DC motors and servo motors. By adjusting the duty cycle, the average voltage applied to the motor can be controlled, thus regulating the motor speed.

- Power Regulation: PWM is used in power supplies to regulate the output voltage. By adjusting the duty cycle, the average output voltage can be controlled to match the desired level.

- LED Dimming: PWM is employed to control the brightness of LEDs. By varying the duty cycle, the average current flowing through the LED can be adjusted, resulting in varying brightness levels.

- Audio Amplification: PWM is used in class D audio amplifiers to convert analog audio signals into PWM signals. These signals are then amplified and filtered to produce high-quality audio output.

Pulse Width Modulation

- The advantages of PWM include efficient power usage, precise control over the average power delivered, and the ability to achieve smooth and accurate control in various applications.

- Overall, PWM is a versatile technique used in a wide range of electronic systems to control power, speed, and brightness, offering flexibility and efficiency in many applications.
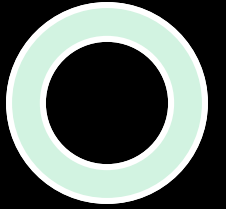
Components Of The Project

- Graphical LCD **glcd-128x64** *(LGM12641BS1R)*

- ATMEGA 32

- Power & Ground

- Connections
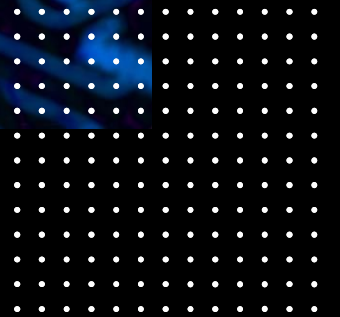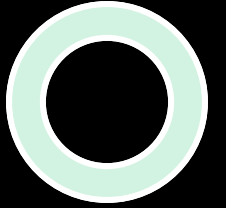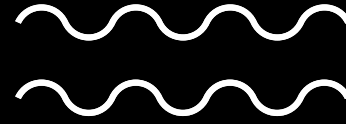
Specification - Graphical LCD

The PWM Drawer utilizes a Graphical LCD for displaying the PWM waveform and frequency information.

The Graphical LCD offers the following capabilities:

1. Displaying the Shape of Generated PWM:

The LCD can accurately represent the shape of the generated PWM waveform, whether it originates from internal or external sources.
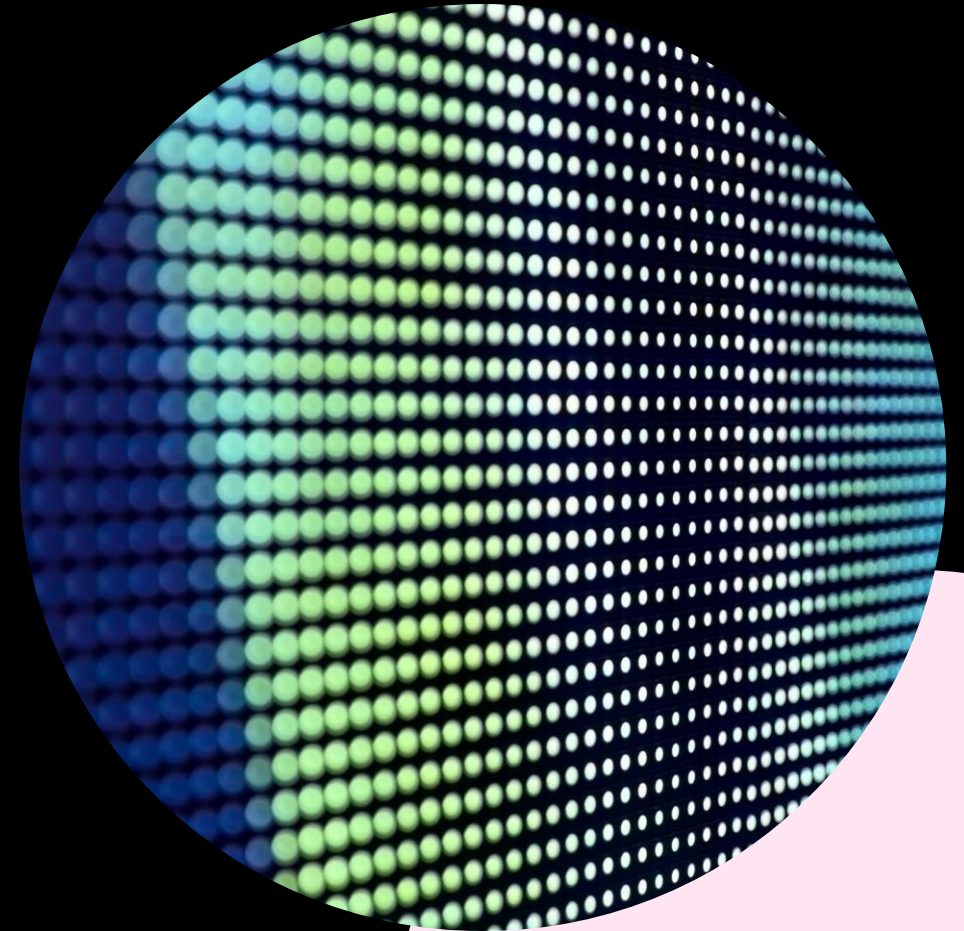
2. Frequency Display:

The upper left side of the LCD provides a clear indication of the frequency of the generated wave in kilohertz (KHz).
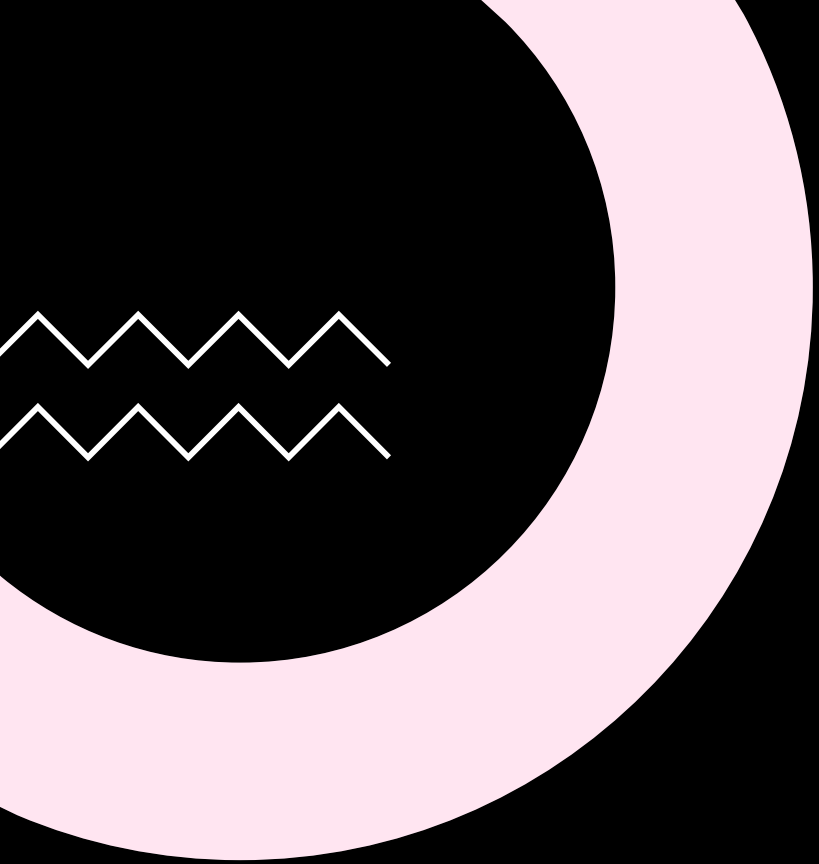
3. Duty Cycle Display:

The upper right side of the LCD shows the duty cycle of the generated wave, providing valuable information about the signal's on and off periods.
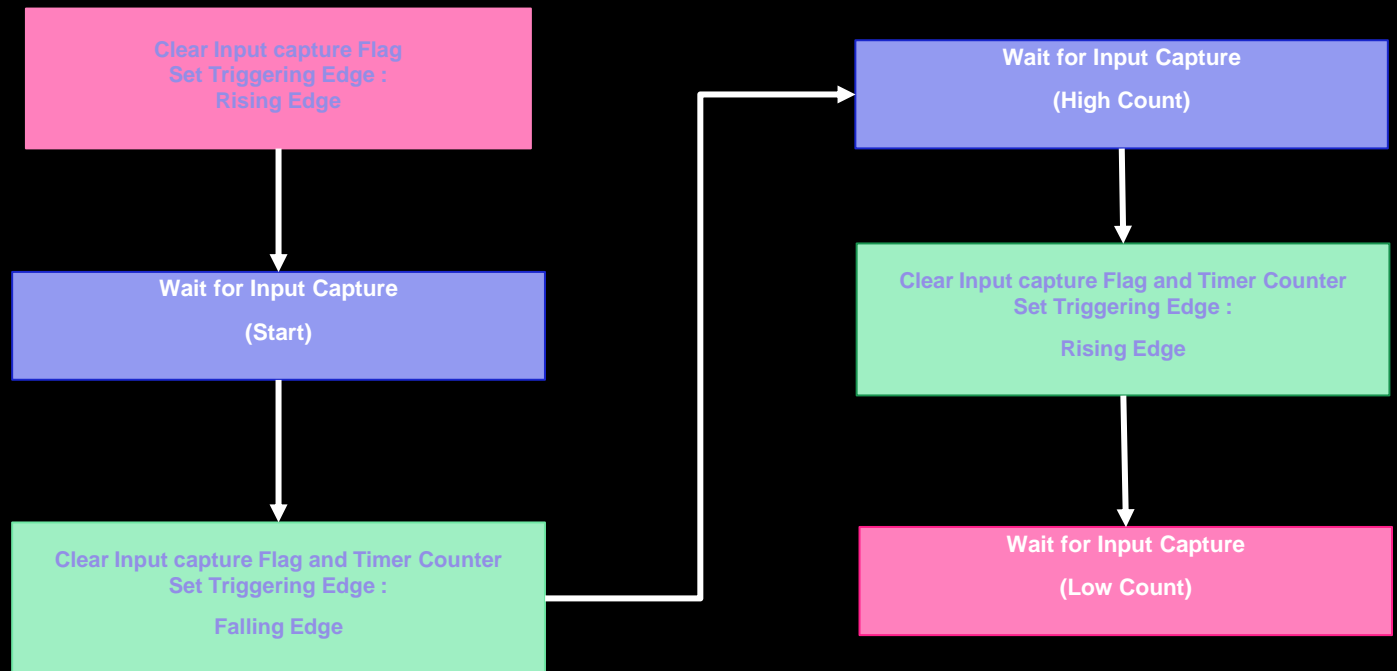
4. Single Cycle Time:

The PWM Drawer also provides information about the time duration of a single cycle of the PWM signal, aiding in waveform analysis and measurement.
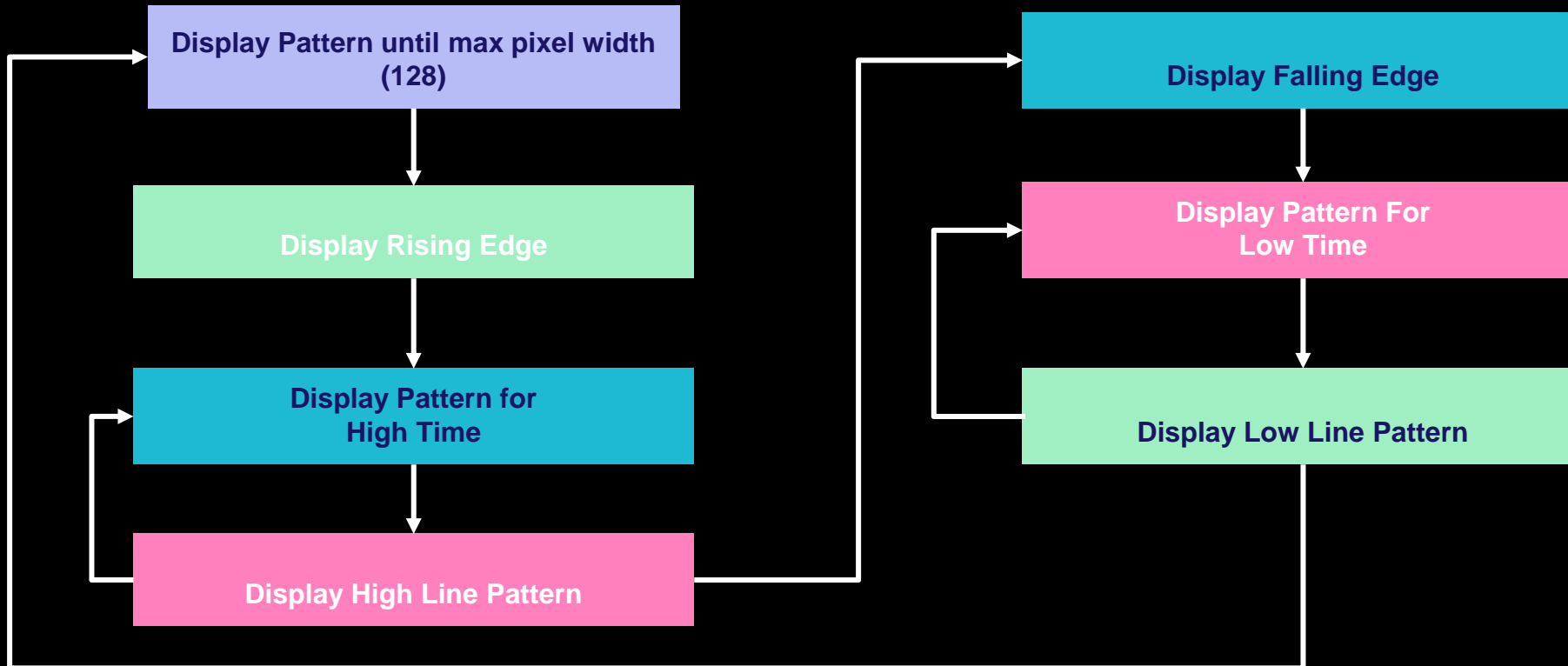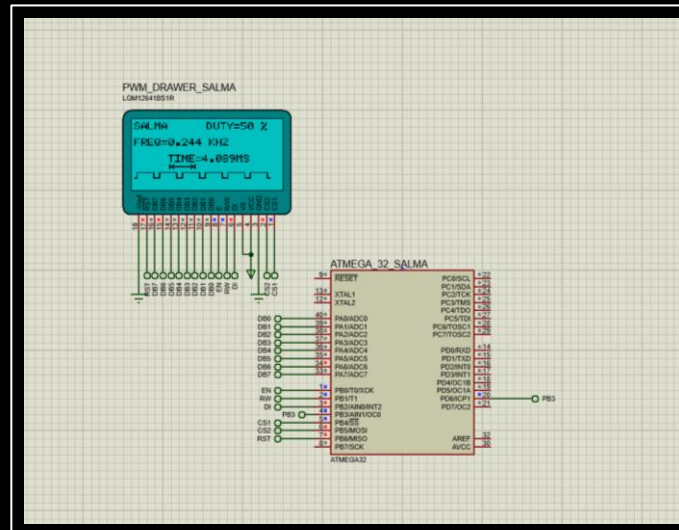
PWM Drawer Program

Clear Input capture Flag
Set Triggering Edge :
Rising Edge

Wait for Input Capture
(Start)

Clear Input capture Flag and Timer Counter
Set Triggering Edge :
Falling Edge

Wait for Input Capture
(High Count)

Clear Input capture Flag and Timer Counter
Set Triggering Edge :
Rising Edge

Wait for Input Capture
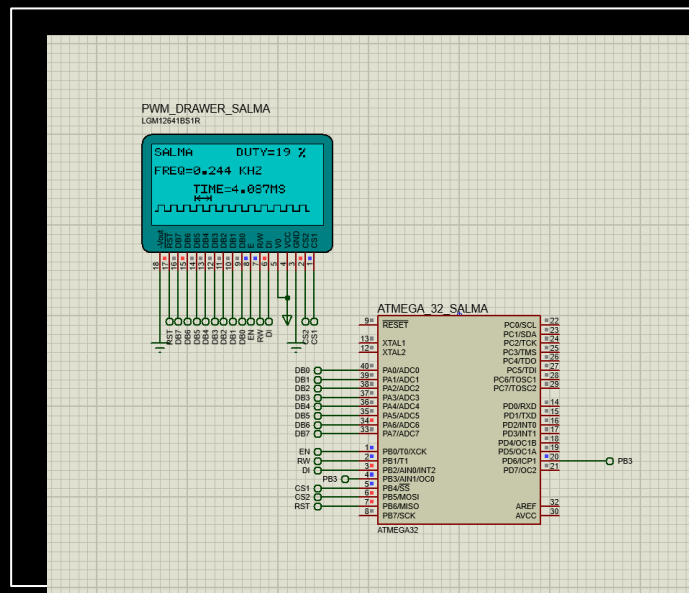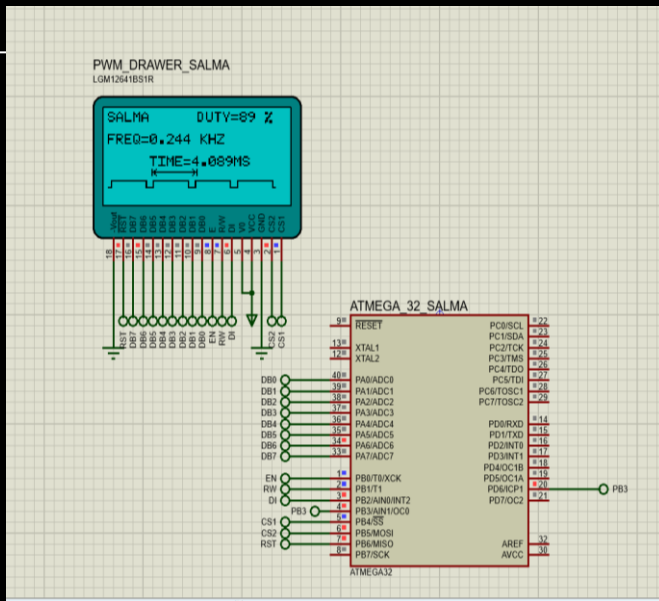(Low Count)

PWM Drawer Program

Draw Signal Shape

Simulation Results

Examples using prescaler 8, 64, 256 with duty cycles 90%, 50%, 20% respectively.

THANK YOU!