PWM Drawer ATmega32

Using GLCD

Graduation Project

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Layered Architecture

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03

Flowchart & I/O List

Layered Architecture

1

Application Layer

Main.c

2

Hardware Application Layer (HAL)

Display:
GLCD

3

Micro Controller Abstraction layer (MCAL)

DIO
GPT
PWM
ICU

Detailed Explanation

- 1. General Purpose Timer (GPT)***:***

GPT provides the timing base for PWM generation. It generates *delays* to correctly space out the waveform on the GLCD.

2. Digital Input/Output (DIO):

The microcontroller toggles a digital pin ***(HIGH or LOW)*** based on the duty cycle of the PWM.

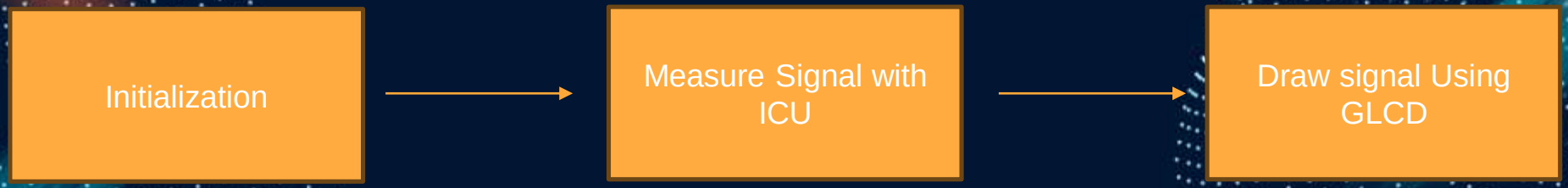
- 3. Input Capture Unit (ICU):

measures the characteristics of an incoming PWM signal. It records timestamps when an external PWM signal changes state (rising or falling edges). ***the ICU can measure the duty cycle and period to adjust control.***

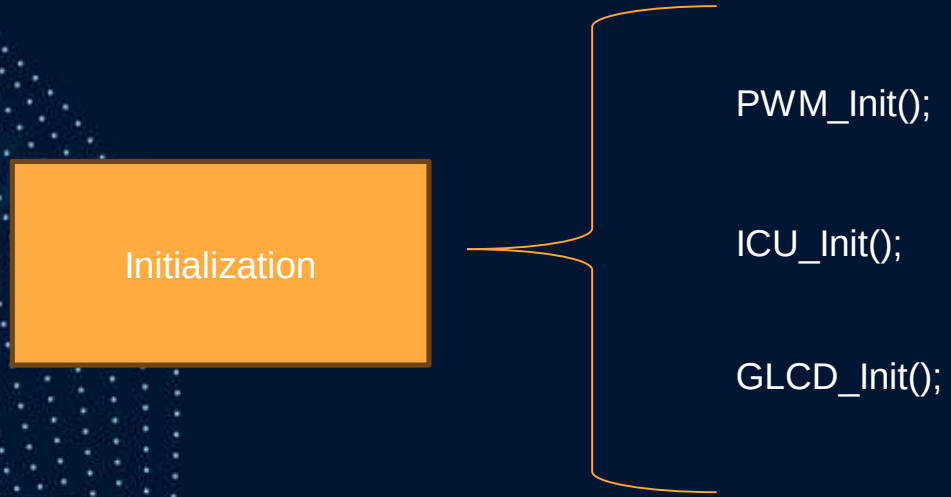
4. PWM Module:

It uses a timer (GPT) to generate a PWM waveform directly. The user only needs to configure parameters like frequency and duty cycle.

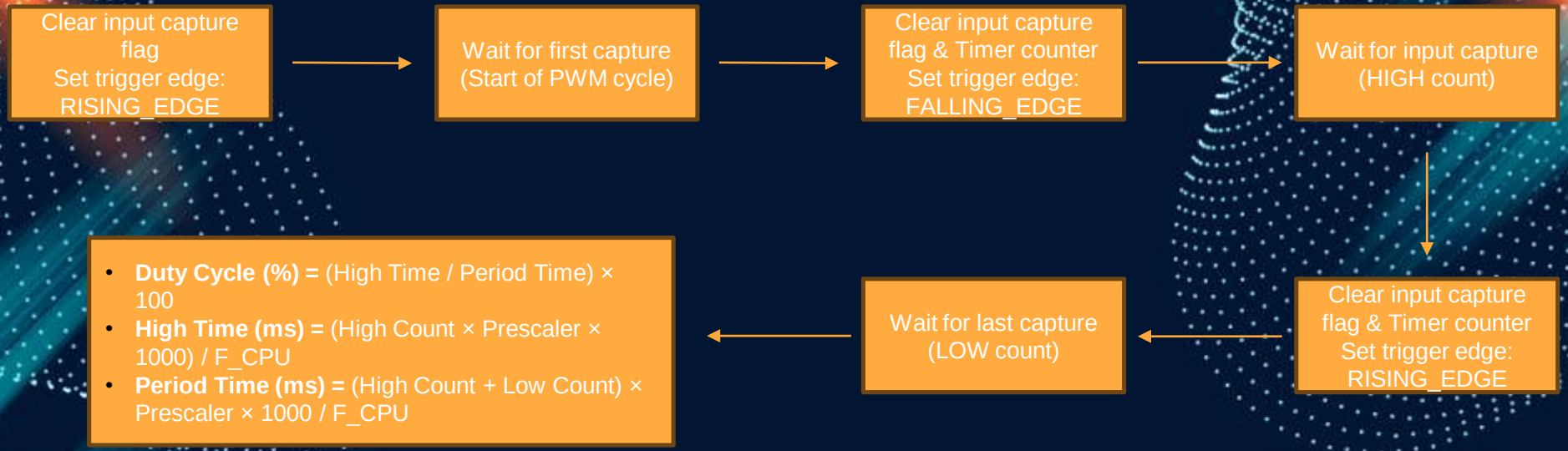
Flowchart


Initialization
Measure Signal with ICU
Draw signal Using GLCD

Flowchart Detailed (1): The Initialization



Flowchart Detailed (2): Measure Signal using ICU



Flowchart Explanation (2): Measure Signal using ICU

ICU_GetDutyCycle();

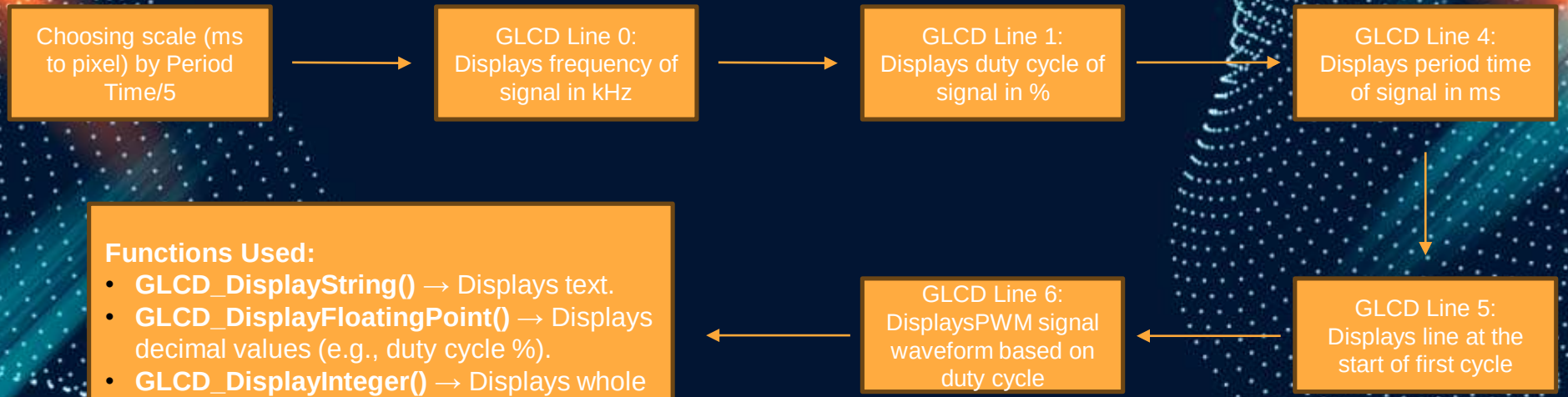
1. Detect the Start of the Signal (Rising Edge)
- Clear the Input Capture Flag.
- Set the trigger to **detect a rising edge** (start of the high pulse).
- Wait for the first capture (this marks the beginning of the PWM cycle).

2. Measure High Time (Falling Edge)
- Clear the Input Capture Flag and reset the timer.
- Set the trigger to **detect a falling edge** (end of the high pulse).
- Wait for the second capture (this marks the end of the high pulse).
- Store this time as **High Count – how long signal stays ON**.

3. Measure the Full Period (Next Rising Edge)
- Clear the Input Capture Flag and reset the timer.
- Set the trigger back to **rising edge** (end of the low pulse).
- Wait for the third capture (this marks the end of the PWM cycle).
- Store this as **Low Count - how long signal stays OFF**.

4. Calculate Duty Cycle
- **Duty Cycle (%) =** (High Time / Period Time) × 100
- **High Time (ms) =** (High Count × Prescaler × 1000) / F_CPU
- **Period Time (ms) =** (High Count + Low Count) × Prescaler × 1000 / F_CPU

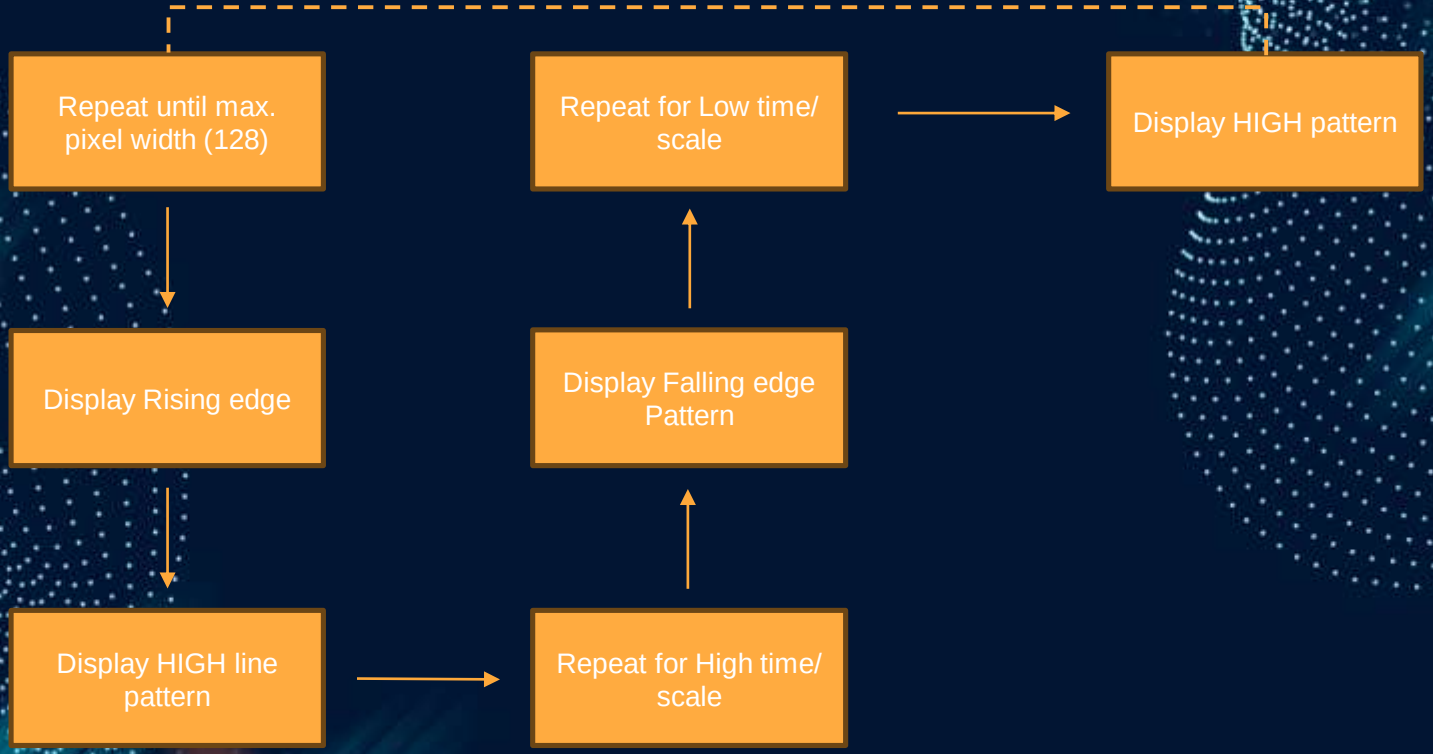
Flowchart Detailed (3.1): Draw signal Using GLCD



Functions Used:

- **GLCD_DisplayString()** → Displays text.
- **GLCD_DisplayFloatingPoint()** → Displays decimal values (e.g., duty cycle %).
- **GLCD_DisplayInteger()** → Displays whole numbers (e.g., frequency, period).
- **GLCD_DisplaySpecialPattern()** → Draws the waveform and the arrow.

Flowchart Detailed (3.2): Draw signal Using GLCD



I/O List

Input

Signal Name	Type	Description
PWM Signal Input	Digital (I)	The PWM signal source to be displayed on GLCD (could be from a microcontroller or external generator).
Microcontroller Clock (System Clock)	Internal	Provides the clock signal for timers and display refresh.

I/O List

Output

Signal Name	Type	Description
GLCD Data Lines (DB0-DB7)	Digital (O)	Used to send waveform pixel data to the GLCD.
GLCD RS (Register Select)	Digital (O)	Controls command/data mode of GLCD.
GLCD RW (Read/Write)	Digital (O)	Selects read or write operation.
GLCD E (Enable)	Digital (O)	Triggers data transfer to GLCD.
PWM Waveform Display	Visual (O)	Displays the waveform pattern corresponding to the input signal.

I/O List

Signal Name	Type	Description
GPT Timer Output	Digital (O)	Generates timing delays for GLCD waveform updates.
DIO Pins (for GLCD Control)	Digital (I/O)	Used for controlling and updating the GLCD screen.

Thank You !