PROJECT OBJECTIVE

The objective of the project was to construct a Morse code decoder on the FRDM-KL05Z development board, where the input source is a button on an external keyboard. The project was developed in the Keil uVision5 programming environment using the C language and pre-existing libraries.

CIRCUIT SCHEMATIC

1. COMPONENTS USED

- FRDM-KL05Z development board
- 4x4 matrix keyboard
- 16x2 LCD display
- I2C converter for the 16x2 LCD display

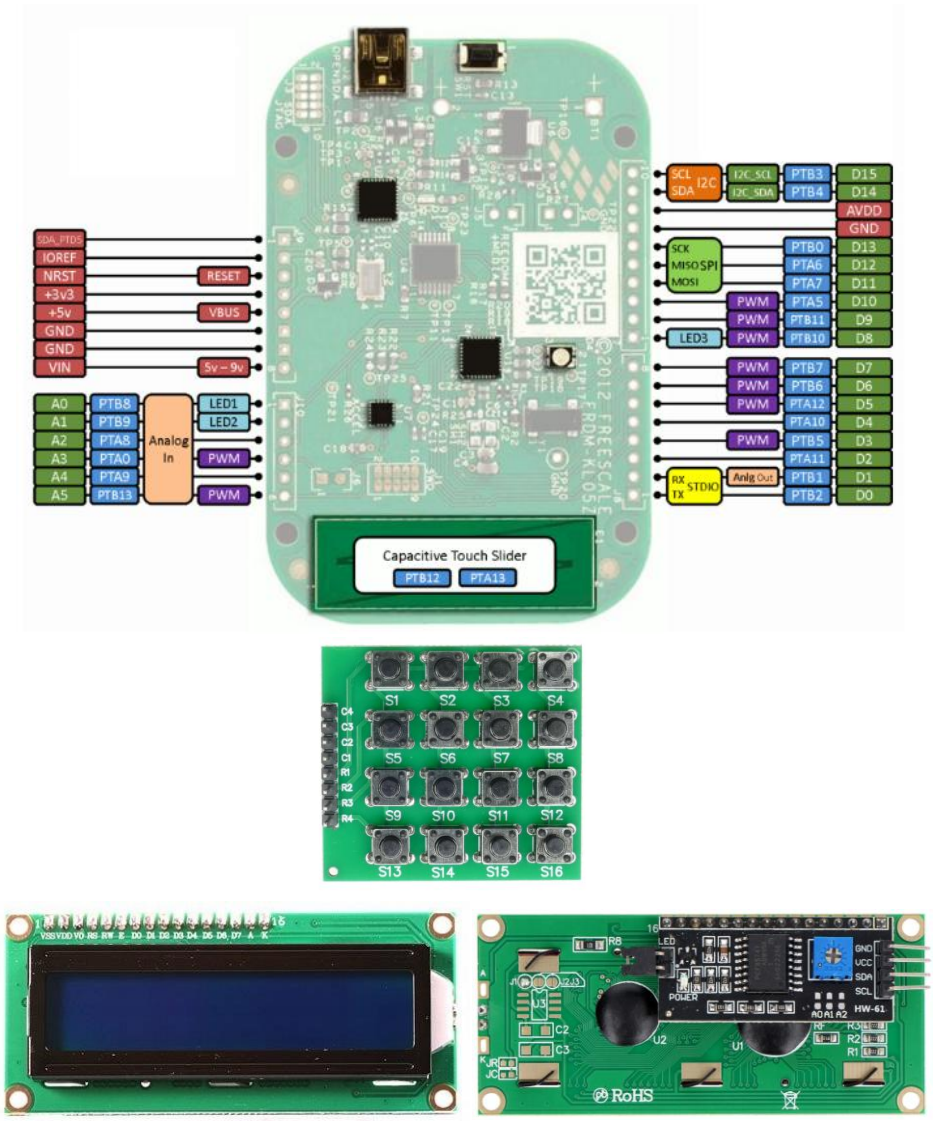

Figure 1: Decoder circuit components

2. *Overview Schematic*

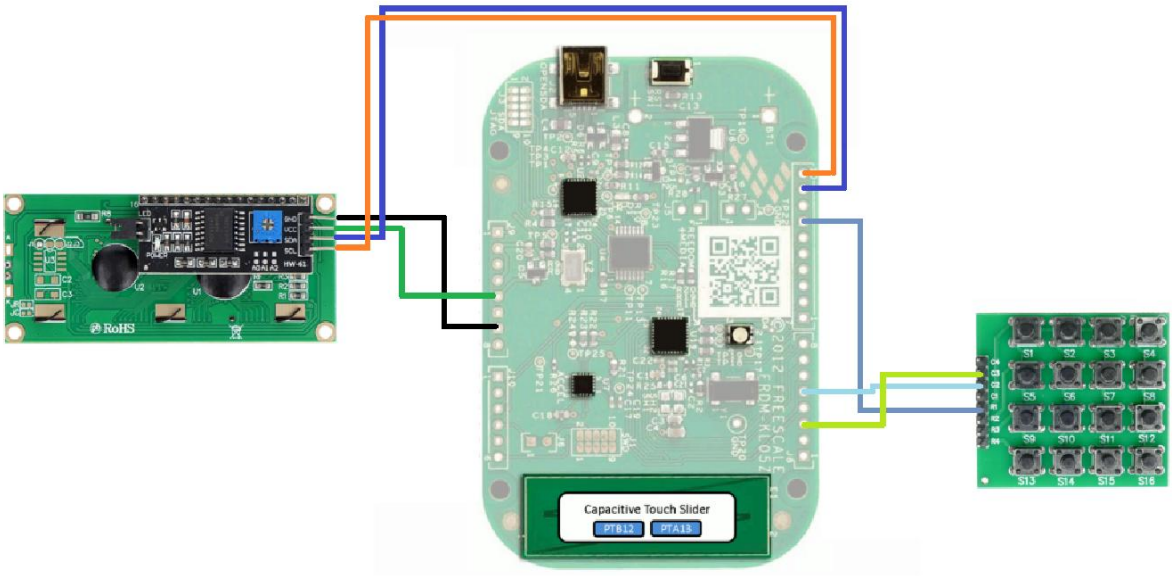

Figure 2: Decoder circuit schematic

FRDM-KL05Z	**LCD**
PTB3	SCL
PTB4	SDA
+5V	VCC
GND	GND

Table 1: LCD Connection to KL05Z Board

FRDM-KL05Z	**Keyboard**
GND	R1
PTA10	C2
PTA11	C3

Table 2: Keyboard Connection to KL05Z Board

FUNCTIONAL DESCRIPTION

The program implements a simple Morse code decoder on the MKL05Z4 platform using buttons and an LCD display. Its primary function is to interpret input signals in the form of dots (".") and dashes ("-"), then convert them into letters, numbers, or special characters. Additionally, it displays the translated message on the LCD and allows resetting the decoder's state.

Key Features

Input Signal Processing

- The user presses button S2 to input Morse signals.
- The duration of button presses determines the type of signal:
    - Short press (< 300 ms) – dot (".").
    - Long press (> 300 ms) – dash ("-").
- The pause between presses determines different stages:
    - A pause between 1000 ms and 3000 ms signifies the end of a character.
    - A pause longer than 3000 ms signifies the end of a word, inserting a space between words.

Morse Code Decoding

- The entered Morse code is compared with a lookup table.
- If recognized, the corresponding character (from the alphabet, digits, and special symbols) is added to the decoded message.
- If the code is unrecognized, a "*" symbol is returned but not displayed on the LCD.

Displaying Results

- The current Morse code is displayed in the first row of the LCD.
- The decoded message appears in the second row.

Decoder Reset

- Pressing button S3 clears both the entered Morse code and the decoded message.
- The LCD resets to the welcome screen: "Morse Decoder".

Key Functions and Mechanisms

decode_morse

- This function translates a sequence of dots and dashes into the corresponding alphanumeric or special character.
- If the code is unrecognized, a "*" symbol is returned.

Interrupt handling

PORTA_IRQHandler

- Interrupt handling for state changes of buttons S2 and S3.
- Registers button presses and sets appropriate flags.

SysTick_Handler

- Measures the duration of button presses and pauses between them.

Main program loop

In the main loop, input signals (press duration and pauses) are analyzed, and appropriate actions are executed:

- Adding a dot or dash to the current Morse code.
- Decoding the code after a long pause.
- Clearing the screen and resetting when button S3 is pressed.

Hardware layer

MKL05Z4 Microcontroller

- Handles interrupts and timing.

Buttons S2 and S3

- S2: Inputs Morse signals.
- S3: Resets the decoder.

LCD1602 Display

- Displays the current Morse code and the decoded message.