

**ECEN406**

**Microprocessor System Design**

**Grade finder using ID**

**Abstract**

This project presents an x86 assembly language program that interfaces with LCD and processes user input from a keypad. The program begins with an initialization phase, configuring input/output ports and initializing the LCD. The main program loop engages the user to input an ID from 1 to 9 using a keypad.

The code effectively handles keypad inputs, displaying corresponding information on the LCD screen. Subroutines manage LCD initialization, command execution, and character/string writing. The project demonstrates the integration of hardware interfacing and user interaction through keypad inputs, providing a foundation for similar applications. The report outlines the program's structure, key components, and the flow of execution, offering insights into the functionalities achieved. Further details of the hardware setup are necessary for a comprehensive understanding and successful implementation.

**Introduction**

The main goal of this project is to design and implement a Grade Finder system that utilizes the processing power of the 8086 microprocessors. The Grade Finder system will encompass the development of software components.

The Grade Finder system revolves around the input of a student's identification (ID) through a keypad and the subsequent retrieval and display of the corresponding academic data on an LCD screen. The keypad serves as the primary input device, allowing users to enter the student's ID with ease.

The 82C55 peripheral interface chip processes the input from the keypad, ensuring accurate data transmission to the microprocessor for further processing. Once the student's ID is received, the 8086 microprocessor initiates a search and retrieves the relevant data from the system's memory. The data, including the student's name, course grades, and any additional information, is then sent to the 82C55 chip2+96 for conversion and display on the LCD screen. The LCD screen provides a clear and concise interface for users to view the information, making it easily accessible for administrators, teachers, or other authorized personnel.

The software aspect will focus on creating an intuitive user interface, implementing efficient data storage, and developing algorithms for ID-based grade retrieval.

**Methodology**

This x86 assembly code is designed for interfacing with an LCD and processing input from a keypad. The program initializes ports, configures the LCD, and interacts with the user through the keypad to display information on the LCD screen.

A screenshot of a computer program

Description automatically generated

**A computer circuit board with many wires

Description automatically generated with medium confidenceMain Components**

**The 8086 microprocessor** is a 16-bit architecture that enables efficient data processing, allowing the microprocessor to handle the input from the keypad and perform the necessary calculations and operations to determine and display the grades on the LCD. With its segmented memory model, the 8086 can address a sufficient amount of memory to store the necessary data, such as student records and grade information.

Additionally, the 8086's extensive I/O capabilities make it well-suited for interfacing with the keypad and LCD. It can handle interrupt handling to detect and respond to keypad inputs, and its programmable I/O ports can control the display on the LCD, ensuring accurate and timely information is presented to the user. Overall, the 8086 microprocessor provides the processing power, memory management, and I/O capabilities required for an effective grade finder system that integrates a keypad and LCD.

**A computer circuit diagram with many wires

Description automatically generated with medium confidenceThe 74HC373** latch can be utilized as an integral component. The 74HC373 is a latch or flip-flop integrated circuit that provides temporary data storage capabilities. In this context, the 74HC373 can be employed as a buffer between the keypad and the microprocessor.

As the user inputs grades or data on the keypad, the 74HC373 latch can temporarily store this information until it is ready to be processed by the microprocessor. This ensures that the data remains stable during the transfer process, preventing any potential loss or corruption. Once the microprocessor is prepared to handle the keypad input, it can read the data from the 74HC373 latch and proceed with the necessary calculations and operations to determine the grades.

The resulting grades can then be displayed on the LCD, providing the user with the desired information. The 74HC373 latch acts as an intermediary, facilitating the synchronized transfer of data between the keypad and the microprocessor, enhancing the reliability and functionality of the gradefinder system.

**A diagram of a circuit board

Description automatically generatedThe 82C55 microprocessor** is a Programmable Peripheral Interface integrated circuit that serves as an I/O interface device, specifically designed for interfacing a microprocessor with peripheral devices. The 82C55 can be used to connect the keypad and the LCD to the microprocessor. It provides multiple I/O ports that can be configured to handle the input from the keypad and control the display on the LCD. The microprocessor communicates with the 82C55 through its address and data lines, issuing commands and reading or writing data to and from the peripheral devices.

The 82C55 acts as a bridge between the microprocessor and the keypad, enabling the microprocessor to receive input from the keypad and process it accordingly. Similarly, it facilitates the microprocessor's control over the LCD, allowing for the display of the calculated grades. Overall, the 82C55 microprocessor provides the necessary I/O capabilities and interface functionalities to seamlessly integrate the keypad and LCD into the gradefinder system, ensuring efficient data transfer and control operations.

**A screenshot of a computer

Description automatically generatedThe LCD** is Liquid Crystal Display that provides a visual interface for displaying the calculated grades or other relevant information to the user. It typically consists of multiple segments or pixels that can be individually controlled to form characters, numbers, or graphical elements. In the gradefinder system, once the microprocessor receives and processes the input from the keypad, it generates the corresponding grades or data.

The microprocessor then communicates with the LCD, sending the appropriate commands and data to display the calculated grades on the screen. The LCD's ability to present clear and easily readable information makes it an ideal choice for conveying the grades to the user. Sectionally, the LCD may also support other features, such as backlighting for enhanced visibility in various lighting conditions.

**A screen shot of a phone keypad

Description automatically generatedThe keypad** allows users to input data, such as grades or other relevant information, into the system. The keypad is typically composed of individual buttons, each representing a specific digit or function. When a user wants to input a grade, they press the corresponding buttons on the keypad, which generate electrical signals. These signals are then processed by the microprocessor, which interprets the input and performs the necessary calculations to determine the grades. The keypad enables a user-friendly and efficient means of data entry, allowing for quick and accurate input of grades. Its compact and intuitive design makes it convenient for users to interact with the gradefinder system. Overall, the keypad plays a vital role in gathering user input, providing an essential interface for users to input the necessary data, allowing the microprocessor to perform the calculations and display the grades on the LCD.

**Code explanation**

A diagram of a computer program

Description automatically generated

**Data Section**

Defines variables for storing port values (PORTA\_VAL, PORTB\_VAL, PORTC\_VAL).

Defines strings for LCD display (MYSTR, MYSTR1, TRY\_STR, etc.).

Defines constants for port addresses (PA, PB, PC) and configuration (CWR).

**Initialization**Initializes ports for input/output and configures the LCD.

Displays welcome messages on the LCD.

Displays the information for the range of IDs that we have.

**Main Program Loop**

Prompts the user to enter an ID from 1 to 9 using a keypad.

Processes the pressed button on the keypad and displays corresponding information on the LCD.

Handles invalid inputs, providing a retry message.

**Subroutines**DELAY: Implements a simple delay using a loop.

LCD\_INIT: Initializes the LCD with specific configurations.

LCD\_CMD: Sends commands to the LCD.

LCD\_CLEAR: Clears the LCD screen.

LCD\_WRITE\_CHAR: Writes a character to the LCD.

LCD\_WRITE\_STR: Writes a string to the LCD.

LCD\_SET\_CUR: Sets the cursor position on the LCD.

**Port Output Subroutines:**

OUT\_A, OUT\_B, OUT\_C: Used to send data to ports A, B, and C, respectively.

**Flow of Execution:**

The program starts with initialization, configuring ports and initializing the LCD.

It enters the main loop, prompting the user to enter an ID from the keypad.

The program waits for keypad input and processes the pressed button.

The LCD displays information corresponding to the pressed button.

Invalid inputs are handled with a retry message.

The program loops back to the main loop, allowing continuous user interaction.

**Conclusion**

In conclusion, the x86 assembly code presented in this project successfully implements an interface between a microcontroller and a Liquid Crystal Display (LCD), incorporating keypad input functionality. The program demonstrates effective utilization of assembly language instructions to configure ports, initialize the LCD, and process user input through a keypad.

The main program loop engages the user by prompting them to input an ID from 1 to 9 using the keypad. Keypad input is efficiently processed, allowing the program to display corresponding information on the LCD screen. The code employs subroutines for LCD initialization, command execution, and character/string writing, enhancing code modularity and readability.

While the project provides a functional framework for interfacing with an LCD and processing keypad inputs, further development could include additional features, error handling mechanisms, or integration with a broader embedded system.

In summary, this project serves as a foundational example of hardware interfacing and user interaction through assembly language programming. It offers insights into the implementation of LCD displays and keypad inputs within the constraints of the x86 architecture. Future iterations or extensions may explore additional functionalities and optimizations to enhance the overall utility of the system.

**Reference**

* <https://userpages.umbc.edu/~squire/intel_book.pdf>
* <https://www.renesas.com/us/en/document/dst/82c55a-datasheet>
* <https://datasheetspdf.com/datasheet/search.php?sWord=8086&gclid=CjwKCAiAqNSsBhAvEiwAn_tmxTGJof-AVdwYR0ld6tX3S4CRqS8SimVjbcPpOAqpQ8PUitcsE0z8yxoCeRYQAvD_BwE>
* <https://care4you.in/interfacing-lcd/>