Microcomputing Systems Term Project

By

The DCLKs

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# Introduction

What do you want to do, what applications can be implemented by your project, and how important is that, briefly explain what you have done and what you have not done, what problems you have faced, how you solved them, and provide a brief functional description of your project, give an overview to the rest of the report.

**Project Overview**

This project incorporates the STM32L031K6 Microprocessor that is attached to the EDUBASE-L452 PCB. For this project, the microcontroller interfaces with the LCD, a 7-segment display, and an external keypad attached by a ribbon cable. Using the components specified we created a digital lock system.

**Applications**

An application this could be used for is any type of safe where a user interface requires a PIN code to gain access to or view material. Another Application could be a security gate that requires the correct PIN to prevent trespassing.

**Priority of the Applications**

The importance is significant in the sense that the program utilized by the application is the frontline defender of the material or contents that the user has deemed vital using their discretion.

**Priority of the Applications**

We have created a program that allows the user unlimited attempts to gain access to the content. We have allowed an administrative PIN to alter the user’s access by changing or deleting pre-existing PINS.

We did enable a user-friendly code with well-descriptive instructions.

We have equipped the board with an external 4x4 mesh keypad with jumper wires.

We have not implemented an exit of the program.

we have not done is limit the number of attempts the users can try before they are locked out.

**Problems Encountered During the Process**

One issue we discovered was we were able to overwrite a previous pin without having to delete the pin first.

Another issue we encountered was deleting a PIN would default back to “0000” which is previously an unusable PIN, however, once the admin deleted a pre-existing PIN, “0000” became a useable PIN unintentionally.

We also ran into an issue where the master PIN could be added as a user PIN by the admin. This caused the unintentional consequence of unlocking the program which was not the admin’s intended purpose.

An ongoing problem we were unable to correct properly was illuminating the 7-segment simultaneously with the buzzer for the 10-second duration. Due to the nature of the 7-segment display needing a continuous quick delay, we could not properly display “FAIL” while the buzzer was sounding.

**Problems Fixed During the Process**

As we previously stated we were able to override a previous PIN without having to delete the PIN first. We fixed this problem by setting a conditional IF statement that only allowed the pin to be added if the current PIN is 0.

For the second issue, we created a conditional IF statement that only allowed entry into the program if the user’s number was not 0.

Our approach for the third problem was to compare the newly added pin with the master pin. If the added pin matched the master PIN would not accept this PIN and display “Invalid PIN” on the LCD.

**Brief Functionality of the Project**

We are implementing a 4-pin Digital lock with 6 correct PINS and 1 Master PIN. If the user successfully enters 1 of the 6 PINS, the lock will open allowing access to the contents. The user will know if the PIN is correct when the LCD displays “Correct PIN, Now Opening”, the 7-segment display illuminates “PASS”, and LED\_0 is enabled for the 10-second duration. The User will know if the PIN is incorrect when the LCD displays “Incorrect PIN, Please Try Again” for 10 seconds while the 7-segment Display illuminates “FAIL”, and the Buzzer sounds alternatingly for 10 seconds. If the user inputs the Master PIN a menu emerges on the LCD enabling the user to either display PINS, delete PIN, delete all PINS, and add a PIN.

**Discussion of the Rest of the Report**

# Project Specifications and Description

Describe the project, draw a block diagram and explain how it works.

# Detailed Implementation

Use pseudocode and flowcharts explaining overall program structure, modularity, and algorithms Interface design: Describe any external interfaces utilized (e.g., switches, LEDs, sensors), Microcontroller resource utilization: describe how the microcontroller’s peripherals (timers, A/D, PWM, I/O ports) as well as its other on-chip resources (Interrupts, SRAM, flash memory, etc.) were utilized including the mode(s) in which they were programmed to operate, provide rationale for the choices made. Software: Describe what the software does and how it is organized/structured. Submit your complete code (comments are mandatory). Illustrations/pictures of your project hardware.

# Analysis

Functionality, and testing results. How did you test the proper operation of the project. You can add illustrations/pictures of your project tests. You should also answer these two questions: (1) Explain how the design of the system considers public health, safety, and welfare. Also, make suggestions to modify the system’s design to better consider these elements. (2) Explain how the design of the system considers global, cultural, social, environmental, and economic factors. Also, make suggestions to modify the system’s design to better consider these factors. The project report ECE 3130 ( 2/2)

# Description of the Teamwork Experience

- (1) How you created a collaborative and inclusive environment and meet objectives (2) How the team members were able to provide leadership, establish goals, and plan tasks. Demo: Each team will demo the project functionality on allotted day and time. From the discussion we will:- - List what works and what does not work - Ensure that the project has been done by you not by someone else or copied. We will ask about the details. 2- Grading

The project report ECE 3130 ( 1/2) The project report should include the following contents in order:

• Title Page (team name, members, class number and name, submission date)

• Table of Contents (TOC)

• Introduction

What do you want to do, what applications can be implemented by your project, how important is that, briefly explain what you have done and what you have not done, what problems you have faced, how you solved them, provide a brief functional description of your project, give overview to the rest of the report.

• Project Specifications and Description: Describe the project, draw a block diagram and explain how it works.

• Detailed implementation: Use pseudocode and flowcharts explaining overall program structure, modularity, and algorithms Interface design: Describe any external interfaces utilized (e.g., switches, LEDs, sensors), Microcontroller resource utilization: describe how the microcontroller’s peripherals (timers, A/D, PWM, I/O ports) as well as its other on-chip resources (Interrupts, SRAM, flash memory, etc.) were utilized including the mode(s) in which they were programmed to operate, provide rationale for the choices made. Software: Describe what the software does and how it is organized/structured. Submit your complete code (comments are mandatory). Illustrations/pictures of your project hardware.

• Analysis: Functionality, and testing results. How did you test the proper operation of the project. You can add illustrations/pictures of your project tests. You should also answer these two questions: (1) Explain how the design of the system considers public health, safety, and welfare. Also, make suggestions to modify the system’s design to better consider these elements. (2) Explain how the design of the system considers global, cultural, social, environmental, and economic factors. Also, make suggestions to modify the system’s design to better consider these factors. The project report ECE 3130 ( 2/2)

• Description of the Teamwork Experience Explain the nature of the collaboration of the team’s members by addressing these points:- (1) How you created a collaborative and inclusive environment and meet objectives (2) How the team members were able to provide leadership, establish goals, and plan tasks. Demo: Each team will demo the project functionality on allotted day and time. From the discussion we will:- - List what works and what does not work - Ensure that the project has been done by you not by someone else or copied. We will ask about the details. 2- Grading

• Projects will be graded on the documentation, functionality, and understanding the project.

• Demo 50% Functionality 30% Answering questions 20%

• Final report 50% [10%] Writing/organization: Writing style, professionalism, technical content, succinctness of report, professional documentation, proper English, good grammar and clear writing style, etc. [25%] Project Specifications and Description, Detailed algorithms and Detail implementation [5%] Analysis [10%] Description of the Teamwork Experienc