Cairo University
Faculty of Engineering

Embedded Systems in Medical Equipment SBES162

Project

Names:	Mohamed Ahmed Hamed	IDs: 1190266
	Ammar Yasser	4210206
	Hanan Tawfik	4200369
	Sharif Ehab Sayed	1200958
	Mohamed Ehab Souka	1190517

Digital Safe Project Report

Introduction

The digital safe project aims to create a secure storage solution using a combination of a keypad, an LCD display, a servo motor, and EEPROM for passcode storage. The safe can be locked and unlocked using a user-defined passcode entered via the keypad. The system is designed to be user-friendly while providing robust security features.

Key Features

1. User-Defined Passcode: Users can set and change the passcode, which is stored in EEPROM to retain it even after power loss.
2. Passcode Entry: Users enter the passcode via a keypad, and the system provides real-time feedback on an LCD display.
3. Servo Motor Lock Mechanism: A servo motor controls the locking and unlocking of the safe based on the entered passcode.
4. Error Indication: A red LED indicates incorrect passcode entries, with the system locking after a specified number of failed attempts.
5. Reset Functionality: Users can reset the passcode by entering a special sequence.

System Components

1. Keypad: Used for passcode input.
2. LCD Display: Provides user feedback and prompts.
3. Servo Motor: Controls the safe's locking mechanism.
4. Red LED: Indicates errors and alerts.
5. EEPROM: Stores the passcode and system status.

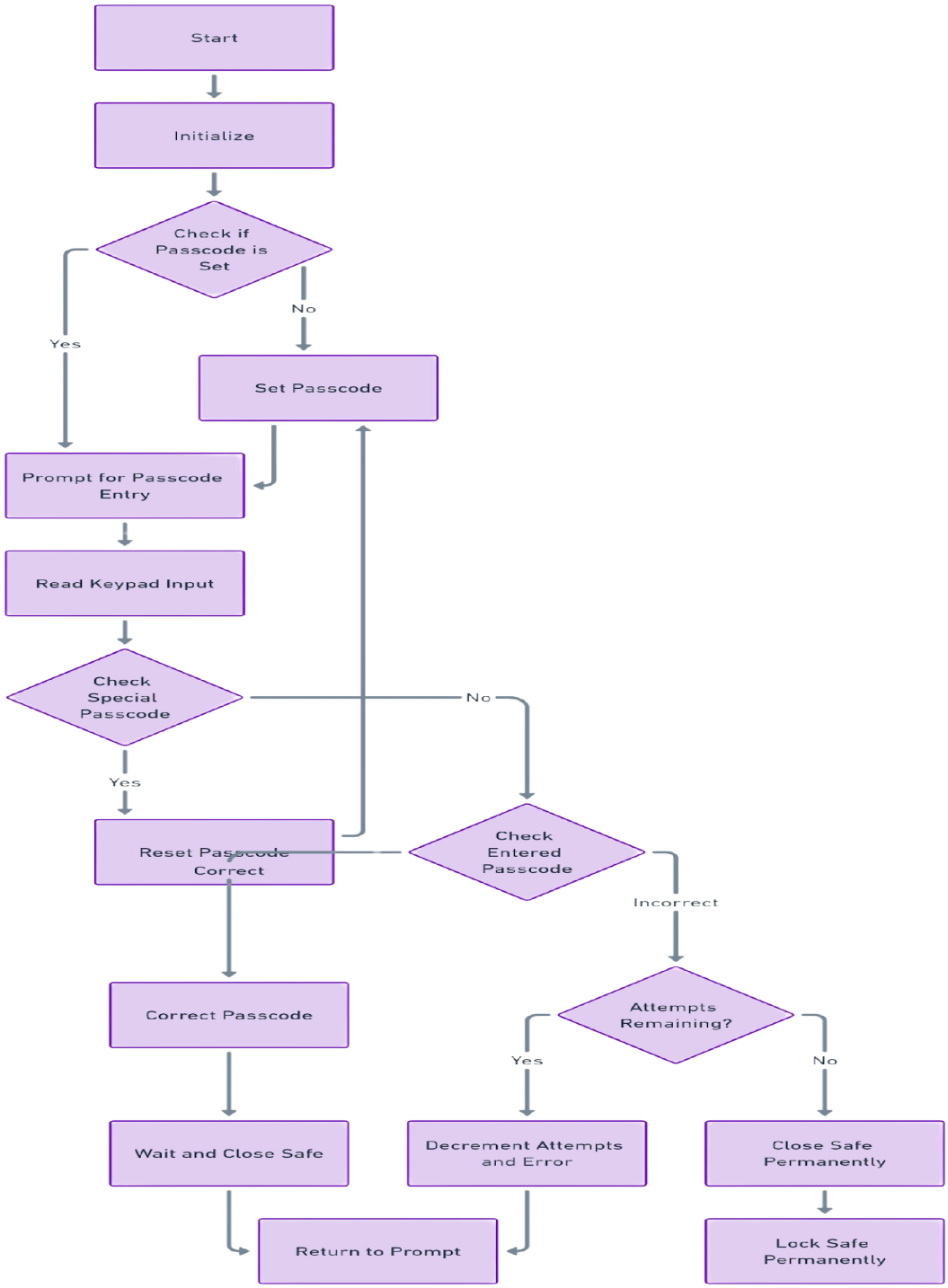
Process Overview

1. Initialization: The system initializes the LCD, keypad, servo motor, and EEPROM.
2. Set Passcode: If no passcode is set, the user is prompted to enter a new passcode.
3. Enter Passcode: The user enters the passcode to unlock the safe.
4. Check Passcode: The entered passcode is compared with the stored passcode.
5. Unlock Safe: If the passcode is correct, the servo motor unlocks the safe and locks it again after a delay.
6. Error Handling: If the passcode is incorrect, the system decrements the number of allowed attempts and indicates the error using the red LED.
7. Reset Passcode: If a specific sequence is entered, the system resets the passcode and prompts the user to set a new one.

By combining these components and features, the digital safe provides a secure and user-friendly way to protect valuable items, with the added benefit of passcode retention through EEPROM. The project emphasizes ease of use, security, and robustness.

Flowchart

The following flowchart outlines the process flow of the digital safe system.



Circuit Description

Components and Connections

1. Keypad:
- Connect keypad rows to pins PD1 to PD4.
- Connect keypad columns to pins PD5 to PD7.
2. LCD:
- RS pin to PC0.
- RW pin to Ground (VSS).
- E pin to PC1.
- Data pins (D4 to D7) to PC2 to PC5.
3. Servo Motor:
- PWM signal pin to PB6 (OC1A).
4. Red LED:
- Anode of the LED to PB7
- Cathode of the LED to Ground.
5. EEPROM:
- Used to store the passcode and the status of the safe.

Circuit Schematic

Below is the circuit schematic illustrating the connections between the microcontroller and mentioned components.