Home Safe

Software Requirement Specification

SRS Version 2.0

Team #1

13 September 2021

Saphal Karki [Manager]
Mausam Shrestha
Safal Poudel
Karan Aryal
Rajesh Upadhayaya

CS 460 Software Engineering

TABLE OF CONTENTS

1 Introduction 2
1.1 Purpose 2
1.2 Intended Audience 2
1.3 Document Overview 3
2 General Description 3

2.1 Block Diagram 3
2.2 Components 4
2.2.1 Keypad 4
2.2.2 LCD Display 4
2.2.3 Lock 4
2.2.4 Lock Sensor 4
2.2.5 Microcontroller 4
2.2.6 Power Source 5
3 Specific Requirement 5
3.1 Logical Interfaces 6
3.1.2 Keypad 6
3.1.3 Power 6
3.1.4 Door Sensor 6
3.1.5 LCD Display 7
3.1.6 Lock 7
3.1.7 Timer 7
3.1.8 Control Software 7
3.2 State Diagram 7
3.2.1 Initial Setup 8
3.2.2 Reset pin 9
4 Design Constraints 9

1 Introduction

1.1 Purpose

This document provides a detailed description of the features, interfaces involved, system design, and design constraints for the control software of the Home Safe system. It explains in detail the functionality and control flow of the system as the user interacts with Home Safe.

1.2 Intended Audience

This document describes in detail the logical and physical interfaces are configure in the Home Safe system. It also describes the functionalities for these interfaces, and how these different components communicate with the microcontroller to provide a functioning digital lock mechanism that users can

interact with. It also defines the design constraints of the system and the specifics of the control flow, and as such is intended for academic personnel and software developers in the management team.

1.3 Document Overview

This document is organized into different sections to provide a detailed overview of the system design and how the control software processes user interaction.

- Introduction: Section 1 describes the purpose, intended audience of this document along with a document overview describing how the different sections are organized.
- General Description: Section 2 details about the physical interfaces involved in the system through a block diagram and describes the components individually over sub-sections.
- Specific Requirements: Section 3 (Specific Requirements) is intended for software developers and contains specifics regarding the control software like the finite state diagram.
- Design Constraints: Section 4 describes the design constraints in the control software.

2 General Description

This section includes a general description of all the physical components associated with the system along with a block diagram representing the physical interface. Section 2.1 represents the block diagram while Section 2.2 describes the features and functionalities of the physical components involved.

2.1 Block Diagram

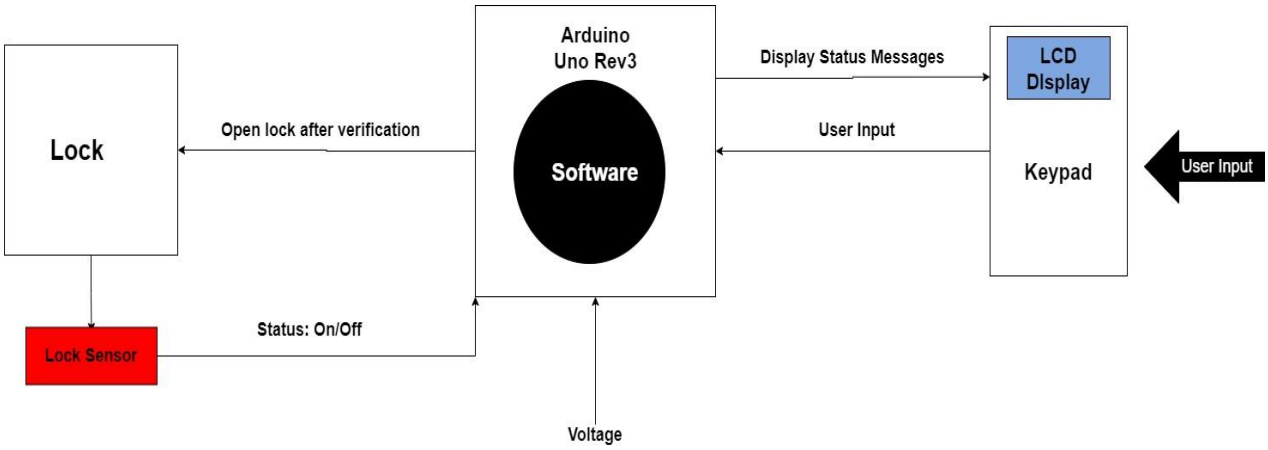

Figure 1: Block diagram of components

2.2 Components

This section 2.2 lists all the physical components of the system and describes it functionalities specific to the operation of the system.

2.2.1 Keypad

The keypad consists of 10 numeric keys (0 - 9) and two-character keys ('*' & '#'). It is connected to the microcontroller and provides input feedback when the user presses a button on the keypad which is then meaningfully processed by the processor. This keypad is used to get the access pin from the user and to perform special operations like reset and lock override.

2.2.2 LCD Display

The system consists of an LCD display used to display status messages forwarded by the micro-controller related to events resulting from user interaction. It also helps the user navigate the control system and informs user about the incurring events.

2.2.3 Lock

The lock is responsible for granting access inside the Home Safe. It communicates with the microcontroller via a lock sensor which tells if the lock is opened or closed. It also has a lock motor which operates on the signal of the microcontroller.

2.2.4 Lock Sensor

The lock sensor is attached to the entry gate of the Home Safe to provide status report to the microcontroller about the status of the gate (i.e., open or closed). It helps the microcontroller to implement features like timeout.

2.2.5 Microcontroller

The microcontroller controls the operation of the digital Home Safe via a control software that manages the operations and events occurring in real time as the user begins interacting with the safe. It communicates with all the

physical interfaces of the system, processes the incoming input, and sends out related commands to operate the system.

2.2.6 Power Source

The Home safe can be powered by an external power supply ranging (7 – 12 V) or with 4 AA alkaline batteries offering the same power range. When operating on batteries the microcontroller keeps track on the power usage and pushes a system notification to notify the user if the battery is less than 10%. In such case, the LCD screen displays “Low Battery!!” and the user must either replace the batteries or connect to an external power supply via the power chord.

3 Specific Requirement

This section of the SRS details the logical interfaces involved in the systems design and a logical flow of events as the user interacts with the control system. Section 3.1 contains a diagram representing the logical interfaces of the system, along with the events representative of that interface. The next section (3.2) represents the step-by-step control flow and logical overview of the system as the user interacts.

3.1 Logical Interfaces

This section contains a diagram representing the logical interfaces involved in the system.

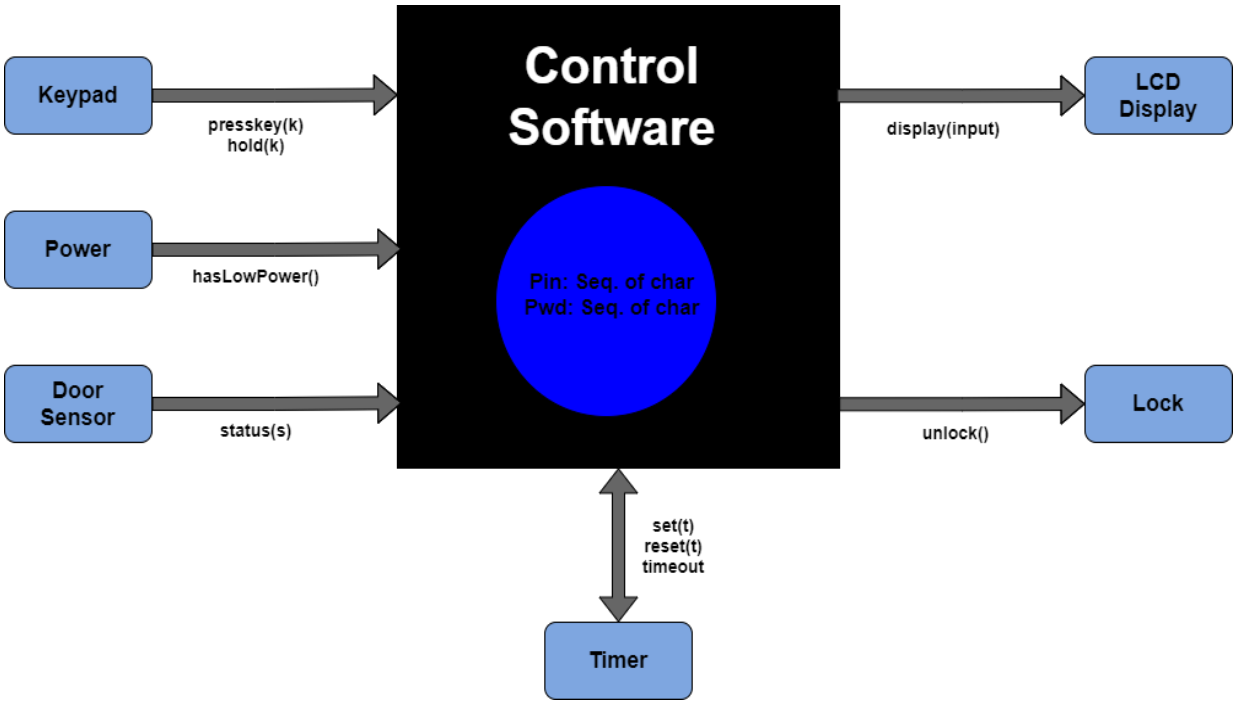

Figure 2: Logical interface diagram

3.1.2 Keypad

This interface sends the input key to the control software each time a key is pressed. It can communicate the following events:

- presskey(k) – a key is pressed.
- hold(k) – a key is pressed for a more than 2s.

3.1.3 Power

This interface send communicates power status to the control software. It communicates the following events:

- hasLowPower() – returns true if the power is low and false otherwise

3.1.4 Door Sensor

This interface sends the status of the door if it is opened or closed to the control software. It communicates the following events:

- status("open") – The lock door is open.
- status("closed") – The lock door is closed.

3.1.5 LCD Display

This interface receives status messages from the control software related to certain events and displays it on the LCD screen:

- display(input) – displays the input message on the screen

3.1.6 Lock

This interface communicates if the user has been granted access to the system. It communicates the following events:

- unlock () – activates the lock motor to unlock the door

3.1.7 Timer

This interface is embedded in the control software which helps to implement a timer for long response time and to indicate timeouts. It has the following events:

- set(t) – sets the timer to 5s.
- reset(t) – resets the timer to 0s.
- timeout – indicates unresponsiveness (>5s no response).

3.1.8 Control Software

The control software is the kernel of the logical interfaces. It consists of embedded logic to communicate with the logical interfaces and execute commands. It also helps to store access pins and update it and provides the functionalities for reset and override.

3.2 State Diagram

This section contains the finite state diagrams representing the control flow of events as the user begins interacting with the system. Section 3.2.1 (Initial Setup) shows how the control flow branches out as the user begins interacting

with the systems by providing different inputs. Section 3.2.2 describes in detail the reset pin mode as the user tries to reset their access pin.

3.2.1 Initial Setup

This section consists of the finite state diagram that represents the possible conditional logical flow as the user begins interacting with the system by providing input. The user can initially choose to access the safe via access pin or reset the pin by enabling reset mode by holding down the '*' button. The user can also try to force reset the access pin, but it requires the door to be unlocked (can do via mechanical key) and the system should be on sufficient power.

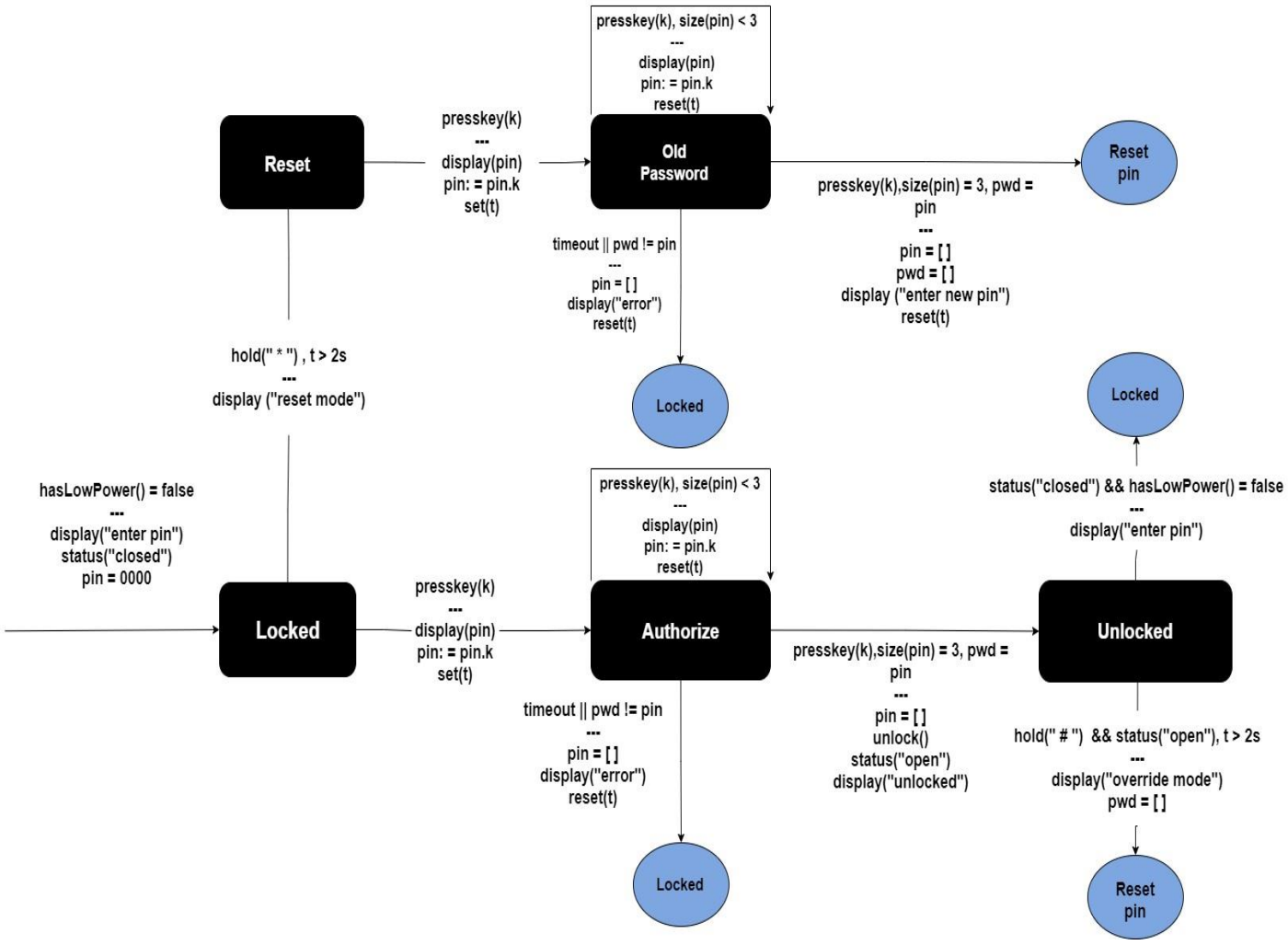

Figure 3: finite state diagram - initial setup

3.2.2 Reset pin

This section describes the process of resetting the access pin. The user first needs to provide the new password and then confirm it. If the user fails to confirm the password or there is delay > 5s in between key entry, the system directs the user again to the beginning of the reset pin mode.

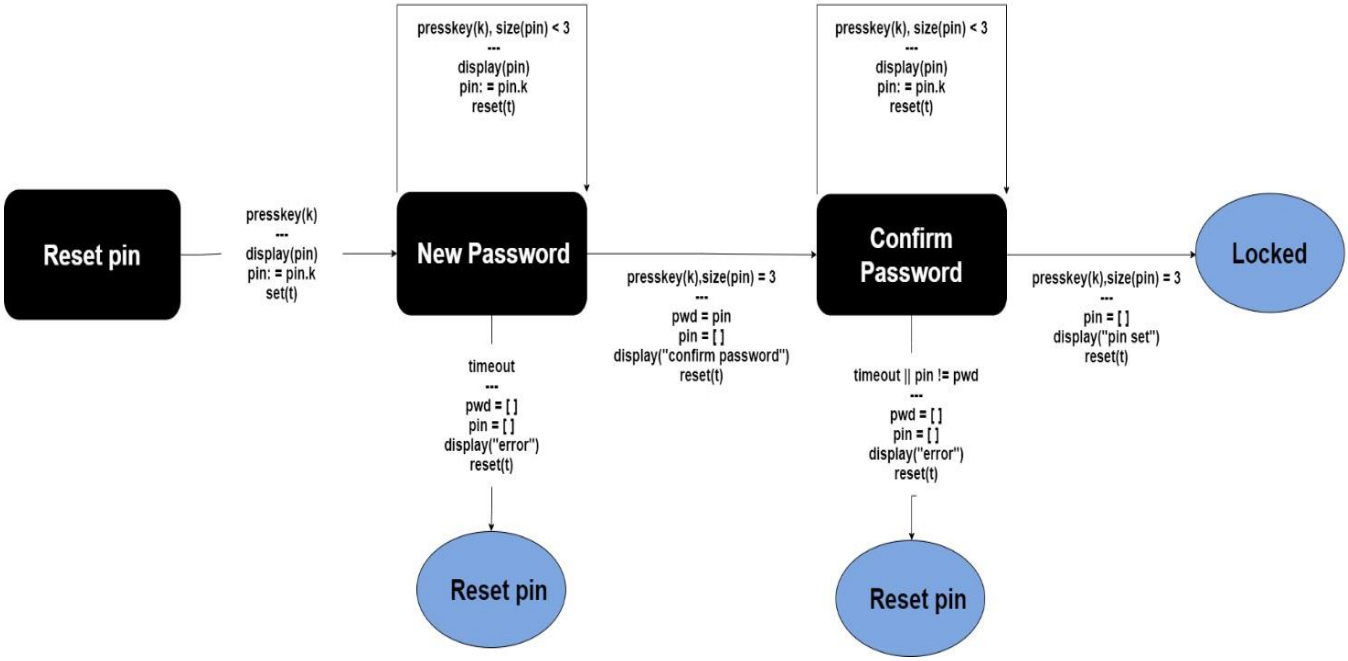

Figure 4: finite state diagram - reset pin mode

4 Design Constraints

- The control software for the system is written in Java and is object-oriented. • Anyone with the access pin will be able to enter the safe, which can pose a security risk.
- Does not store any access records, which can be used as evidence in case of theft.
- The system is not connected to the internet.
- In case of sudden power shortage, if the user is resetting a pin he must start over again.