Innopolis University
Software Architectures 2016
Requirements Specification Document

Lift Controller

Document Version History

Date	Version	Description	Author
30/01/2016	0.1	Homework	Krikun G.

Contents

1 Introduction

1.1 Purpose

This requirements specification document describes the functions and requirements specified for "Lift Controller". Also it will illustrate constraints and quality attributes.

This document is primarily intended to be proposed to a customer for its approval and a reference for developing the first version of the system for the development team. But it is written like you know nothing about the lift.

1.2 Scope

Lift Controller supposed to use on hardware system, full list of components will describe later. It must controll lift motors, indicators and sensors. Also it must provide safety, call servicing, performance, reliability.

The maximun number of controlling lifts - four lifts per controller, 20 floors. One lift per shaft. All lifts are same numbers of floors. But on common model it could be different.

So at the bottom line, this system is controlled by the people near or inside it. Also guaranteed limited access (could be remote) to the system administration.

A distinctive feature of this device is that it really can kill you, so at least cabin shouldn't smash the floor. Also should be instructions, how to use the lift, maximum load, and other important information, both inside and outside cab. In case of getting stuck in the lift, the cab is provided with a communication service.

1.3 Functionality

All lifts, if there're more than one, must be used approximately same. The system can change state (according current) by commands received from command interfaces.

Lift Controller's interfaces:

- `Root control panel`
- `Floor control buttons`
- `Cabin control panel` *(could include authentication middleware)*

A main function is assumes, to transport people and other different goods in vertical direction, up and down. Every floor have a number. To get them designed special shaft, with movable cabin. It is prohibited to access shaft outside the cabin[1]. On the first and last floors lift must be fully be stopped.

[1] With the exception of technical staff.

On every[2] floor doors can be opened and closed, depending on the state.

1.4 Logic

Logic for determining priority of actions may vary. But in common case lift circulates through the mine or stay in static. So we can highlight five[3] basic state:

`Off`	- not powered, in static position.
`On (Pending)`	- ready to go, powered, but in static.
`Move`	- in action.
`Broken`	- powered, but can't function.
`Drop down`	- emergency case.

2 Glossary

Floor control button(s)
: Intuitive interface, for call lift. Futher in the text just `button`. Could be single or double control buttons for lift call in both directions.

Cabin control panel
: Complex of buttons, for selection of floor, canceling action, calling services, and management additional functions inside the cabin of lift, like doors managing or cooling system.

Root control panel
: Interface (could be remote) for controling state off all lifts. Access to this panel granted only for technical staff.

Control devices
: This group of units include buttons, controllers, buses to them, and considered as a self-contained device with declared I/O protocols. Like lift controller, door's motor controller, light controller, etc.

Control interface (bus access)
: End-user control points, like floor buttons, cabin's panel, root panel (bus access), power switchers, etc.

Sensors
: System units with declared I/O protocols, to provide data feedback

[2] Can be limited access. This is about authentication issue.
[3] Normal mode is only three of them.

about lift system state. It include floor lift sensors, door collision sensor, weight sensors, etc.

Indicators
Output channels for displaying system status. For example lift status indicators (displays current floor), button state indicators (highlight pushed button), sound speakers and so on.

Authentication middleware
Autonomous unit that provides limited access, whatever how. It could be firegerprint access or card key. But should provide I/O standardized connections to other control units.

Hardware system
In this case the system is complex of hardware units that perform the main function of the system. Include:

- Power source
- Movable mechanisms
- Control devices
- Control interfaces (bus access)
- Sensors system
- Indicators complex
- Authentication middlemare

As mentioned earlier system can also include authentication access on some (or all) floors. This middleware can be implemented separately from the system. Here and further colored in gray as not mandatory.

3 Product Description

3.1 User Roles

Role	Description
`root, repairer`	Admin user, somebody of technical support. Solve issues from other users, either directly or remotely. But direct access granted only specially for trained staff. For this administrative job could be configurated notifications system.
`common user`	Person who can access to lift directly. Also can call cabin, take the lift and escape.
`authenticated user`	In cases when to get access to some floors need access rights.

3.2 High Level Software Features

High Level Software Functionality	Associated User Histories (US)
`HL-01`	US-xx

3.3 User Stories for Functional Requirements

US-01	**The system diagnostics**
Description	As a root, I want recognize the system is safe to use.
Acceptance criteria	The lift is powered and ready to go. All sensors functioning properly and detected normal conditions. Lift shafts doors are locked. Root gets feedback.
Priority	High
Effort	High

US-02	**The system initialization**
Description	As a user, I want recognize the system is ready to use.
Acceptance criteria	The diagnostic system passed all tests. Outside indicators show that system is ready for use. User find out that can use buttons.
Priority	High
Effort	Medium

US-03	**Push the call-button**
Description	As a user, I want call lift for subsequent use.
Acceptance criteria	Button indicator changes state (turn on). The system accepts request.
Priority	High
Effort	Low

US-04	**Call command**
Description	As a user, I want get the lift in soon.
Acceptance criteria	According to the system state criteria could be different: When system ready to go or moving in selected direction, lift should start (continue) moving in right direction. Overwise (choosed direction is opposite) call is added to queue, lift continues moving in previous direction, until it finishes the previous task.
Priority	High
Effort	Medium

US-05	**The stop**
Description	As a user, I want safely get inside the lift.
Acceptance criteria	Side sensors signal that lift present, and located behind the doors, fully stopped. The call-button indicator (or corresponding send-button) turned off. Doors perform open-close cycle.
Priority	High
Effort	High

US-06	**Push the send-button**
Description	As a user, I want choose the right floor.
Acceptance criteria	Button indicator changes state (turn on). The system accepts request.
Priority	High
Effort	Low

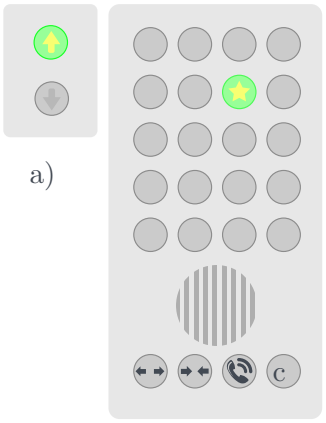
US-07	**Move command**
Description	As a user, I want use the lift to get the selected floor.
Acceptance criteria	According to the system state criteria could be different: When system ready to go or moving in current direction, lift should start (continue) moving in right direction. If selected not only one floor, last floor in current direction is added to the queue. Overwise (selected floor in opposite direction), lift continues moving in previous direction, until it finishes the previous task.
Priority	High
Effort	Medium

US-08	**The moving**
Description	As a user, I want safely get selected floor.
Acceptance criteria	Lift normally moves at 1.2 m/sec. In slow mode, before arriving, 0.3 m/sec.
Priority	High
Effort	Low

US-09	**The canceling**
Description	As a user, I want stop motion at any time.
Acceptance criteria	Lift stops at nearest floor. Doors perform open-close cycle. All last send-commands are canceled.
Priority	Medium
Effort	Low

US-10	**The falling**
Description	As a user, I want survive in falling lift.
Acceptance criteria	Lift stops with not lethal acceleration. User survive.
Priority	High
Effort	High

3.4 Mock-up of the User Interface



a)

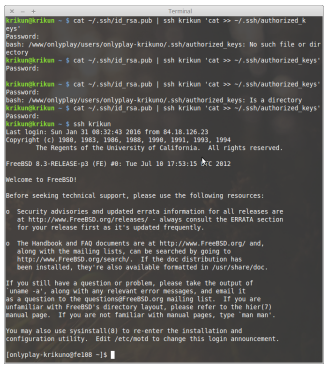
b)

Green with yellow buttons indicate choice.

(a) The call-buttons (on floors)

(b) The send-buttons (in the cab)

(c) Root terminal



3.5 Non-Functional Requirements / Quality Attributes

QA-01	Clear system status
Description	The system should clearly show it state.
Importance	Medium
Justification	If users don't know system status, they wouldn't use it.
Measure	Popularity of lift.

QA-02	Interface usability
Description	The system should immediately react on user's actions. (e.g. US-03, US-06)
Importance	Medium
Justification	If users don't know system status, they can't use it.
Measure	Feedback of users, tolerance. Burnt buttons.

3.6 Software Constraints

CONS-01	**The final stops**
Description	The system should always stop when arriving at top or bottom.
Importance	High
Justification	Overwise possible collisions.

CONS-02	**Existing floors**
Description	The system should moving lift throught give set of floors.
Importance	High
Justification	Overwise possible collisions.

CONS-03	**Always close the doors**
Description	The system shouldn't move with open doors.
Importance	High
Justification	Overwise possible deaths.