5/1/2017 Version 1.0

Team Malaga

Dual-Alarm AM/FM Clock Radio

Bryce Charydczak, Eric Hofesmann, Marge Marshall

CSCI 360

Vision

Introduction

The AM/FM radio and dual alarm clock is to be the all encompassing device for the typical consumer needing an alarm to keep their scheduling organized with their musical interests intact. The radio should have the ability to store up to two alarms of different times with the ability to enable the AM or FM radio to play a certain station as the alarm playing tune.

Positioning

Business Opportunity

A large number of consumers need to be able to set an alarm to wake up in the morning. Many prefer having a traditional physical alarm clock instead of a phone utility for reasons of familiarity, reliability, visibility, or other options not available with a phone. Synchronous broadcasting of music stations through set alarms is a niche format with low levels of competition. This software brings a large level of utility to a market not yet acclimatized to the innovation of tangential functions (timekeeping with alarm indication via broadcasting channels).

Problem Statement

Consumers need an alert system that aids them in being punctual and on time. Many consumers find the interface of a radio alarm clock preferable, and feel that the radio alarm clock provides greater fault tolerance both in its design and in the way we interact with it; an alarm clock is not likely to be left on the train, an alarm clock, provided it is plugged in, will not perform an automatic update in the middle of the night that delays or prevents an alarm from going off.

Product Position Statement

This system is for consumers and people who wish to be able to wake up or need a reminder for scheduled events. It will provide two separately programmable alarms, a snooze utility, and a radio that is capable of playing both AM and FM frequencies. The user may program the alarm to activate either a traditional beeping alarm or the currently selected radio station.

Alternatives and Competition

Beyond competing similar products, there are also a number of consumers who rely on smart phone alarm features and use streaming music services as their primary means of listening to music. The dual alarm clock radio is a more familiar interface for many consumers, and as previously mentioned is not a mobile device likely to be lost.

Stakeholder Descriptions

Stakeholders that are of certain concern for prompt acknowledgement of a time and wish the be made aware of that time through the musical inclination of their favorite music station can seek to do so through this unit.

Market Demographics

Those who prefer the traditional alarm clock for their scheduling needs, and wish to listen to local radio.

Stakeholder (Non-User) Summary

The user's bosses, co-workers, family members, anyone affected by the punctuality of the user. Radio DJs, advertisers, and backers. Neighbors, housemates, and anyone in close enough proximity to hear the alarm.

User Summary

The user is the individual consumer or those affected by the alarm (family, housemates).

Key High-Level Goals and Problems of the Stakeholders

High-Level Goal	Priority	Problems and Concerns	Current Solutions
Punctuality to recurring events and obligations	High	User needs to be notified at the correct time.	Use other devices or people to remind the user of when events are about to occur.
Know the time	Medium	Various time throughout the world. The clock needs to keep the time accurately.	Any device with time telling capabilities. However, many do not have all of these goals incorporated.
Listen to radio	Low	No radio stations in the area.	Receiving of broadcasting signals that correspond with specific radio stations.

User-Level Goals

- *Primary user:* set alarm, silence alarm, disable alarm, set snooze, find radio stations, set time, change volume
- *Radio broadcasters:* expand audience

Product Overview

A product ready for market integration in the expanding digital age of timekeeping and music listening.

Product Perspective

The product is designed for in-home personal use.

Summary of Benefits

Supporting Feature	Stakeholder Benefit
Sounds an alarm at a set time	Ability to be notified when a given time occurs.
Able to detect and play radio signals.	Ability to listen to radio for entertainment or other reasons.
Provides the means to program current time	Ability to change time in accordance with time zone changes or daylight savings' time

Assumptions and Dependencies

1. It is assumed that the user is capable of reading and operating the hardware for input
2. It is assumed that the user is capable of hearing and that an audio alarm will suffice their needs
3. It is assumed that the user is operating the radio within range of a functioning radio station

Licensing and Installation

This system is to be used with specified hardware. The hardware must provide the user with the ability to give necessary input, and must provide a display that shows the current time and radio station. The final product only requires a power source for basic functions. There may also be room for utility patent involvement in this software development if approved, which could lead to greater licensing control on specific functionalities. With this type of licensing legal recourse could net the business further revenue in addition to that of the finished and licensed software product.

Summary of System Features

- 12 or 24 hour clock display - Hours and Minutes only
- Two programmable alarms
- 10 minute snooze timer
- AM/FM radio

Supplemental Specification

Functionality

The AM/FM radio dual alarm clock is meant to accurately tell time and provide an alert at a specified time by the user.

Usability

The unit should be simplified in a manner that leads to a more aesthetically appealing and thus a more understandable model that can be interpreted by new users and increase its usability.

Reliability

The unit should be reliable enough to a certain threshold that it will not power down or potentially miss alert times which are critically important to the user and stakeholders. Battery power is a potential design modification that could help facilitate such a level of reliance.

Performance

The unit should have precise enough software that it will not diminish from overall usability and should be able to perform the basic functions listed earlier without any inconveniencing to the user/consumer. The unit should be able to provide the maximum amount of functionality with the least amount of memory/computation/power consumption.

Supportability

Iterative platform development should help to promote a supportive architecture by which this AM/FM radio dual alarm clock can be supported and help to bleed into all other aspects of the FURPS+ credibility. This architecture should have a broad level of compatibility with many different computational structural formats so as to promote the highest level of functionality to the user/consumer.

Hardware and Software Constraints

The unit should not exceed a certain wattage threshold in order to prevent possible arcing and overheating/meltdown scenarios. The unit should not have any unnecessary software in order to condense on memory allocation and ultimately save on costs per unit produced. The unit should also not incur any unnecessary usage of memory or CPU power so as to not provide too taxing of a system to run.

Development Constraints

Limitations have been set in tangent with hardware specifications, otherwise all usability and functionality should pertain to software integration. The only notable constraints of the sort can be seen in functionality request and deadline progression.

Physical Environment Concerns

The unit should not be implemented in a device that is able to accommodate the software's space and time complexity and should

Standards (technical, safety, quality)

The unit should be operable under most all conditions that don't impede upon the physical environmental concerns. The unit should not infringe upon the safety of the user's information or confidentiality of sorts and should comply with all of ACM's code of ethics.

Operational Concerns

One of the only things as that will not be implemented in the software design is an automatic Daylight Savings Time changing function. This could provide potential functional inaccuracy for the unit but should be made clear that the user will be in charge of these changes when appropriate. If the stakeholder concern for this functionality is large enough then certainly a patch distribution of its finalized implementation could come into order.

Use Cases

Use Case 1:

Name: Set an alarm
Scope: AM/FM radio and alarm
Level: User Goal
Primary Actor: Clock User
Stakeholders and interests: Consumers
Pre-condition: Time for alarm is entered in twelve hour format as opposed to military time, alarm is set to ON, the clock is set to the correct time
Post-condition: Alarm is set to trigger at the time specified, repeating at each occurrence of the time.

Main Success Scenario:

1. The user wants to wake up at a specific time.
2. They set the time for alarm 2.
3. The user then specifies the alarm sound as “alert.”
4. The user selects if they want the alarm to repeat daily or not.
5. The time is then saved and the alarm is set to activate the speakers at the desired time.

Extensions:

1. The clock time changes before the alarm goes off. The internal alarm time will not change, however the user will not have it go off at their desired time.
2. The user can change the alarm options to play a specific radio station.

Special Requirements: An uninterrupted source of power (can be battery operated or connected to an outlet)

Technology and Data Variations List:

1. Power to the alarm could be from various outlets around the world.

Frequency of Occurrence: Can be done at any time, likely twice a day due to having two separate alarms.

Open Issues: What happens when an alarm that has been previously set is triggered while the radio is already on, in the case where the user has specified that the alarm should trigger the radio turning on?

Use Case 2:

Name: Find different radio stations
Scope: AM/FM radio and alarm
Level: User Goal
Stakeholders: Consumers, broadcasters, advertisers who run ads on radio
Pre-condition: The radio broadcasters are sending radio signals that can be received.
Post-condition: Radio waves being received via the antenna are properly decoded and output to the speakers.

Main Success Scenario:

1. The user wants to listen to a particular radio station.
2. They turn the radio on, and the device begins listening for radio signal broadcasts and outputting sound signals to the speakers.
3. The frequency is given to the user, who can then increase or decrease the frequency in set increments to other radio stations.
4. On input to change the frequency up or down, the device will search in the chosen direction for a clear broadcast signal.
5. The first clear signal will then be chosen, with the new frequency output to the user, and sound being output to the speakers.

Extensions:

1. The designated radio station currently selected is inoperable at the time and no radio signal is being received from them. The radio should play white noise to indicate the lack of radio signal.
2. The user seeks the radio past the point of potential radio signals within the given radius that the antenna can receive and thus the radio should loop the seek back to the beginning of possible AM/FM station addresses instead of allowing the user to continue to push the seek to an infinitely high number.
3. The radio seeking mechanism should change the address in intervals relative to the available stations (no need to have the user seek more than twice to acquire a local station).

Special Requirements:

1. Functioning radio antenna
2. Radio dial
3. Ability to switch between AM and FM frequencies
4. Stereo speakers

Technology and Data Variations List:
Different radio stations in different parts of the world. The radio signals may be stronger with the radio placed in different locations around the house.

Frequency of Occurrence:
Every few minutes while listening to the radio which could happen multiple times a day.

Open Issues:
Hardware malfunction
Changing of broadcasting methods of AM/FM radio waves

Use Case 3:

Name: Silence alarm
Scope: AM/FM radio and alarm
Level: User goal
Stakeholders: Clock User
Pre-condition: The time is set correctly and an alarm has been set to go off on daily repeat.
Post-condition: The alarm is silenced.

Main Success Scenario:

1. The user wants to wake up at a specific time.
2. They set the alarm to the time that they want it to sound.
3. The user goes to sleep and does not interact with the device.
4. Once the set time has been reached, the alarm triggers.
5. The standard alarm sound is played
6. The user silences the alarm.
7. The alarm will sound again in 24 hours when the set time is reached again since it was set to repeat.

Extensions:

1. The user activates the snooze feature. The alarm is now silenced but it will sound again in 10 minutes.
2. The user can play the radio at any time even if the alarm is set.
3. The alarm sounds and plays a radio station set by the user instead of the standard alarm sound.
4. If the time changes then the alarm will now sound whenever it reaches the set time according to this new changed time. This could possibly be due to either daylight savings time or a time zone change.

Special Requirements:

1. Alarm must be able to be loud enough to wake up a person
2. Snooze function must be easy to operate
3. Functioning radio antenna

Technology and Data Variations List:

1. Power must be applied to the alarm in order for it to be able to go off.
2. The date can be set in either 12 hour time or Military Time.

Frequency of Occurrence:
Occurs any time that an alarm goes off. Can possibly go off multiple times if the snooze function is used.

Open Issues:

What happens if the radio is playing while the alarm goes off? Does the radio continue to play after the alarm is silenced?

Use Case 4:

Name: Disable an alarm
Scope: AM/FM radio and alarm
Level: User Goal
Primary Actor: Clock User
Stakeholders and interests: Consumers
Pre-condition: An alarm is currently set to trigger at some specified time.
Post-condition: The current alarm is no longer set to trigger

Main Success Scenario:

1. The user no longer wants to use alarm 1.
2. The user selects alarm 1.
3. The user cycles through the alarm time settings without changing them
4. When the user is prompted to select the sound for the alarm (alarm sound or radio) they will also be prompted with the option to turn the sound for the alarm off
5. The time for the alarm is now still saved but the alarm is currently disabled and will not sound

Extensions:

1. Alarm 2 is set as well as alarm 1. The user must disable both alarms separately.

Special Requirements: An uninterrupted source of power (can be battery operated or connected to an outlet) in order to save the specified time of the disabled alarm.

Technology and Data Variations List:

1. Power to the alarm could be from various outlets around the world.
2. Disable option must be easy to find and apparent to user
3. Alarm's status (enabled or disabled) should be apparent at all times.

Frequency of Occurrence: Can be done at any time, likely once or twice a week for weekends or holidays

Open Issues:

Use Case 5:

Name: Change Volume
Scope: AM/FM radio and alarm
Level: User goal
Stakeholders: Consumers

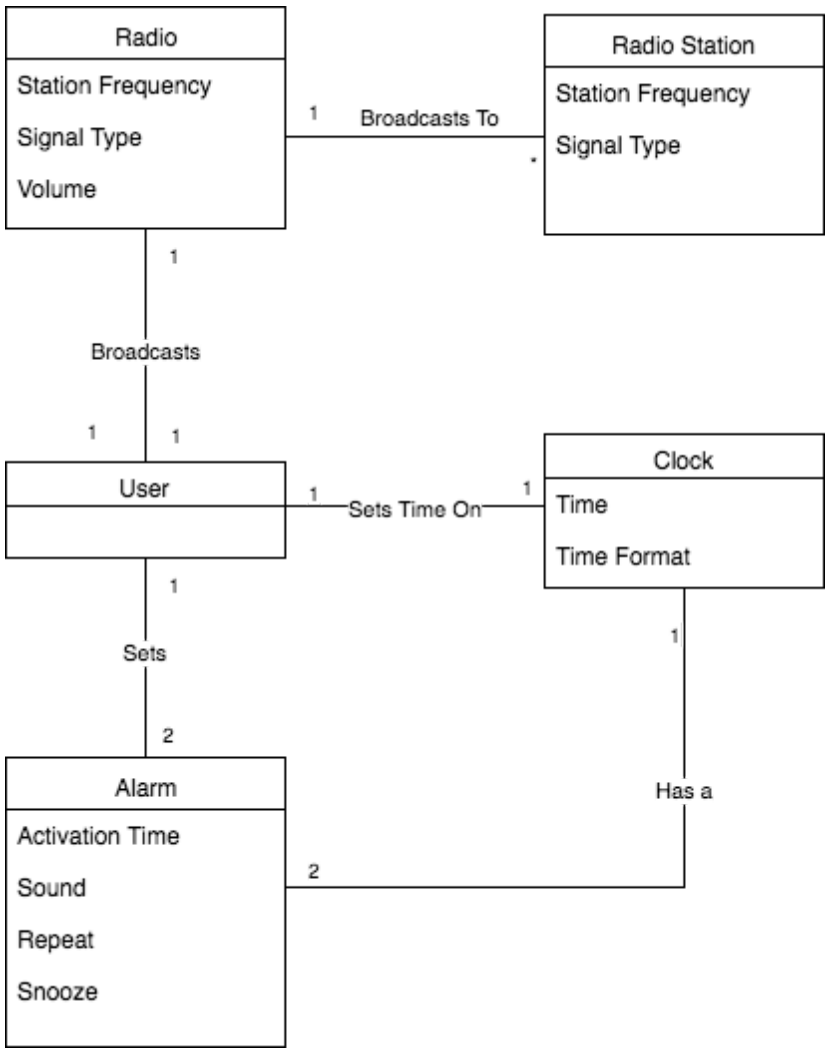
Main Success Scenario:

1. The user is listening to the radio but it is too loud.
2. They access the volume of the device and adjust it.
3. It is still too loud so the user continues to lower the volume until their preferred volume is reached.

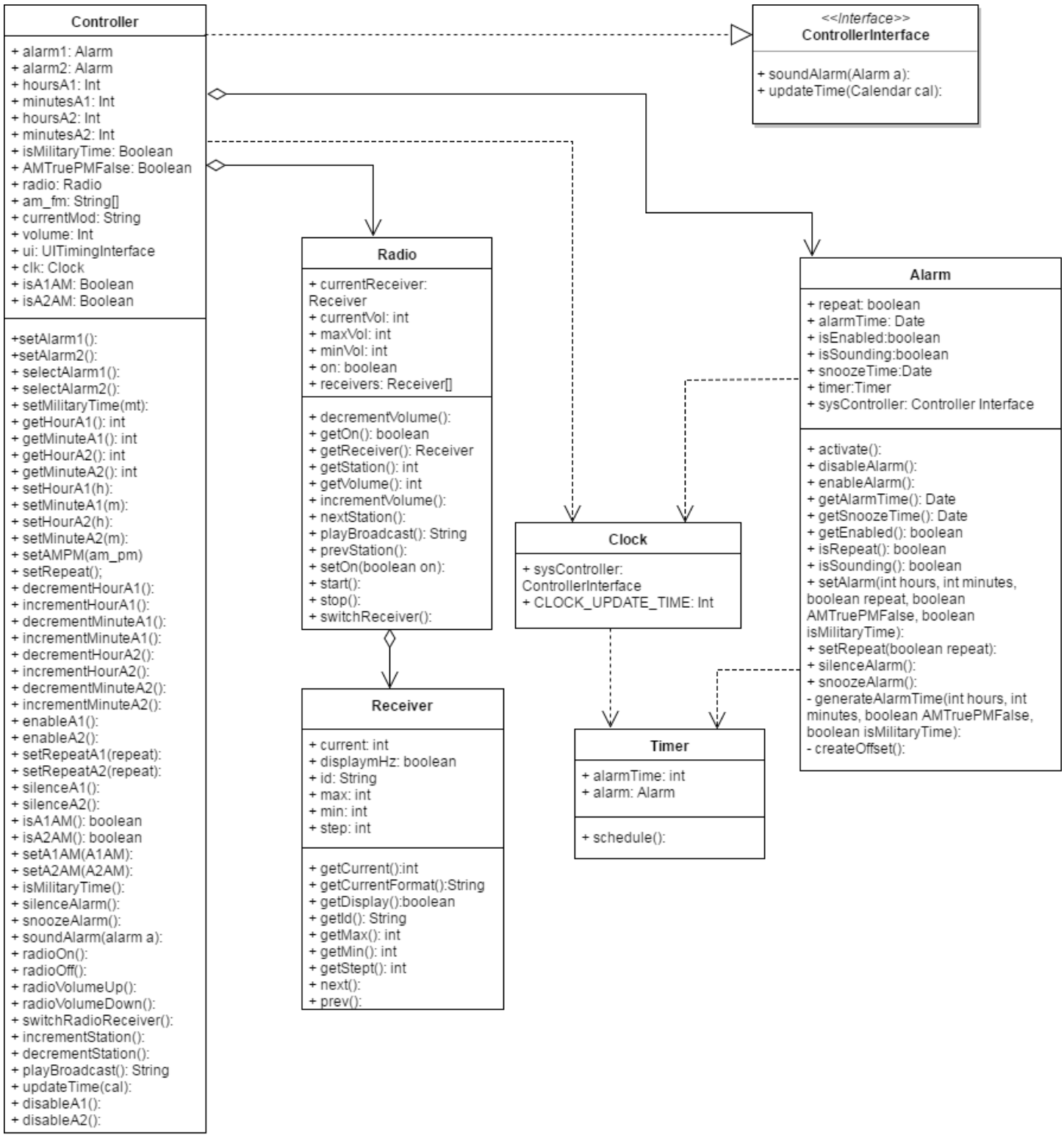
Extensions:

1. The radio is too quiet, so the user raises the volume until their preferred volume is reached.
2. The radio is too quiet and the user raises the volume, but the volume is at it's maximum and the radio continues to be too quiet.

Domain Model

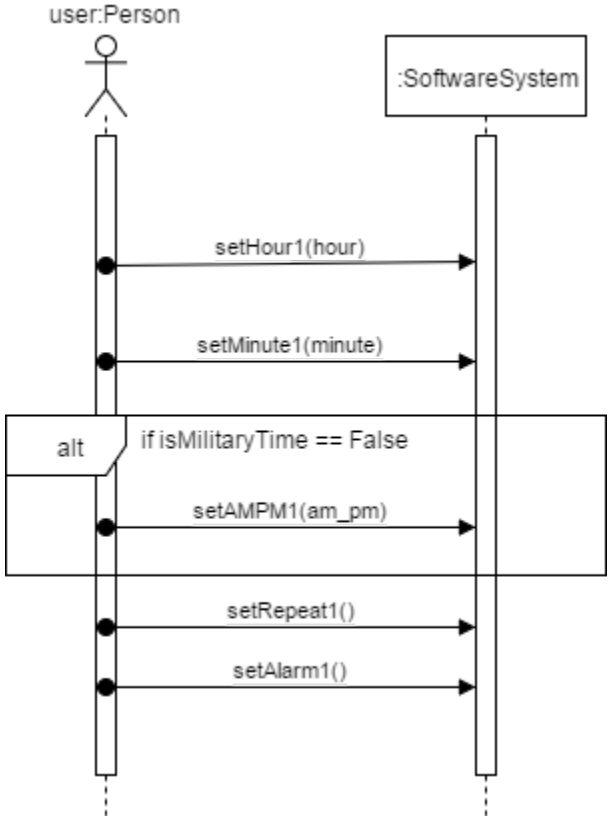


Class Diagram



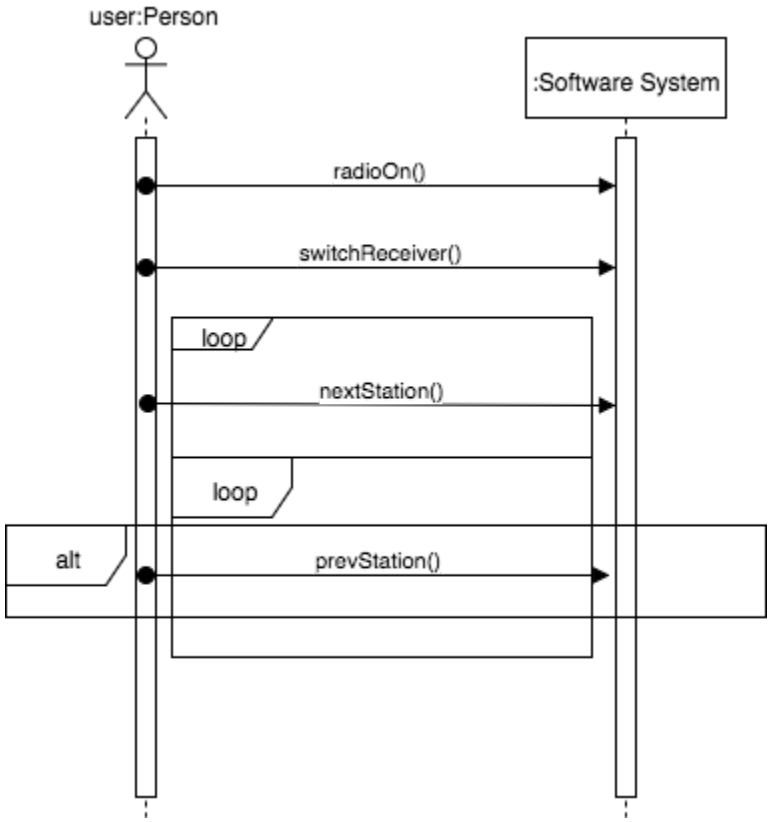
System Sequence Diagrams

System Sequence Diagram 1: Set Alarm 1



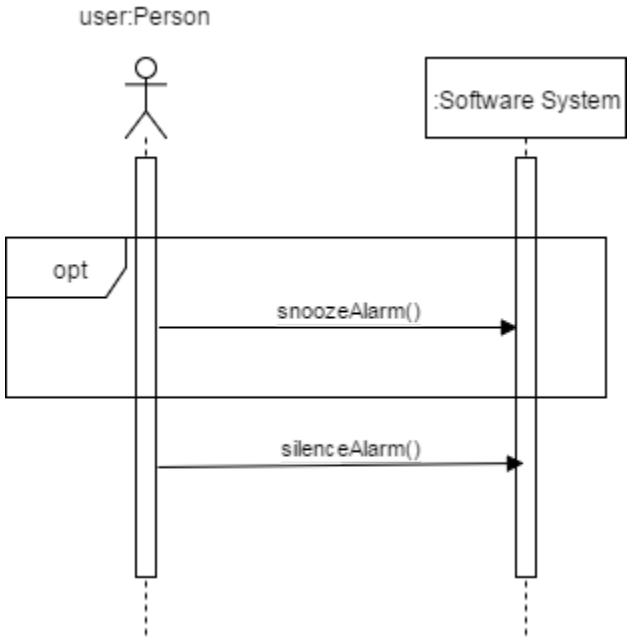
Operation Contracts for SSD: Set Alarm		
Operation	**Preconditions**	**Postconditions**
setHour1(hour)		The alarm 1's hour has been set.
setMinute1(minute)		The alarm 1's minute has been set.
setAMPM1(am_pm)	Military time is equal to False.	The alarm AMPM parameter is set to equal am_pm.
setRepeat1()	The alarm clock has power and an alarm has been set.	isRepeat is equal to True. The alarm will now repeat every 24 hours.
setAlarm1()	Hour1, minute1, and repeat1 have been set.	Alarm attributes hour, minute, am_pm, and isRepeat are set.

System Sequence Diagram 2: Find Radio Station



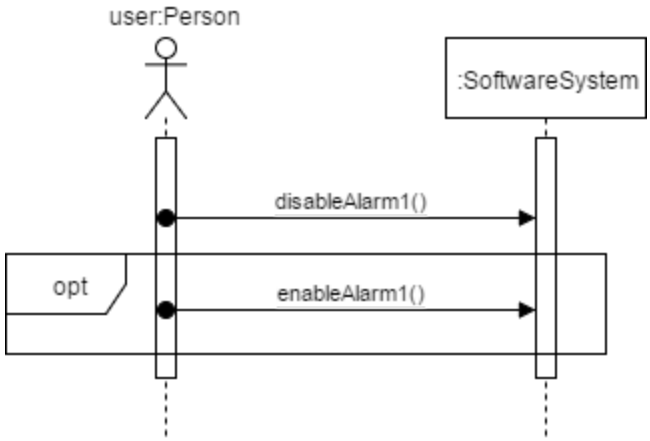
Operation Contracts for SSD: Find Radio Station		
Operation	**Preconditions**	**Postconditions**
radioOn()	The radio has power and radio stations are broadcasting their signals.	The radio will be on and play. currentStation is set to equal the playing radio frequency.
nextStation()	The radio has power and radio stations are broadcasting their signals.	Receiver frequency is incremented.
prevStation()	The radio has power and radio stations are broadcasting their signals.	Receiver frequency is decremented.
switchReceiver()	The radio has power	The receiver is toggled either to the AM receiver or FM receiver.

System Sequence Diagram 3: Silence Alarm



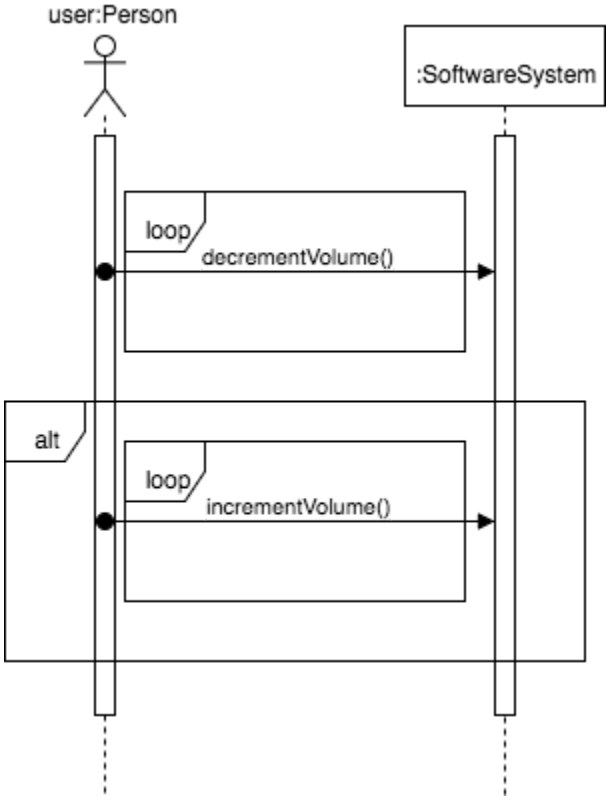
Operation Contracts for SSD: Silence Alarm		
Operation	**Preconditions**	**Postconditions**
silenceAlarm()	An alarm is sounding, otherwise does nothing.	The sounding alarm(s) is silenced for a certain delay time period.
snoozeAlarm()	An alarm is sounding, otherwise does nothing.	The sounding alarm(s) is silenced for a period of 10 minutes.

System Sequence Diagram 4: Disable Alarm 1



Operation Contracts for SSD: Disable Alarm		
Operation	**Preconditions**	**Postconditions**
disableAlarm1()	Alarm 1 is enabled.	Alarm 1 has been disabled and will not go off at the time it is set.
enableAlarm1()	Alarm 1 is disabled	Alarm 1 is enabled and the timer is set to go off at the hour and minutes it has been set to, if it they have not been set the timer will go off at noon

System Sequence Diagram 5: Change Volume



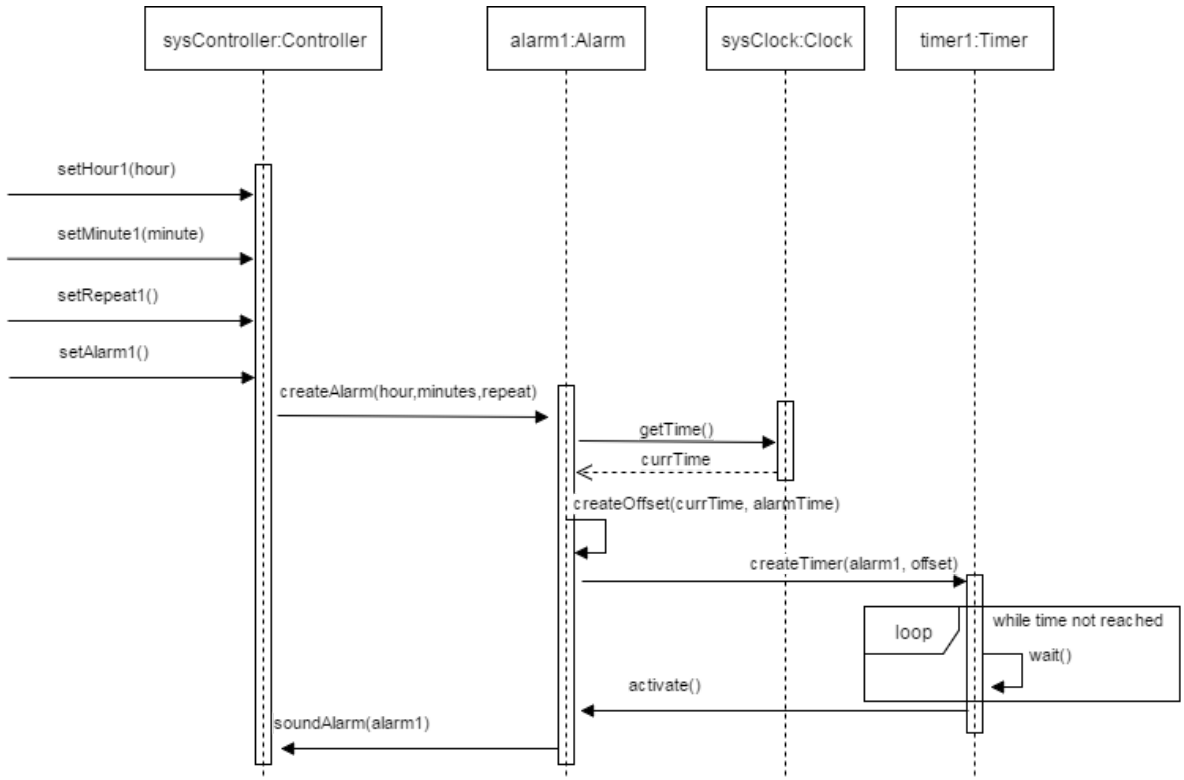
Operation Contracts for SSD: Change Volume		
Operation	**Preconditions**	**Postconditions**
incrementVolume()	Radio is on, volume is not at maximum.	Volume was increased.
decrementVolume()	Radio is on, volume is not at minimum.	Volume was decreased.

Object Sequence Diagrams

Setting Alarm:

Objects:

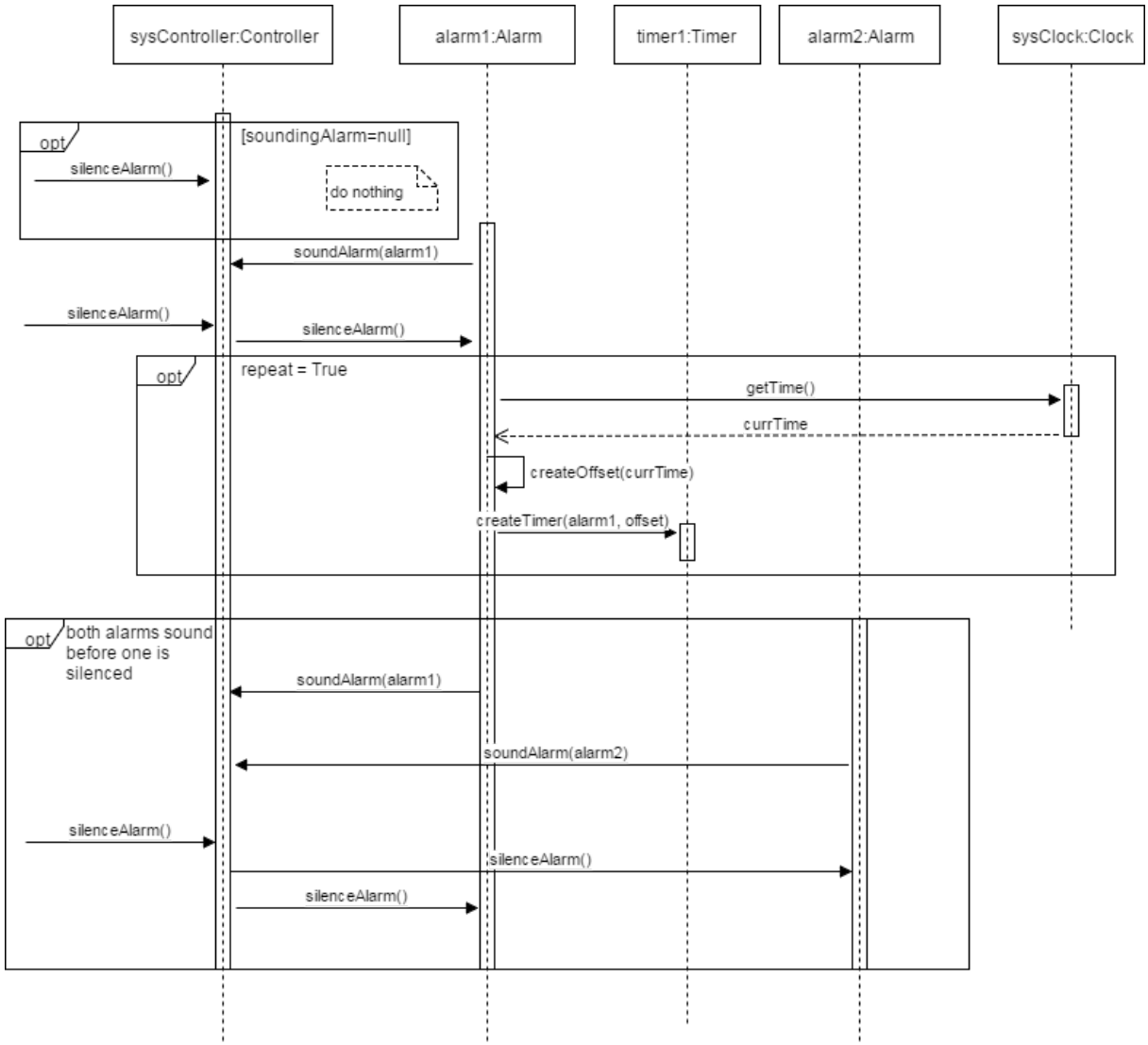
- sysController: Controller
- alarm1: Alarm
- sysClock: Clock



Silencing Alarm:

Objects:

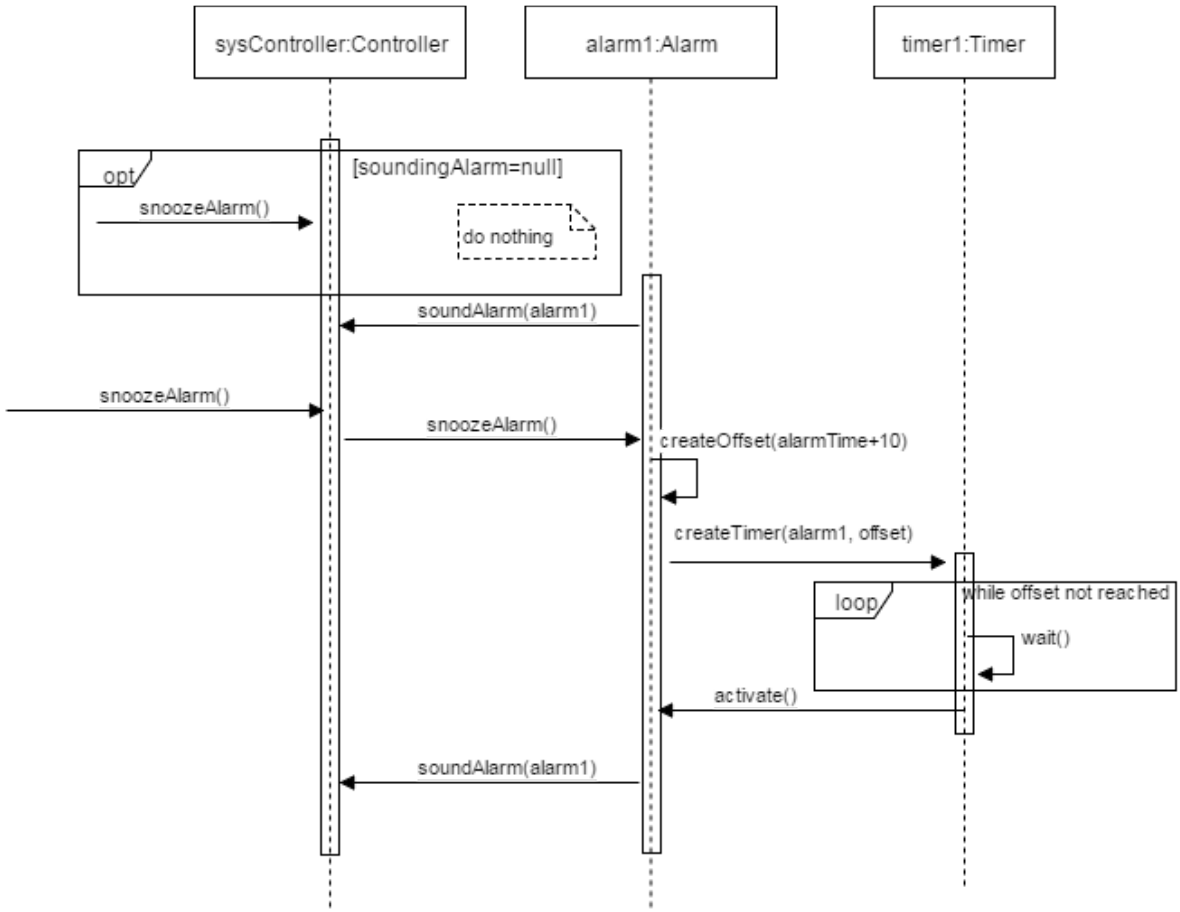
- sysController: Controller
- alarm1: Alarm
- alarm2: Alarm
- sysClock: Clock



Snoozing Alarm:

Objects:

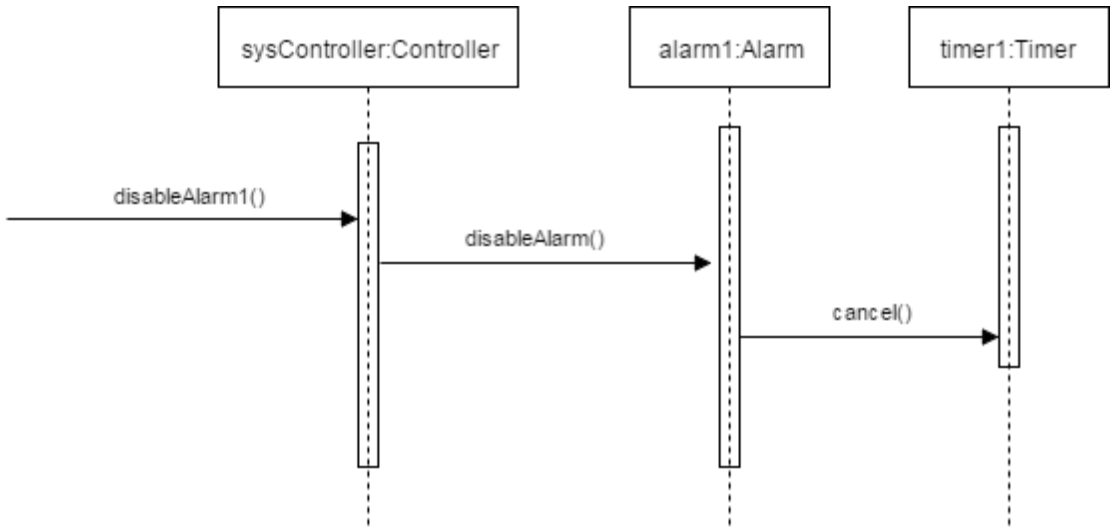
- sysController: Controller
- alarm1: Alarm
- sysClock: Clock



Disabling Alarm:

Objects:

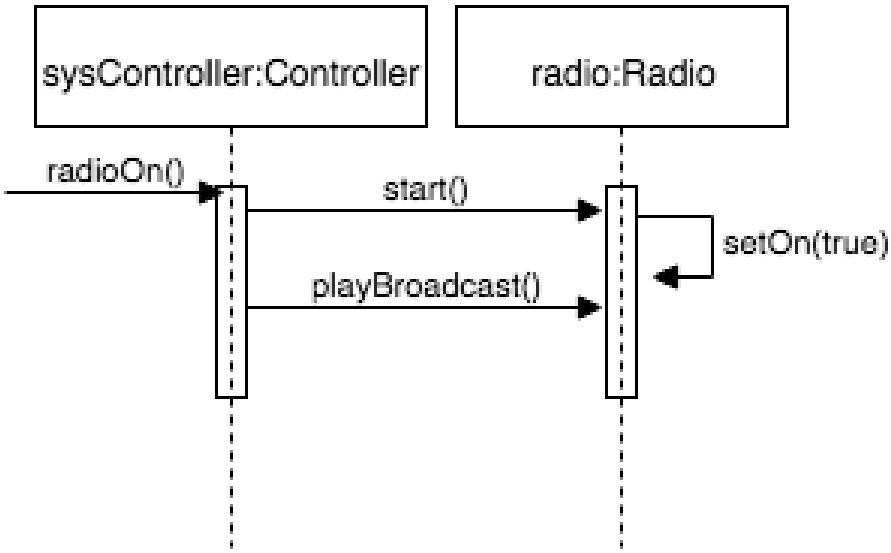
- sysController: Controller
- alarm1: Alarm
- timer1:Timer



Turning the Radio On:

Objects:

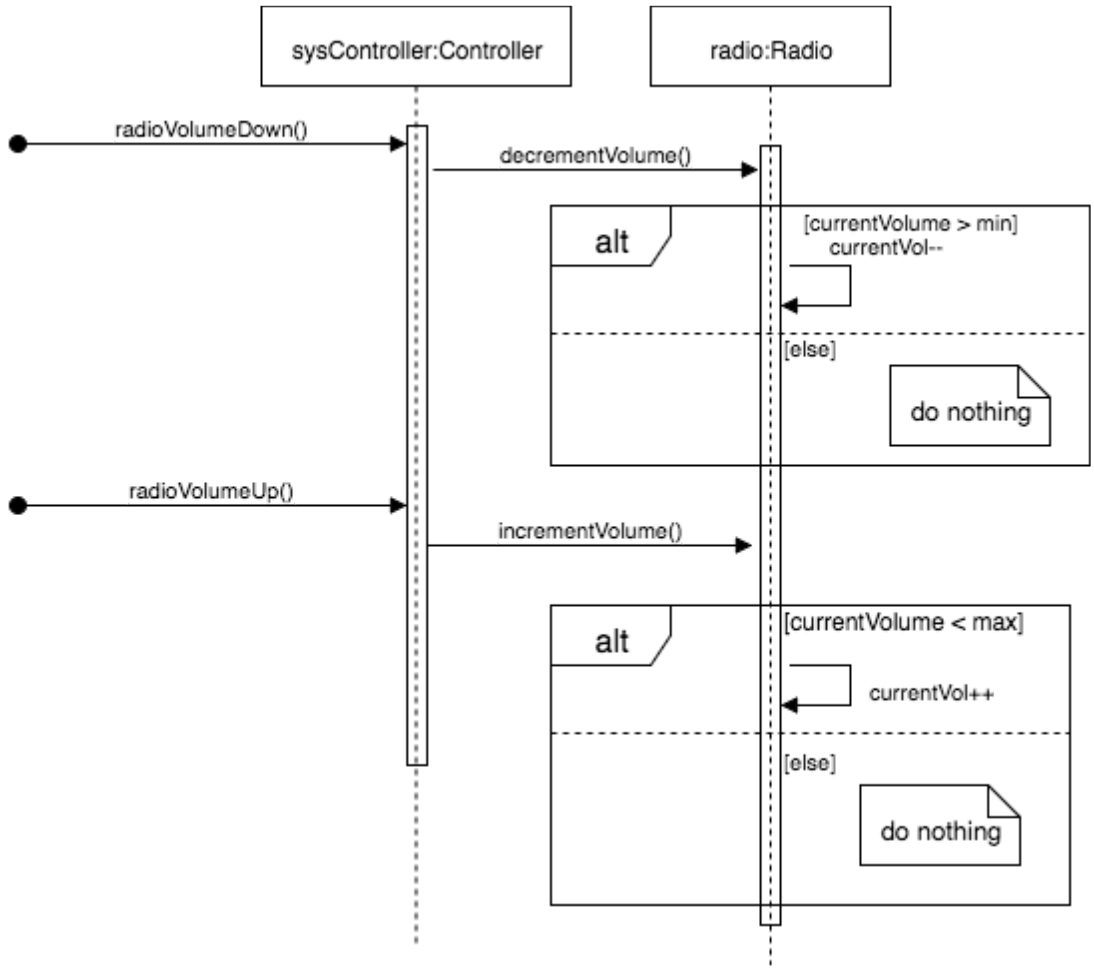
- sysController:Controller
- radio:Radio



Changing the Volume:

Objects:

- sysController:Controller
- radio:Radio

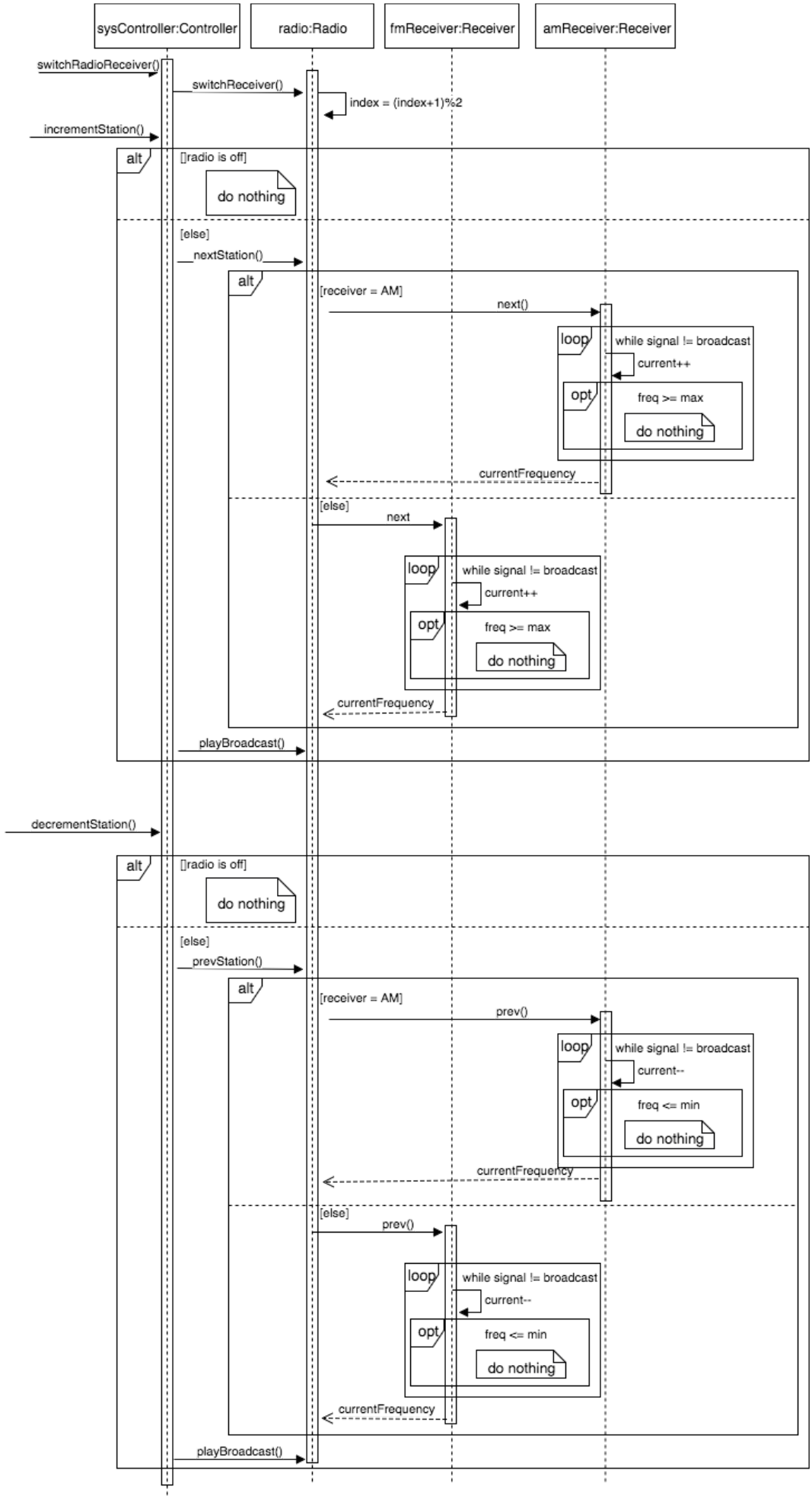


Changing Radio Stations:

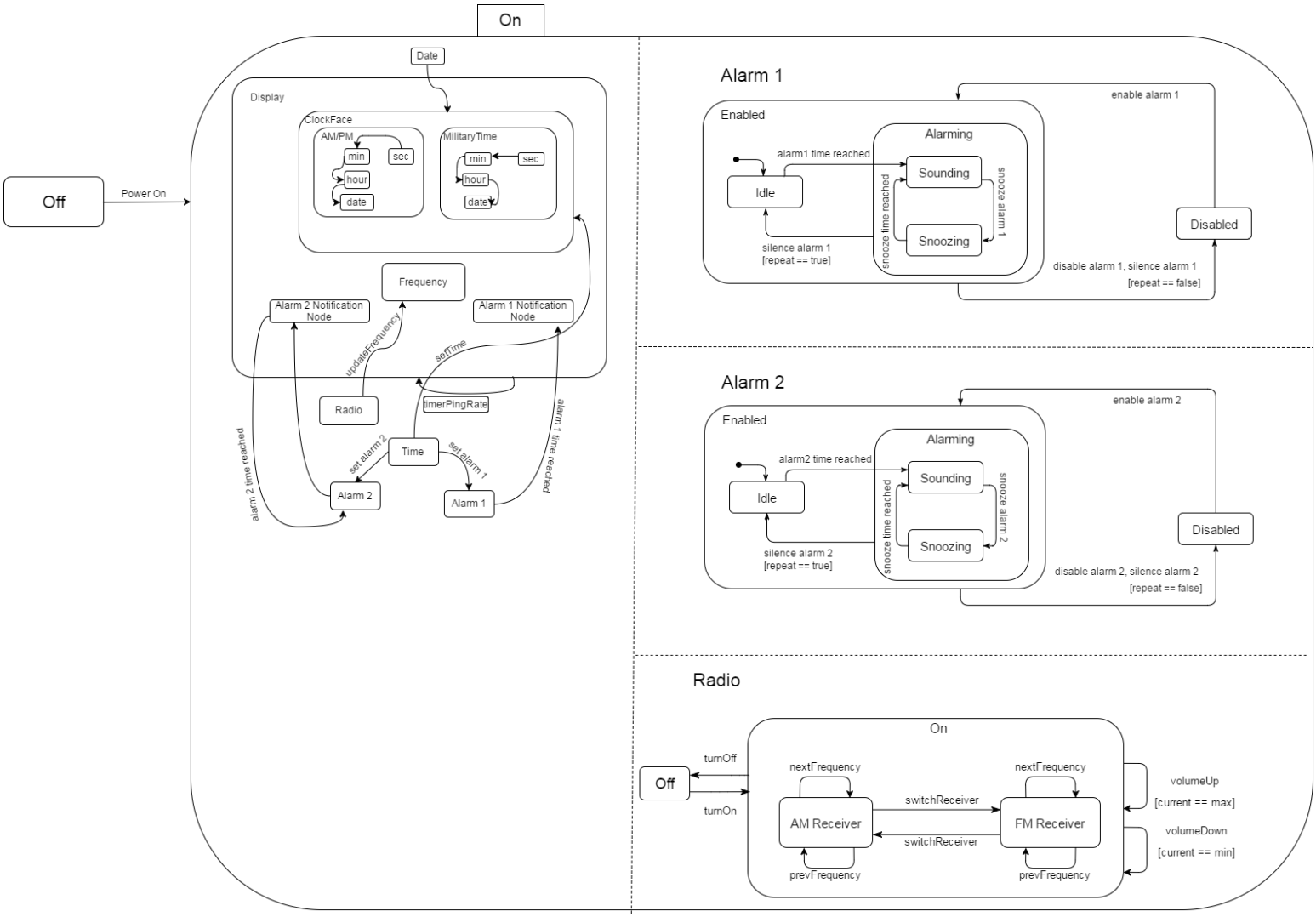
Objects:

- sysController:Controller
- radio:Radio
- fmReceiver:Receiver
- amReceiver:Receiver

(diagram next page)


sysController:Controller
radio:Radio
fmReceiver:Receiver
amReceiver:Receiver
switchRadioReceiver()
switchReceiver()
index = (index+1)%2
incrementStation()
alt
[]radio is off]
do nothing
[else]
nextStation()
alt
[receiver = AM]
next()
loop
while signal != broadcast
current++
opt
freq >= max
do nothing
currentFrequency
[else]
next
loop
while signal != broadcast
current++
opt
freq >= max
do nothing
currentFrequency
playBroadcast()
decrementStation()
alt
[]radio is off]
do nothing
[else]
prevStation()
alt
[receiver = AM]
prev()
loop
while signal != broadcast
current--
opt
freq <= min
do nothing
currentFrequency
[else]
prev()
loop
while signal != broadcast
current--
opt
freq <= min
do nothing
currentFrequency
playBroadcast()

State Machine Model



Glossary

Revision History

Version	Date	Description	Author
First Draft	Jan 26 2017	Expanding content and formatting	Eric Hofesmann
Second Draft	March 14 2017	Replacing dated information, minor reformatting, and respecification of info	Bryce Charydczak
Third Draft	April 20 2017	Refactoring of diagrams and specifications	Marge, Eric, and Bryce

Definitions

Term	Definition and Information	Format	Validation Rules	Aliases
Alarm trigger	The alarm clock reaches its set time and activates the alarm.			
AM Radio	Amplitude modulated radio stations.			Amplitude Modulated
Broadcasters	The companies sending out the radio signals from their stations			
FM Radio	Frequency modulated radio stations.			Frequency Modulated
Military Time	24 hour clock going from 00:00 to 23:59 o'clock.	Two Integers, colon, two integers	First two digits >= 0 but < 24. Last two digits >=0 but < 60.	
Radio Frequencies	The various signals that the device is collecting corresponding to different radio stations.			
Receiver	A device that receives broadcasts from either FM Radio or AM Radio Stations			

Timer	A software class that will update continuously until it reaches a prespecified time.			
Twelve hour format	12 hour clock that begins at 12:00 AM (midnight), runs to 11:59 AM, then runs from 12:00 PM (noon) and runs to 11:59 PM	Two Integers, colon, two integers	First two digits >= 0 but < 12. Last two digits >=0 but < 60.	
Stakeholder	Any type of investor in the overall product, and a person of interest when developing the software to fit their needs.			