

Deliverable #1 T02 Group 2

SE 3A04: Software Design II – Large System Design

March 10, 2017

1 Introduction

1.1 Purpose

The purpose of the document is to provide a detailed description of the requirements for the software application described in the scope. It serves to highlight objectives and key features of the application, while also describing constraints and the interface of the system-to-be, and its environment. This document is intended for use by the stakeholders of the project as reference throughout the various stages of the SDLC. The primary stakeholders include Prof. Ridha Khedri, who has commissioned this project as part of Software Engineering course SE3A04 as provided by McMaster University, Tutorial Assistants for SE3A04, who are responsible with oversight and review of the deliverables of the project and members of the development team (ie. authors of the document). Other stakeholders include any future teams of developers and managers, that may maintain the application or use this project application as an open source reference.

1.2 Scope

Climatar is a UI based mobile game, designed for Android OS, that simulates climate change as experienced by the world made popular by animated TV series, Avatar: The Last Airbender. The game generates news events, which describe real world actions, policies and decisions, which either contribute to or deter climate change, influencing variables that monitor the environmental sphere of the applications model world.

The world of Avatar has been selected as the application's model world as it provides a fictional backdrop for the game and the world's political, social, and economic environment describes a simpler model of the contemporary world. This ensures that the consequences of the news events are enforced on the world independent of prior news events. [1]The geography of the model world is divided into four independent nations: Air Nomads, Water Tribe, Fire Nation and Earth Kingdom. The user will have the option to choose one of these nations, enacting the news events pertaining to the chosen nation through a role of governance. Actions taken on news events further enact long and short term consequences pertaining to all four nations. Each nation follows a unique political system, culture, and lifestyle; whilst using the element specified in its name as the nations primary source of energy.

The objective of the game is to regulate news events in order to minimize the effects of greenhouse gasses and mitigate global warming. The game ends once the model world has experienced sufficient damage due to climate change, severely changing the world's ecosystem, and resulting the user with a loss. The application shall provide users with a save and load game option, allowing the user to play the game when they please without loss of data. The game should be available for download through an application store.

1.3 Definitions, Acronyms, and Abbreviations

1. **BBC:** British Broadcasting Corporation, a public service broadcaster based in the UK.
2. **Climate Change:** Extended and permanent change, as experienced by long term weather patterns.
3. **GHG:** Greenhouse Gases, classification for gases in the atmosphere that absorb and emit radiation within the thermal infra-red light range. Major contributor of Global Warming.
4. **Global Warming:** Gradual increase in average surface temperature of Earth.

5. **FPS**: Frames per second, frequency at which a series of images (frames) are displayed, consecutively.
6. **SDLC**: Software Development Life Cycle, described as the framework used to define the hierarchy of tasks to be performed at each stage of the software development process.
7. **SL4A**: Scripting Layer for Android, library used for creating and executing various scripting languages based in Android systems.
8. **TTS**: Text to speech.

1.4 References

- [1] A. Wiki, "Geography of the world of avatar," http://avatar.wikia.com/wiki/Geography_of_the_World_of_Avatar.
- [2] BBC, "Climate challenge," http://www.bbc.co.uk/sn/hottopics/climatechange/climate_challenge/.
- [3] Monash, "Monash simple climate model," http://monash.edu/research/simple-climate-model/mscm/greb/cgi-bin/scny_i18n.py?scenario=28&variable=02&locale=EN&activetab=undefined.
- [4] G. S. Google Play Store, "Energy wars," <https://play.google.com/store/apps/details?id=com.gz.EnergyWars>.
- [5] Google, "Material design," <https://material.io/>.
- [6] A. Developer, "Core app quality," <https://developer.android.com/distribute/essentials/quality/core.html>.

1.5 Overview

The rest of the document is divided into three main sections: Overall Description, Functional Requirements, and Non-Functional Requirements. The Overall description of the project provides an abstract overview of the product and its major functionality. The section defines the constraints for the system and the assumptions that affect the system's requirements, all the while highlighting the proposed system's benefits that distinguish it from similar products available. The Functional Requirements section provides a detailed description of the functional requirements perceived, which describe the specific behaviour of the system. The contents of this section are classified as business events and viewpoints. The final section, Non-functional Requirements, provides a detailed description of the non-functional requirements, which describe the quality attributes of the system. The plan for implementing functional and non-functional requirements will be detailed in system design and system architecture documents.

2 Overall Description

2.1 Product Perspective

Climate and world simulation as a software solution is not a new idea, however Climatar as a solution to world events is distinct from the current off-the-shelf solutions, appealing to a new client base, as well as utilizing current solution features to provide an enhanced software system for those using existing off-the-shelf solutions.

Existing products related to Climatar include:

- **BBC - Climate Challenge** [2] Is a web application for simulating the effects on controlling taxation, laws, and government spending for the country of Great Britain. The major areas where the user may act are: military, food and water supplies, energy, the environment, and political relations. The application advances with 10 year turns, each turn allows a specific set of decisions to be made within the major areas the user governs. Each decision affects just Great Britain. The overall goal is to become a no-emissions country within 200 years.

Climatar contrasts this application through the following points:

- Climatar is for use on android devices. Android web players do not support the application BBC - Climate Challenge.
- Climatar allows different political regions to influence the world attributes, out of the control of the user.
- The over arching goal is to show feasible world reactions to events, elimination of C02 emissions thus is not the only simulation feature.
- Each play through of Climate Challenge is identical, at each phase of the simulation the same options are available. Climatar is to engage users interaction and knowledge growth by ensuring different instances of the simulation will play through differently based on previous actions, illustrating long term effects of decisions.

- **Climate Models of Earth**

Software illustrations of Climate predictions such as the Simple Climate Model by Monash, utilize mathematical predictions through data extrapolation on climate change to illustrate predictions on future climate if all growth rates remain constant with population, C02 levels, average temperature, etc[3].

Climatar contrasts this application through the following points:

- Climatar simulations do not assume constant growth rates, instead all system components like climate simulate and react with on another, causing complex predictions to events to be explored.
- Applications that model the earth are designed for research use. Climatar is to educate the general public on the effects actions have both long and short term with respect to complex systems which could include, but is not limited to: environment, political toil, sea level, etc.
- The simulations executed in Climatar will however try to be as accurate to real physical systems, allowing for user analysis of reactions to events in a similar to real world way.

- **Energy Wars** Is an Android game[4] where users control the worlds demand for energy through development of green energy schemas such as Wind, and Solar generation stations, as well as pollutant energy generation schemas such as Coal, Natural Gas, and Oil. The world is ever responding to the state of the worlds climate, such event responses include natural disasters and war. The game itself is designed to be a puzzle to solve within each provided stage. Providing points for quickness of completeness and the state of the world after a given challenge has been met.

Climatar contrasts this application through the following points:

- Climatar is to be a simulation solution of the complex systems interacting and handling aspects of regional events and how they effect other regions, whereas Energy wars is designed as a game to and the simulation of the world in the game is non realistic, such that the game moves at a fast pace.
- Both systems utilize the Android platform.
- The user of Climatar is not omnipotent, they may only react to the changing system through events, whereas in Energy Wars users control energy production of every single region, advancements in one relate to advancements in another.
- As opposed to the game modelling the earth, Climatar Models the world present in the Avatar universe. Changing the setting removes the restrictions to the real world, allowing for simulations of generated regions to occur not as the world is, forcing adaptability to the game play aspects of Climatar.

Although many more solutions exist, the above outline all of the main elements to current systems which contrast to Climatar's place in the family of world simulation software solutions.

Climatar is a self-contained software solution with respect to the Android system it is running on. No external databases, servers, or systems are required for Climatar to work. The system itself contains layers for world containment, world components (i.e. Climate, Greenhouse gas levels and emissions, political stances

etc.), and event interaction. Depending on the simulated world, each of the sub layers interact differently. Furthermore the System interacts with the Android platform utilizing the features available to applications on Android devices.

2.2 Product Functions

As an End User, Climatar is to simulate regions of a world based on the political and general (both regional and global) climate, and pollution levels of the world. Users are granted the ability to make the decisions a country may be faced with based on the state of the world, and relations with other countries. However, the User is not granted a role of omnipotence, they cannot control all aspects of how the world or their region behaves. Instead, based on previous actions and the state of the country under governance, the User is presented with events, in the form of news items, which they can react to. Each event has some factor of consequence associated with it (such as: additional pollution, cost, loss of relation...), providing Climatar Users the ability to analyse the long term effects of decisions on a global and regional level. Lastly, information is presented to the user on a per region and international scale, allowing for decisions to be made with a maximized set of information to contrast.

2.3 User Characteristics

The general characteristics of a user of Climatar are as follows:

- Able to read and comprehend English.
- Understands how to navigate and use an Android system, as well as the controls provided by an Android system.
- The ability to see the system; including:
 - Ability to view objects, and distinct elements on the device.
 - Differentiate colouration of components such as red from blue.

2.4 Constraints

1. Climatar is to be restricted to android platforms.
2. Programming language(s) used must be supported by SL4A

2.5 Assumptions and Dependencies

The following list of assumptions hold for the entirety of the SRS, any changes to the below list must be reflective throughout the SRS for it to be considered stable.

- The use of the system assumes that the hardware utilizing the software is running at least Android KitKat 4.4.
- Hardware under use is assumed to have a resolution of at least 720p.
- Climatar is to be granted any system accessibility requests by the user for the system to respond as stated to all requirements.
- The program assumes the power of the system is not immediately set to off without the operating system notifying all applications.

2.6 Apportioning of Requirements

Requirements being delayed, thus not included within the SRS are as follows:

1. Online capabilities of the system are not included within the requirements however are alluded to as possible features.

3 Functional Requirements

BE1. User wants to start the game

VP1.1 User

- i. The user shall be able load a previous saved game.
- ii. The user shall be able to start a new game by selecting a game mode.
- iii. There shall be survival mode and overlord mode available to choose
- iv. Upon starting the game, the user shall be periodically prompted with news events.
- v. The user shall be able to see a loading screen while loading.

BE2. User wants to quit the game

VP1.1 User

- i. The user shall be capable of quitting the game at any time.
- ii. The user shall have the option of saving a game at any time.

BE3. User wants to respond to a news event

VP1.1 User

- i. The user shall be able to select one of the options presented in the news event.
- ii. The user shall be presented with a game over screen if losing conditions are fulfilled.
- iii. The user shall be presented with a game win screen if winning conditions are fulfilled.
- iv. UI elements shall be updated based on the progress made by the user.

BE4. User wants to interact with game view

VP1.1 User

- i. The user shall be able to move the game view around.

BE5. User wants to pause the game

VP1.1 User

- i. The user shall be able to pause the game at any time he want while the game is running.

BE6. User wants to resume the game

VP1.1 User

- i. The user shall be able to resume the game when the game is paused.

4 Non-Functional Requirements

4.1 Look and Feel Requirements

4.1.1 Appearance Requirements

LF1. The product shall minimize the use of visual adornments that would otherwise clutter the interface.

LF2. The product shall use a single colour palette to help develop and maintain it's brand identity.

4.1.2 Style Requirements

LF3. The product's application icon shall be designed in the common negative-space style to help it sit better amongst other popular application icons.

4.2 Usability and Humanity Requirements

4.2.1 Ease of Use Requirements

- UH1. The product shall be usable by anyone fluent in the English language.
- UH2. The product's navigational elements shall behave in the ways standard to the Android operating system. This should make the application more intuitive to use for new users.
- UH3. The product's functions shall be designed a way such that they require a minimum number of gestures from the user.
- UH4. Where it makes sense, the product shall favour input elements such as sliders over raw text input.

4.2.2 Personalization and Internationalization Requirements

n.a

4.2.3 Learning Requirements

- UH5. By using standard Android navigational elements, the product should not take more than 10 minutes for a new user to become adept with it.

4.2.4 Understandability and Politeness Requirements

- UH6. The product shall use common navigational elements (ie. status bar, tab bar, hamburger menu) to help usability amongst new users.
- UH7. The product shall use common iconography to help usability amongst new users.
- UH8. The product shall contain no language or ideas inappropriate for an elementary school level user.

4.2.5 Accessibility Requirements

- UH9. The product shall make heavy use of contrast to help it's usability amongst colour blind users.
- UH10. The product's interface shall use intractable elements at a minimum of 1x1 cm in size to help users with reduced motor skills.
- UH11. By employing standard Android SDK best practices as mentioned in LR1, the product shall adapt the user's global accessibility settings such as TTS (text to speech) and increased/decreased font sizes.

4.3 Performance Requirements

4.3.1 Speed and Latency Requirements

- PR1. Each user interaction shall be followed up by a visual change on screen. The time between these two events should never exceed half a second.
- PR2. Procedural world generation for a new game should take no longer than 2 seconds.
- PR3. Loading an in-progress game should take no longer than 1 second.
- PR4. The application should launch in no longer than 2 seconds on a Samsung Galaxy S6.
- PR5. The application should resume from background in no longer than 1 second on a Samsung Galaxy S6.

4.3.2 Safety-Critical Requirements

n.a

4.3.3 Precision or Accuracy Requirements

PR6. the application shall favour the use double precision to minimize rounding error.

4.3.4 Reliability and Availability Requirements

PR7. The product shall not require an active internet connection (ie. it will be available offline).

PR8. In any case that the device is running under normal circumstances, the application shall be available.

4.3.5 Robustness or Fault-Tolerance Requirements

PR9. The application shall temporarily save an ongoing game in the event that it is terminated unexpectedly by the user or by the operating system in the event that memory needs to be freed.

PR10. The application shall reopen an ongoing game in the event that it is launched following an unexpected termination.

4.3.6 Capacity Requirements

n.a

4.3.7 Scalability or Extensibility Requirements

n.a

4.3.8 Longevity Requirements

PR11. The product should be maintainable and extensible within it's planned maintenance budget for 5 years post launch.

4.4 Operational and Environmental Requirements

4.4.1 Expected Physical Environment

OE1. As the application operates within the Android environment and introduces no restriction under which it operates within that environment, the product shall be usable under circumstances where the Android operating system allows it.

4.4.2 Requirements for Interfacing with Adjacent Systems

OE2. The product shall work on any smartphone running Android 4.4 (KitKat) and later.

4.4.3 Productization Requirements

OE3. The product shall be installable directly from the Google Play Store.

OE4. The product shall have 5 screenshots and a short text description to advertise it on the Google Play Store.

4.4.4 Release Requirements

n.a

4.5 Maintainability and Support Requirements

4.5.1 Maintenance Requirements

- MS1. Hotfixes must be available to publish within a day of them being made.
- MS2. The code shall be architected modularly such that it can be more easily maintained.

4.5.2 Supportability Requirements

- MS3. A link to the company's support url will be provided in the description on the Google Play Store for feature requests and bug reports.

4.5.3 Adaptability Requirements

- MS4. The product's interface shall be designed in a way such that it can be easily adapted to different screen sizes.
- MS5. The product is expected to run on version of Android 4.4 (KitKat) and later.

4.6 Security Requirements

4.6.1 Access Requirements

- SR1. When online features are introduced in the future, only a user logged into an account may play under that account's identity.

4.6.2 Integrity Requirements

- SR2. The product shall guard against the introduction of incorrect data to, for example, guard against an attacker spoofing high scores numbers.
- SR3. When online features are introduced in the future, the product shall guard against the automated generation of user accounts.

4.6.3 Privacy Requirements

- SR4. The product shall inform users of its information policy before collecting data on them.
- SR5. The product shall inform the users of changes to its information policy.
- SR6. The product shall adhere to its information policy if revealing private user information.

4.6.4 Audit Requirements

n.a

4.6.5 Immunity Requirements

- SR7. As the product runs under management of the Android operating system, the immunity of the product relies on the guards put in place by Android.

4.7 Cultural and Political Requirements

4.7.1 Cultural Requirements

- CP1. The product shall favour the use of icons such that, when needed, it can be more easily adapted to different languages and cultures.
- CP2. The product shall aim to not offend any ethnic or religious groups.

4.7.2 Political Requirements

n.a

4.8 Legal Requirements

4.8.1 Compliance Requirements

LR1. Personal information shall be implemented in compliance with the data protection act.

4.8.2 Standards Requirements

LR2. The product shall use Android SDK best practices so that for instance the user's global accessibility settings (text size, text-to-speech etc...) will take effect in the app.

LR3. Where it can, the product shall conform to Google's material design guidelines.

LR4. The application will conform with acceptable performance standards for games and simulations.

LR5. The application will conform to the Android Core Application Quality standards to minimize turnover approval time and to increase the chances of being featured in the Google Play Store.

A Division of Labour

Division of Labour sheet which indicating the contributions of each team member. This sheet must be signed by all team members.

Contributor Name	Contributions
Wenbin Yuan	Section 3.* Functional Requirements Planning and Formalization in association with Haris; Revisions for section 3.*
Haris Khan	Section 3.* Functional Requirements Planning and Formalization in association with Wenbin; Revisions for section 3.*
Riley McGee	Section 2.* Overall Description; Revisions for 2.*; Proof Read and Edited Document
Vishesh Gulatee	Section 1.* Introduction; Revisions for 1.*; Proof Read and Edited Document
James Taylor	Section 4.* Non-Functional Requirements; Revisions for 4.*; Proof read document

By signing below you agree to the work divisions stated above correctly representing all contributions made:

IMPORTANT NOTES

- Be sure to include all sections of the template in your document regardless whether you have something to write for each or not
 - If you do not have anything to write in a section, indicate this by the *N/A*, *void*, *none*, etc.
- Uniquely number each of your requirements for easy identification and cross-referencing
- Highlight terms that are defined in Section 1.3 (**Definitions, Acronyms, and Abbreviations**) with **bold**, *italic* or underline
- For Deliverable 1, please highlight, in some fashion, all (you may have more than one) creative and innovative features. Your creative and innovative features will generally be described in Section 2.2 (**Product Functions**), but it will depend on the type of creative or innovative features you are including.