Software Engineering Project Report

Development Project - Go Geo

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I Project Description

1 Project Overview

"Go Geo" is a location based game where the player travels to various places in the world and accomplishes certain targets. It is especially designed for the users to make them aware of the climate changes like global warming due to pollution that is affecting various forms of life and depleting the ozone layer. The game tries to empower the users on how to overcome these challenges along with fun and excitement, thus giving an insight on making our planet much safer and healthier place to live not only for humans, but also for all the forms of life over the generations to come.

This game is primarily a web based application game that can be played over mobile and desktop. Each place (cities across the world) constitutes a gaming level. Initially the levels are easy and makes gamers understand the game. The difficulty surmounts upon each level. The player has to increase points(XPs) in each level to qualify for the next level. The game can be played by a single player or can be played in teams. Each player can select the team mates based on the level they are in and also by the points they have earned. The main targets of the player are to reduce the pollution levels in the city (carbon monoxide, Sulphur oxides, nitrogen oxides, lead etc.,), increase the oxygen levels by planting more trees, encourage the citizens to utilize more public transportation and riding bikes thereby reducing the usage of fossil fuels, make cities plastic free, and so on.

This game can be used as an educative tool by teachers in schools. The students will be entertained as well as engaged in learning about the nature and its conservation. It also provides few facts on the various locations in various countries, pollution and its effects before the start of each level. It has few bonus rounds in between levels which are short and fun. Players can invite their friends by Facebook or any other emails.

2 The Purpose of the Project

2a The User Business or Background of the Project Effort

Global warming has become a major threat to the planet and all the species residing on it. The major affected areas are the north and south poles where the ice mountains and glaciers are melting down, resulting in the rise in the sea level. The native species are the worst affected. According to recent studies, there is drastic decline of the penguins on Antarctica over the past few decades. The ultimate impact will be on humans. Also, the pollution in the various elements of the Earth such as air, water, fire, and land had already shown considerable impact on humans. The depletion of ozone layer is making humans vulnerable and susceptible to various skin diseases and cancers. The seasons are unstable and unpredictable. The summers are warmer and winters are colder every year.

The inspiration to create this gaming project was derived from the instances mentioned above. The game allows users understand the impact of the global

warming and pollution, and steps to rectify the issue of climate changes in a fun and thrilling way. The idea of teaming up in the game and changing the world together has been the pivot for a newer and better world.

Not many games of this kind are available in the market right now. This game will be engaging, thrilling, and informative which will provide players with a perspective and insight of the world. It encourages users to plant trees, avoiding usage of plastic bags, and other activities which will lead to bigger changes that can help in shaping up the world.

2b Goals of the Project

The main objective of this game is to provide players a refreshing experience alongside teaching them the right and small things that make them, and the future generations, live in a safe and healthier place without disturbing the ecological balance of the planet. 'Live and let live' has been the main motto of this gaming project

2c Measurement

Measurement is vital in determining if our product is effective as any other trending game and if the people are liking it. This can be determined by the number of downloads. The occasional survey that can be taken from the users to know how they feel about it and make any changes or add new features by providing updates to the games in the later versions. The data collected from the users also helps in projecting and estimating the commercial success of the product.

To determine if the game is user friendly and less complex, The AI will keep track of 'help' button clicks. This will help the development team to improve the tutorials for understanding the game further, and make the experience worth their time.

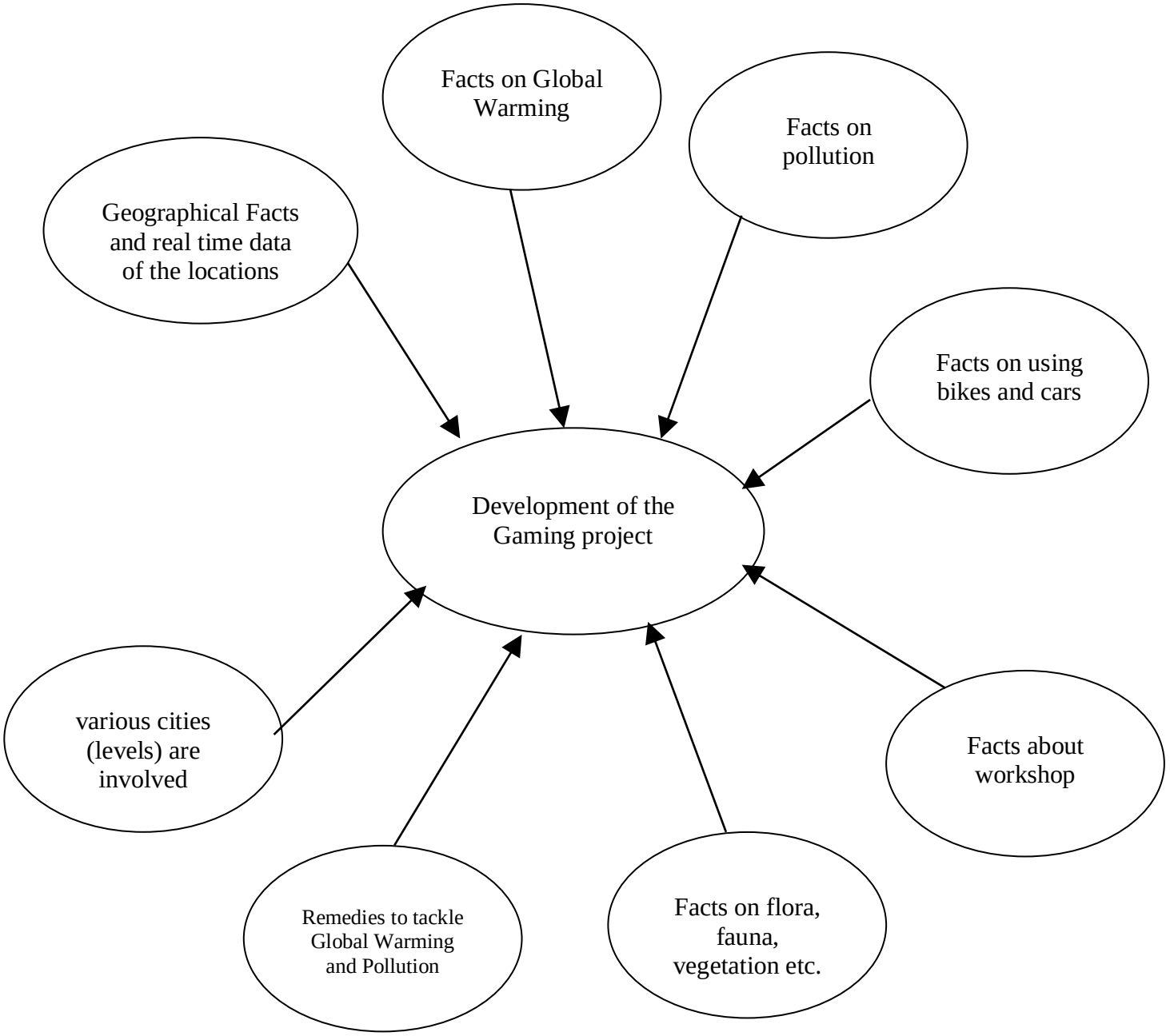
3 The Scope of the Work

3a The Current Situation

Global warming became one of the hot topics because of it is obvious influence in the climate around the world. Therefore, understanding the cause of global warming and how to stop or reduce it became a challenge for many educators. Many ongoing research thoroughly studies effects of global warming. The game will introduce global warming effects to the players in an interesting way. In addition, players will be exposed to the areas around the world that are suffering from global warming. This game can be used by teachers in order to aid their students understand what is global warming, its impact, and steps of reducing it .

3b The Context of the Work

Certain facts are required as inputs while designing the game. This is explained with the diagram as shown below.



The designer must know facts about the global warming, pollution, worst affected cities, remedies to tackle them, geographical and historical details of those cities, the local flora and fauna, and details about campaigns because these facts are part of different levels in the game.

3c Work Partitioning

Event No.	Event Name	Input and Output	Summary
1	Initial start up	I/P: User starts the game with default location/country provided by the computer. O/P: Different tasks are assigned based on the location	The game has various locations/countries as different levels. The locations are decided based on the least affected to the worst affected due to global warming and pollution around the world, that increase the level of difficulty of the game. The player has to finish each level successfully to unlock the next level.
2	Show information about the country.	I/P: Based on each level(location), user will be provided with a brief information about historical, climatic and geographical facts of the location/country. O/P: Quiz questions are built as the information gets provided to the player.	Player will eventually know various facts of the location/country with the information provided. As the player reads the information, questions are created dynamically which will be used later in a quiz.
3	Quiz - questions related to the information provided in "event 2".	I/P: Four options will be provided to the user. The player will select correct answer from those options. O/P: If the player's selected answer is correct, points/coins will be added to the account.	User is provided with a question and four options to choose from. It will be a multiple choice question type quiz. For each correct answer, points/coins will be added to the player's account. The duration of the quiz will be 30 seconds, The player can earn as many coins as possible.
4	Buy Seeds	I/P: User will use the points/coins to buy seeds. O/P: Appropriate amount of seeds will be provided.	The game will provide player with appropriate amount of seeds based on the points/coins spent.
5	Provide Location	I/P: After the seeds were acquired by the player. O/P: a location will be provided to seed the plants.	Once the player has desired amount of seeds, a location will be picked by the game. Player will have to plant those seeds at that location to finish the task.
6	Plant Seeds	I/P: Player decides how many seeds to plant. O/P: Decrease in required experience to unlock next level or place.	The player will have to plant certain amount of seeds to get points towards next level.
7	Insufficient Points	I/P: Quiz or bonus rounds O/P: Increase in points/coins.	In case of insufficient points to buy the seeds or move on to the next level, the user will be provided with another quiz (Event 3) during the level. Player can also increase points by playing bonus rounds in between levels.
8	Unlock Task In The Level	I/P: Finish the current task O/P: The next task will be unlocked	The player will be able to unlock next task in the level only after finishing the current task successfully.
9	Reduce Waste	I/P: Player will recycle all the waste found when roaming in the location. O/P: Increase in the points and reduce amount of experience required to reach next level	Some locations will have a lot of waste in one place. Recycling it will give users bonus points.
10	Fossil Fuel Campaign	I/P: Run campaigns to raise awareness about global warming. O/P: reduce amount of experience needed to reach next level	User will select different campaigns to run to raise awareness about global warming. Length of campaign will be decided by the player and coins spent. Ex. Campaigns to buy only electric cars, use solar energy, etc. This will reduce the experience required to reach next

			level.
11	Level Up	I/P: Player decided which location/country to visit next. O/P: Event 2. Bonus points awarded. Increase amount of experience required to reach next level.	When user reaches new level, the player in placed in the next least affected country from the list. Event 2 is repeated. Bonus points are also awarded. The amount of experience needed to reach next level will increase compared to last level.
12	Bonus Rounds	I/P: Player participates in the bonus rounds in between levels O/P: Player receives the additional points	Any deficiency in points to unlock next levels can be obtained by playing these bonus rounds.
13	Marathon	I/P: Player will take part in different marathon. O/P: Increase experience.	Player will have an additional option to increase their experience level by taking parts in marathon. Activities such as running and biking will be involved.

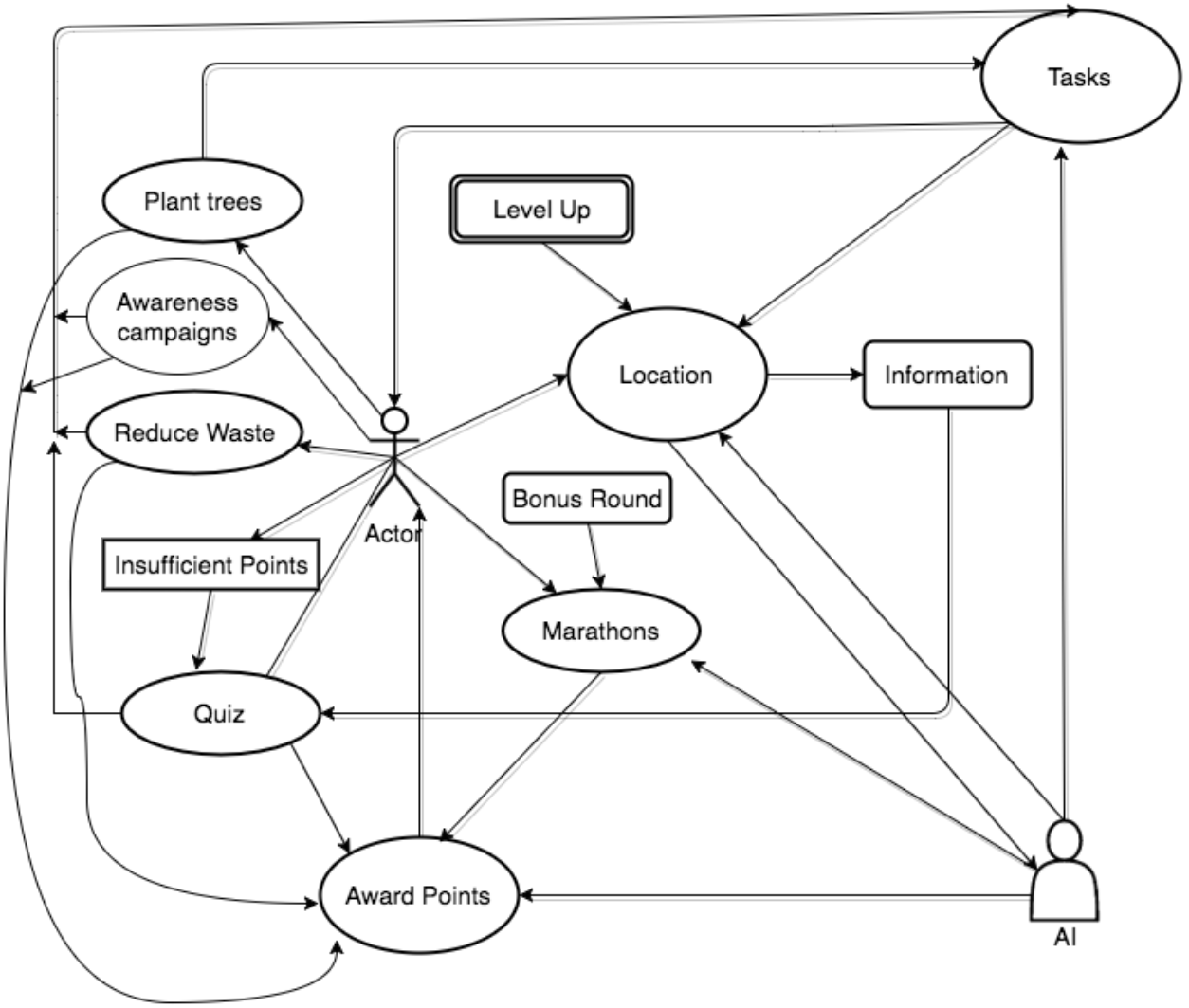
3d Competing Products

Most of the location based games are created for fun and entertainment without any objective. Our game is created as an educative tool. Using this game will make players get sufficient information about global warming and insight to reduce it. In addition, this game will boost the geographic knowledge of the players as well as their historical knowledge of global warming in different areas around the world.

4 The Scope of the Product

This product is an experience based game where the user has to cover different locations by planting seeds, reducing waste in certain areas, and take part in marathons. The point of this game is to get people to work together in making the earth's air cleaner. It can be played as single player or in a team. As a single player, the user's job to progress in the game is to select an unclaimed location, plant the required amount of seeds in that location, and move on to the next one. Each location has a required amount of seeds that need to be planted. To further progress in the game, move to the next "area". To better understand this, think of seeds as a subset of locations and locations as subset of areas. User will need coins in order to buy seeds. Different tasks are created to earns coins. Recycling waste and taking part in various marathon will be one way to earn coins. As described above, planting seeds will help immensely to level up. Each level has pre-defined experience required. Most experience is earned by plantings seeds, but taking part in marathons and cleaning waste will also help. Player will also have an option to run campaigns. This will cost them appropriate amount of coins but will help them immensely in earning experience. To play as a team the same rules apply, only difference is that all users must plant at least one seed in each location.

4a Scenario Diagram(s)



See Section 9a for a discussion of and examples of use-case diagrams.

4b Product Scenario List

1. Start Game Scenario
2. Earning points Scenario
3. Level up Scenario

4c Individual Product Scenarios

1) Start Game Scenario

At the start of the game the user will come to a screen with a list of ten countries. The countries are listed in the order from the least polluted to the most polluted. To start the game, the user must select a country they'd like to reduce pollution in. New users with no experience in the game only have the option to select the country with the least pollution; as they progress they will be able unlock other countries.

2) Earning points Scenario

- The quiz - Once the (new) user has selected a country, the first thing that will come up are some fun facts about the selected country. The user must pay attention and learn these facts as they will be taking a quick 30 second quiz in order to earn their first points. This is also true for experienced user that run out of points. Once the quiz has started, user has 30 seconds to answer as many question as they can, each correct answer is rewarded with points. The fast each question is answered the more points they can earn.
- Planting seeds – To earn experience the user can plant seeds. In order to plant seeds, the user must have seeds otherwise they must buy them with the points they have. In the case of the user having no seeds to plant they must look for a nearby seeds store. Once they've selected a seeds store and purchased desired amount of seeds the game will load the seed quantity into their account. At this point the user will have the seeds and so they must plan seeds in the location provided by the game.
- Reduce waste – To earn points by reducing waste in the selected location the user must roam around and find recyclable trash from the street and put them in the recycle bin.
- Air pollution awareness – To earn points by raising awareness of air pollutions. The user must join a campaigns of various lengths (the longer the campaign the more points earned) to raise awareness. Each campaign will have different activities. Activities include: sticking posters of electric cars, carpooling, and reduce the use of energy.

3. Level up Scenario

To go from one level to the next the user must increase their experience level required for the next level. The next level up is the country with the next least pollutions in the list of ten countries in the start screen. Each thing in the earning points scenario increases the users experience. Along with the experience, the user is required to do an additional task in order to move to the next level which is to reach the required amount of seeds planted for each location. Once the user fulfills the two requirements they may go on to the next level, at this point the start screen is presented again and the user can select the next country in the list.

5 Stakeholders

5a The Client

This game is designed for two purposes, one for a fun outdoors activity and the other is to reduce the toxicity in the air via planting plants thus producing more oxygen, so an ideal client would be someone or an organization that spreads awareness of global warming. More generally, the client could also be anyone that wants to take ownership, maintain and distribute this game. The source code of this game will be given to the client for any future updates/changes the client wants to make. The client may send the product back for further implementation, after the final product is delivered for review, if they are not satisfied with it.

5b The Customer

This game can be played by anyone that has access to internet. Someone who enjoys nature and outdoors activity is likely to enjoy this game. It brings communities all around the world together to help make their environment a better place for themselves and future generations.

5c Hands-On Users of the Product

All though this game is open to anyone, it can be of greater interest to teachers. An example of the use of this game in a classroom is to teach:

- User name/category: Environmental studies
- User role: This user can use this game as homework for their students.

  Some responsibilities of this user include:

  1. Monitor each student's progress
  2. Grant more bio seeds when requested
  3. Set requirements and deadlines

- Subject matter experience: Journeyman. This user should have some knowledge in the subject botanical environment in case a student asks a question regarding where it is suitable to plant.
- Technological experience: Journeyman. This user should have basic knowledge of how to use a computer and the web; mobile and/or PC.
- Other user characteristics: This user must know how to use this game and be able to teach how to use it.

- On the other hand the students can use this game also as part of expanding their knowledge.

- User name/category: Students
- User role: This user's role in the game is to
    1. Plant the amount of seeds required by the teacher
    2. Report progress
    3. Claim location so another student cannot plant in the same location.
- Subject matter experience: Novice. This user does not need to know anything about botany.
- Technological experience: Journeyman. Like the teacher, his/her user should have basic knowledge of how to use a computer also.

5d Priorities Assigned to Users

Whether played in a group or individually, all users are key users. All are key users because the progress of a user does not depend on another user. Requirement to progress:

- The amount of seeds that need to be planted varies depending on the location so to progress in the game the user must claim locations by planting the required amount of seeds for each location.
- Seeds planted in a location is a subset of the location and in order to go to the next location the user must finish planting required seeds.
- Locations is a subset of an area and in order to go to the next area the user must plant seeds is a required amount of locations.
- Eventually, the user will have to take part in marathons and run campaigns to progress.

5e User Participation

When the game is played in a team each user participation is very important for the group progress. The way progress works when played in a team is all users must plant at least one seed in the location that is in progress to move on to the next locations; if a team has enough seeds planted in a location to move on to the next but one user in the team did not plant a seed in that location, the team may not go to the next location until that user has planted at least one seed.

5f Maintenance Users and Service Technicians

Back end users of the game are the users who will maintain and update the database of the game. Duties of this user are:

- Resolve user issues such as login (keep track of individual players), progress not displayed and other glitches
- Make sure data, such as player progress, is being reported and displayed fast enough.
- Overall maintenance of the database and make sure the servers are up and running at all time.
- Update the location information periodically

The service technicians must know how to navigate through the game's UI along with basic knowledge of the game play. This knowledge is needed because users may present an issue and the technician must know how to resolve it, whether it's by contacting the maintenance user in case of a back end issue or by navigating the user through the UI in case the user is new to it.

6 Mandated Constraints

6a Solution Constraints

Description: The game shall operate in any type of machine (Mobile phones, tablets, laptops and desktops) and on any operating systems.

Rationale: The player can run the game in any type of machine in order to be able to play the game on-the-go or on a desktop.

Fit criterion: The game shall be approved as compliant by all operating systems' testing teams.

Description: The game shall allow multiplayer to play the game.

Rationale: The player can play the game with other players in order to have more fun and gain different skills in playing the game.

Fit criterion: There shall be an option in the game which allow the player who wish to play the game online as a team to connect with other online players.

Description: The game shall automatically provide the player(user) with a unique ID.

Rationale: Database needs to differentiate for individual users, so a game connects with a unique ID to keep track of it.

Fit criterion: In the beginning of the game the player(user) will be automatically provided with a unique ID.

Description: There shall be a regular update to the information which the game provide to the players.

Rationale: keep the information which the game provide up to date will challenge the players to continue playing the game in order to extend their knowledge.

Fit criterion: There shall be a button on the game's menu screen, which inform the player about the new version of the game.

Description: The game shall be tested before issued.

Rationale: The game tested to make sure that the user can understand and follow the steps of the game easily.

Fit criterion: The game developer shall test the game's before issuing a version.

Description: The game shall provide the player a description about the game steps.

Rationale: Knowing the general idea of the game will help the player to enjoy playing the game without spending time to figure out the requirements of each step or level while they are playing.

Fit criterion: The game shall have "learn me" button which provide step by step guide to the player of how to play the game in general; in addition to, in each level of the game there shall be "learn level" button that provide the player a description of how to play that specific level.

Description: The game shall be free of charge.

Rationale: As the developer of this game are aiming to use the game for educating purpose; there is no charge to play the game, so the player can play it as much as they want and expand their knowledge for free.

Fit criterion: The player shall be able to play the game or download the game from the internet for zero charge.

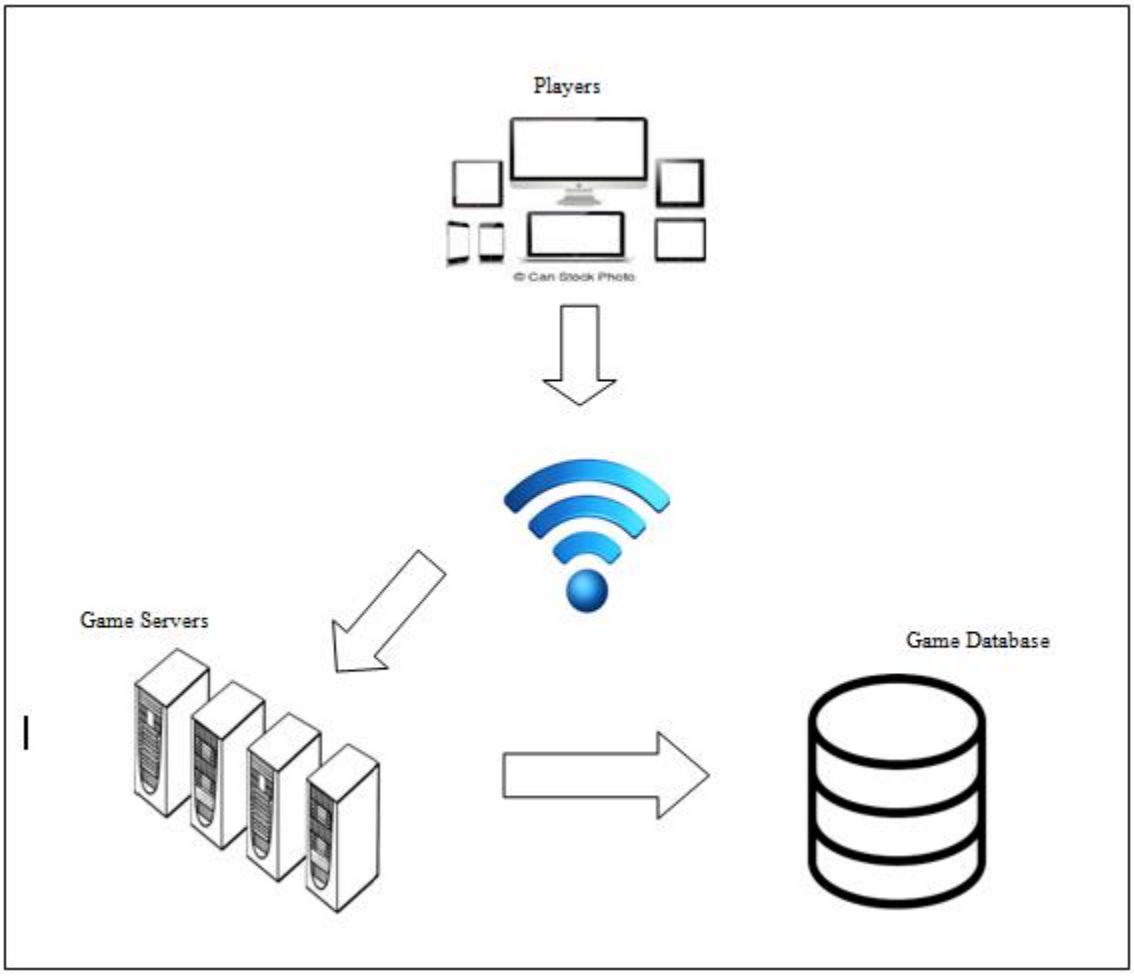
Description: The game shall provide a pop-up screen about the survey sheet which will be provided at the end of each game.

Rationale: There will be a notification at the start of the game recommend the user to complete the survey sheet which will be provided at the end of the game. Survey sheet is where the players can write their feedback about the game and subscribe the game. The player feedback can be used for developing the game.

Fit criterion: There will be a pop-up screen which pop-up in the beginning of the game where the user will be notified about the survey sheet.

6b Implementation Environment of the Current System

In order to play the game an internet connection is required. The player can play the game as a single user or as a team. To play the game as team all players must be connected to the internet (must be online).



6c Partner or Collaborative Applications

Teachers in the schools can use this game to teach their students about Global warming, its impact and how to reduce it, in addition to some geographic knowledge about places that suffering from this issue around the world. This will help to increase the number of the game players as well as the popularity of the game will increase too.

6d Off-the-Shelf Software

Microsoft Visual Studio 2015 – Main platform used for coding and developing the product.

Unity Engine – Create animations.

Note: This what could be determined at this point of time, so maybe later on more software will be added.

6e Anticipated Workplace Environment

The game can be used in learning environment such as schools. Therefore, the information provided by the game must be up to date and must be from a trustable reference to be eligible to be used for education purpose. However, the game will be available online, so can be used by any one from any place in the world, which means most likely will be used at home sitting more than classrooms.

6f Schedule Constraints

There should be enough time given to the developer to develop the game in order to avoid the delay in finishing the product or submitting untested product. Therefore, the following schedule should help the developers to finish the product within the planned time.

The first three months will be used to plan most important components to the game such as environment, technology, plot etc. This will make critical components that the developers need to develop the game clear and pointed out.

The next four months, the developers start built the game under the constraints that set at the beginning of the project.

The next two months the game will be ready for teasing and the developer should test the game and make sure every step in the game is working as planned and in

satisfactory state. This will help them to debug the possible errors and handle them before the game is issued to the clients (players).

After debugging the errors and fixing the game will be releasing in stores and advertise it to the world.

6g Budget Constraints

The development of this game should not take more than one year and it is a free game so it should not cost in total more than $0.5 million.

7 Naming Conventions and Definitions

7a Definitions of Key Terms

- Client: The organization\user investing the game.
- User(Player): The person who is playing the game
- Level: the game consists around 10 levels where each level represents a city in the world.
- Task: each level consists of four to five tasks where these tasks are the work required from the user to do in that specific level in order to get scores to move to next or higher level.
- Campaigns: To raise awareness. Different campaigns focused on various activities such as reduce water usage, electricity usage, etc. Increases experience.
- Pant Seeds: Seeds needs to be planted to reduce the pollution. Earn experience level.
- Marathons: Take part in different marathons to earns points and experience. Marathon includes bike riding and running.
- Reduce waste: Recycle or clean certain areas where waste is in abundance. Earn points and experience.
- Quiz: Answer questions based on current location. Earn points.
- Required experience: Each level has a pre-defined number set called experience(XP). Once the pre-defined number is reached, user will move to next level with more experience(XP) required to complete it. With each level, the required experience increases.

7b UML and Other Notation Used in This Document

This document generally follows the Version 2.0 OMG UML standard, as described by Fowler in (Fowler, 2004). Any exceptions are noted where used.

7c Data Dictionary for Any Included Models

Undetermined at this point of time

8 Relevant Facts and Assumptions

8a Facts

- The facts on global warming, pollution and climate changes are presented in the game.
- The facts on how these factors are affecting particular city will be present to the user before the start of each level. For example, the first level will be played in the city of Chicago. So some facts of Chicago along with pollution levels and climate change over the past decade of the city will be projected.
- The statistics will be collected from the reliable sources such as www.weather.gov (national weather service), climate journals etc.
- The cities of each level will be designed by the actual geography and planning of the cities using maps and other official resources.
- Few landmarks of every city will be included in each level of the game. For example, as each level has four tasks, the first level in the city of Chicago will include one or more tasks in the city's famous landmarks such as the lake Michigan, the Millennium park etc..
- The game also includes facts about the local natural vegetation, flora and fauna of the city present in each level.

8b Assumptions

- The game is primarily developed to be played on mobiles and tabs. But it will also be designed to make it compatible with the desktop. The desktop doesn't use the exact location of the player but assumes a start location and move along the maps.
- The product shall work with client's latest mobile, tab and system's configuration.
- The servers and database of the product shall be operational 99.99% of the time.

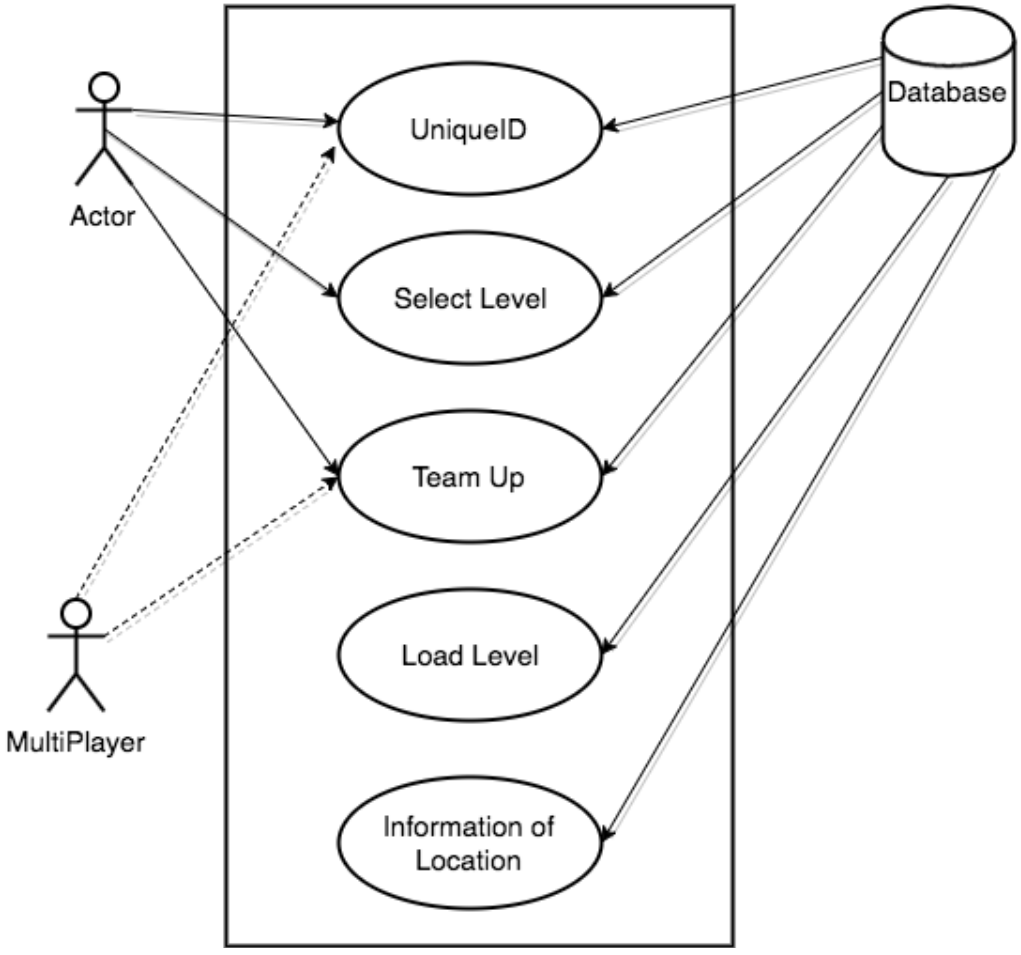
- The client will have at least some prior knowledge on playing location based games.
- All the later versions of the games will be compatible with the original release of the game.
- The game can be transferred from any mobile to tab and vice versa.
- The character in the game can play either at day or night. The time depends on current location/country.
- The game will be launched in not more than 11 months after starting its development.

II Requirements

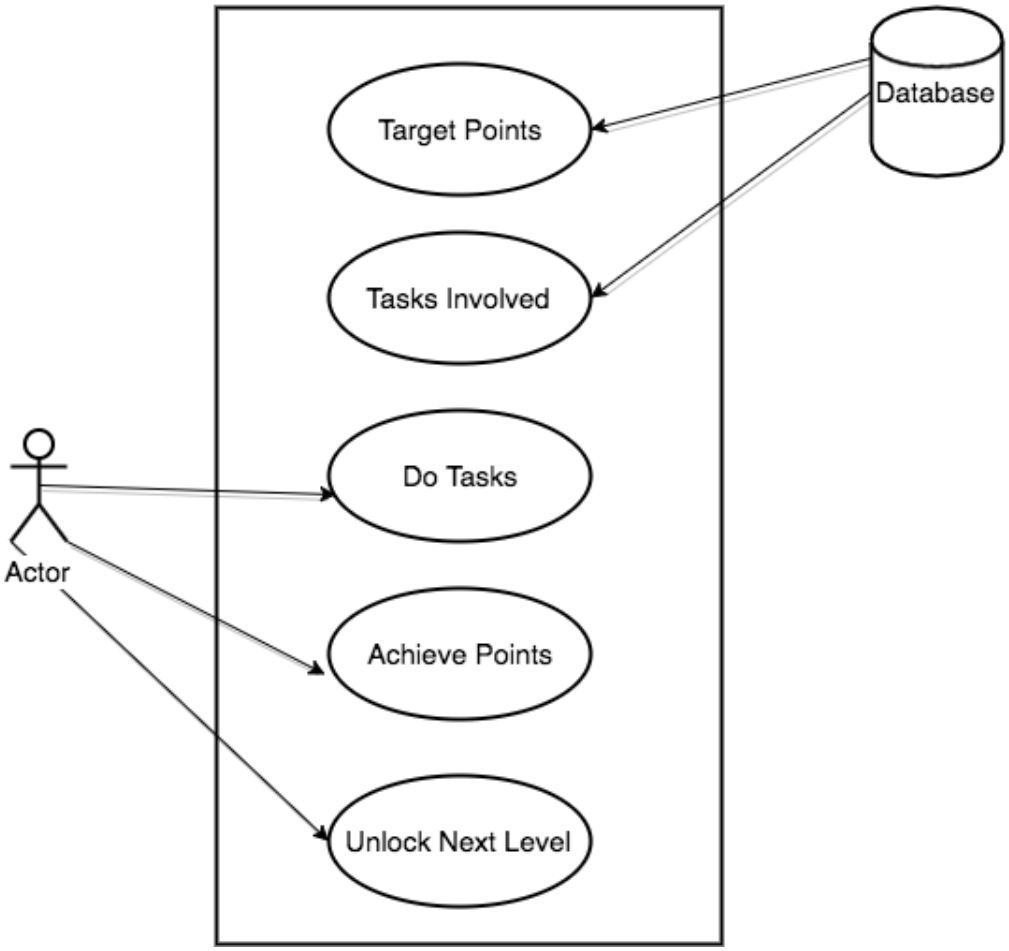
9 Product Use Cases

9a Use Case Diagrams

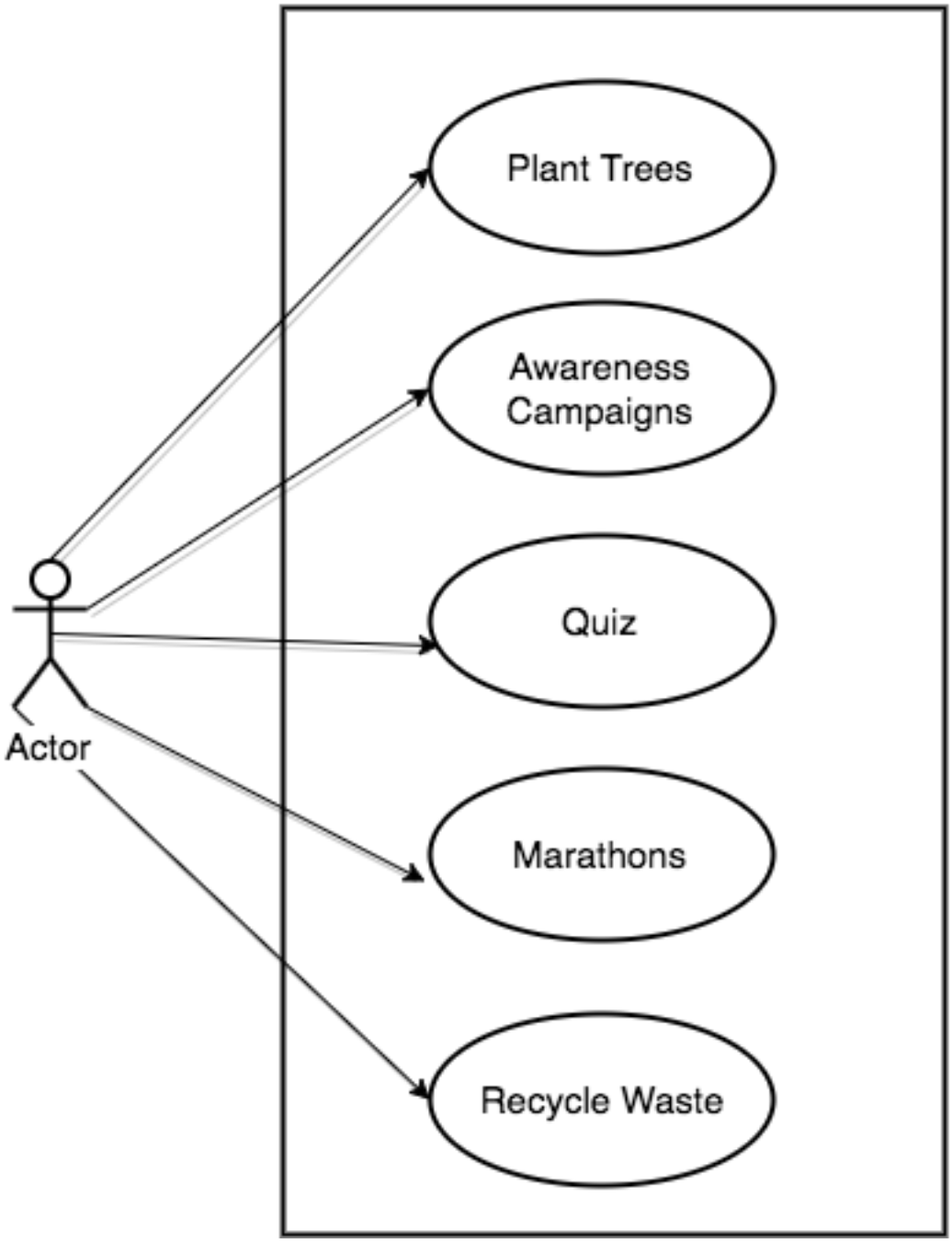
Start of the Game



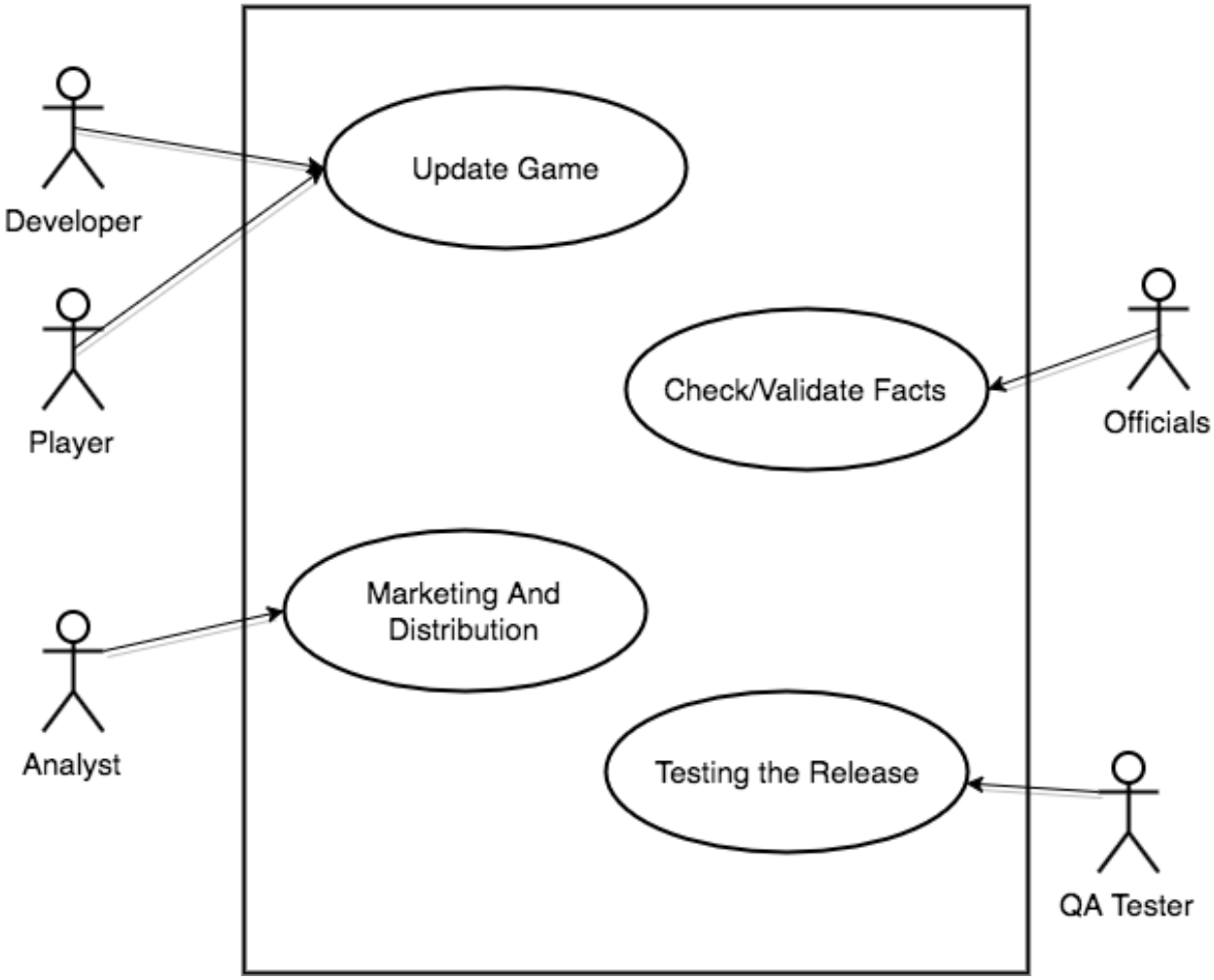
GamePlay


Database
Target Points
Tasks Involved
Do Tasks
Actor
Achieve Points
Unlock Next Level

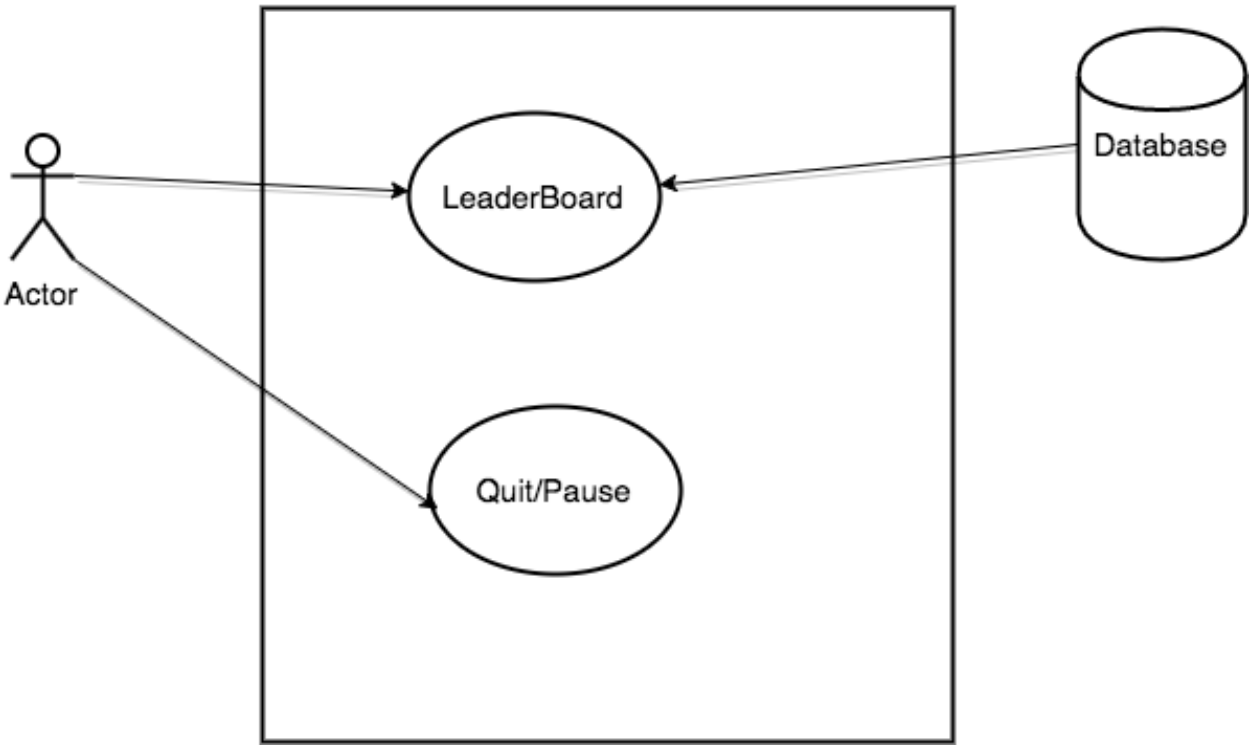
Tasks/Bonus Rounds



Updating/Modifying the game



Quit the game



9b Product Use Case List

9c Individual product use cases

Table 1. Unique Id Use Case

Use case name	Unique Id
Participating Actors	Initiated by user Communicates with Database
Flow of Events	1. Player initiates by starting the application on their device 2. System displays the login or sign up option 3. New users should sign up and existing users should login 4. New users will fill a form with their details. 5. The database will generate a unique id for new users and this will be the login id for the user. User can also select a password which is optional
Entry conditions	Player must have an internet connection and GPS must be enabled

	for mobiles and tablets. Player will start the application
Exit Conditions	All the data will be saved in the database
Quality Requirements	1. System will display the sign up form within 30 seconds of clicking for sign up option. 2. All the data will be saved correctly in the database.

Table 2. Start a new game Use Case

Use case name	Start a new game
Participating Actors	Initiated by user
Flow of Events	1. After player has entered his correct details, the system will take the player to the gaming environment. 2. System will display an option of choosing **between start a new game** and **resume game**. 3. User will select one among the two.
Entry conditions	Player has entered correct login details
Exit Conditions	Player can start playing.
Quality Requirements	In case of resume, player's previously saved game will be loaded.

Table 3. Choose game mode Use Case

Use case name	Choose game mode
Participating Actors	Initiated by user
Flow of Events	1. After clicking on 'Start a new game', system will ask the user to choose a game mode. 2. User can select within two game modes- single player mode and multiplayer mode 3. User will select one of the three options.
Entry conditions	Player clicks on 'Start a new game'

Exit Conditions	Player can choose a level.

Table 4. Choose a level/location Use Case

Use case name	Choose a level
Participating Actors	Initiated by user
Flow of Events	1. After selecting the game mode, system will display a list of levels that are locations of different countries. 2. Initially for new users only one level i.e. the default level will be unlocked and rest of the levels will be locked. For existing users, the levels they have unlocked will also be available 3. User has to choose either the default level or the unlocked level
Entry conditions	Player has chosen the mode for the game.
Exit Conditions	Player will select a level
Quality Requirements	System will display full details of the factual information about the location before the loading the location and after selecting the location.

Table 5. Play the game Use Case

Use case name	Play the game
Participating Actors	Initiated by user
Flow of Events	1. After player has completed all the requisites, he will start playing the game. 2. Player must accomplish few tasks (4 or more) to gain points. 3. The few examples of tasks are planting trees in a location, create awareness campaigns, reduce and

	recycle waste, quiz based on the data provided on the location etc. 4. Player should gain the points that are needed to complete the present level by accomplishing tasks and unlock the next level 5. After gaining the necessary points, the next level will be unlocked 6. If no, the player should replay the level again. 7. There will be bonus rounds such as running a marathon, bicycle tour etc., in between levels to gain additional levels
Entry conditions	Player has fulfilled all the requisites. Player must go through the factual data on climate changes of a location.
Exit Conditions	Player will start playing
Quality Requirements	1. Gaming environment would be as genuine as possible. 2. Effective sound effects. 3. Points on completing tasks. 4. Genuine facts. 5. Gaming environment would be interactive.

Table 6. Quit / Pause Use Case

Use case name	Quit/pause Game
Participating Actors	Initiated by user
Flow of Events	1. In case, player wants to stop the game in between, he can either quit the game or pause the game. 2. In both the cases, system will save the running game that can be reloaded on player's demand.
Entry conditions	Player wants to stop the game

Exit Conditions	His game will be saved.

Table 7. Leaderboard Use Case

Use case name	Leaderboard
Participating Actors	Initiated by user Communicates with the database
Flow of Events	1. After completion of a level, system will display the player's scores. 2. Player can also choose to look up at the leader board that would display scores of all the people who have completed the level and the highest scoring player.
Entry conditions	Player has completed a level
Exit Conditions	Player sees his scores.
Quality Requirements	System will display full details of every player who has completed the level.

Table 8. Game update Use Case

Use case name	Game Update
Participating Actors	Initiated by developers of the game Users update the game
Flow of Events	1. Developers initiate the use case by updating the game. 2. Users will update the newer version of the game.
Entry conditions	Developers have updated the game
Exit Conditions	Players will have an updated version of the game

Table 9. Marketing and Distributing Use Case

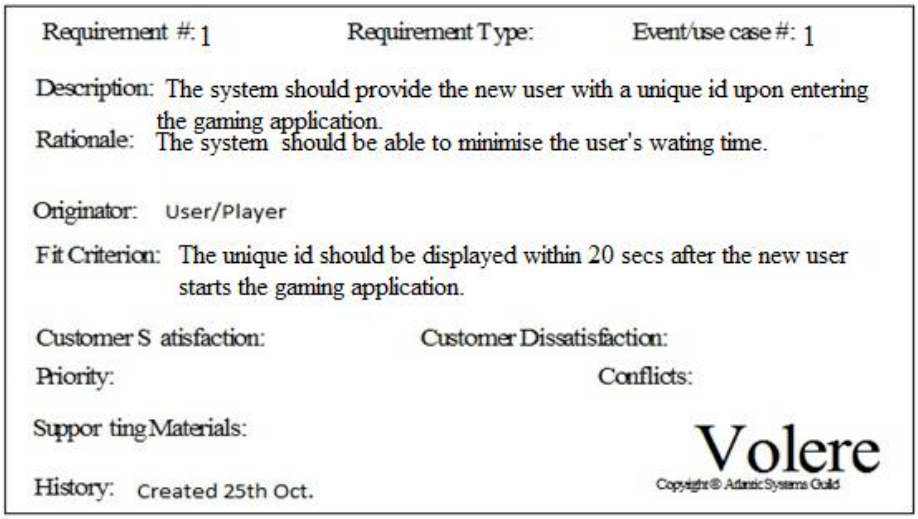
Use case name	Marketing and Distribution
Participating Actors	Initiated by marketing analysts

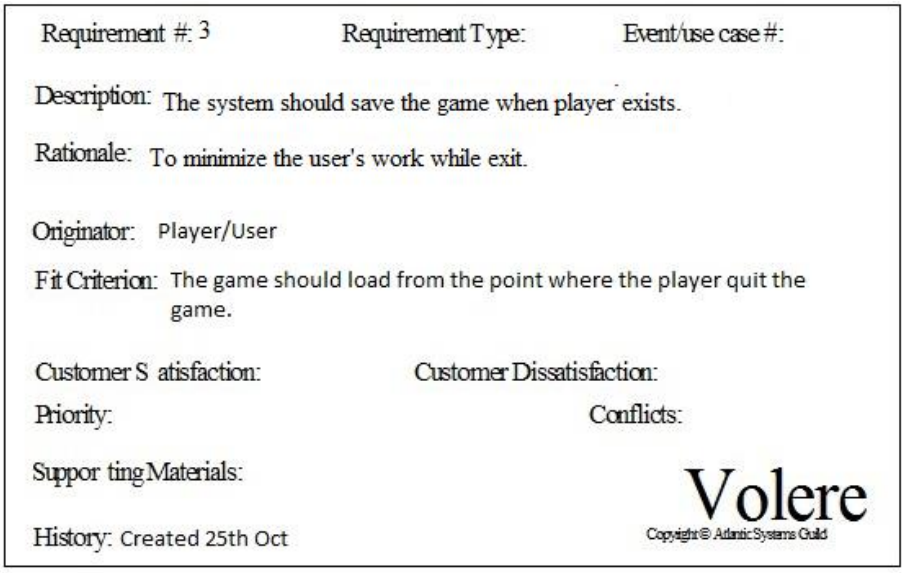
	Players participate
Flow of Events	1. Marketing analysts will advertise the developed game in the market. 2. Users will download the gaming application. 3. Revenues will be generated by advertisements that are broadcasted while playing games and making users buy some premium features of the game.
Entry conditions	Developers have developed the game
Exit Conditions	Players will get a new generation game.

Table 10. Validating and testing the game Use Case

Use case name	Validating Facts/ Testing
Participating Actors	Initiated by professional gamers and testers
Flow of Events	1. Both the professional gamers and testers will validate the working and the facts used in the game by playing the game.
Entry conditions	Developers have developed the game
Exit Conditions	Game will be validated.

10 Functional Requirements





Requirement #: 4	Requirement Type:	Event/use case #:

Description: The game should display the information about the the location before the start of every level.

Rationale: To educate the user and to help him in answering the quiz later in the game

Originator: Player/User

Fit Criterion: The game should load the factual data of the location present in the level with in 20 secs after selecting the level.

Customer S atisfaction: Customer Dissatisfaction:

Priority: Conflicts:

Suppor ting Materials:

History: Created 25th Oct

Volere

Requirement #: 5	Requirement Type:	Event/use case #:

Description: The game should display the tasks to be accomplished by the user after loading the particular level he wishes to play

Rationale: To make player know the tasks he/she needs to accomplish to complete the level successfully.

Originator: Player/User

Fit Criterion: The tasks should be displayed before the player starts the game.

Customer S atisfaction: Customer Dissatisfaction:

Priority: Conflicts:

Suppor ting Materials:

History: Created 25th Oct

Volere

Requirement #: 6 Requirement Type: Event/use case #:

Description: The system should display the information of bonus rounds in between levels

Rationale: To make player understand about that bonus rounds that would help him fetch additional points.

Originator: Player/User

Fit Criterion: The information of the bonus round that the player is in, only must be displayed.

Customer S atisfaction: Customer Dissatisfaction:

Priority: Conflicts:

Suppor ting Materials:

History: Created 25th Oct

Volere

Requirement #: 7 Requirement Type: Event/use case #:

Description: The system should display the scores of all the players as well as the details of the players who has completed the level.

Rationale: To be able to provide the details of the other players to the users at a single click.

Originator: User/Player

Fit Criterion: The details of the players who has completed the level should only be displayed.

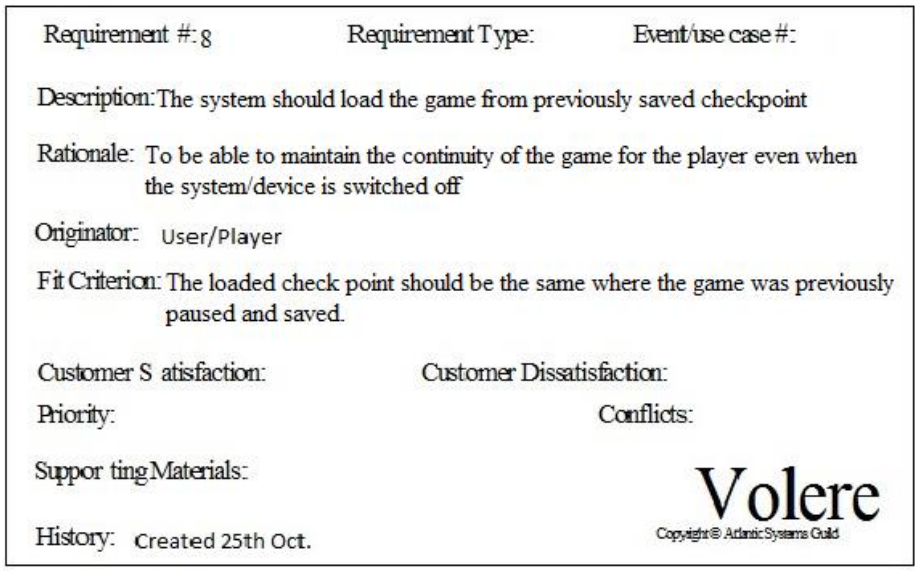
Customer S atisfaction: Customer Dissatisfaction:

Priority: Conflicts:

Suppor ting Materials:

History: Created 25th Oct.

Volere



11 Data Requirements

The factual data of the various locations across the world such as the pollution levels, the people affected due to it, levels of harmful gases in the atmosphere etc., should be gathered from the reliable sources. The consensus thus gathered should be displayed as information to the player after loading each level and before the gameplay.

12 Performance Requirements

12a Speed and Latency Requirements

- The response time of any interface between the system and the user must be less than or equal to 30 secs.
- Points which player earn from completing tasks and levels must be updated in 10 seconds.
- Transitioning between the tasks in a level must not take more than 30 seconds.
- Resuming the game after pausing must not take more than 20 seconds.
- User must be provided with unique ID and levels must be displayed (default Location/Country) within 20 secs after clicking start the game option.
- Network latency must be 100 at the maximum for all the players who play over a network.

12b Precision or Accuracy Requirements

- The points that are required for player to complete a level must be within the pre-defined number set for that specific level.
- The points that player earns after accomplishing a task must be a whole number.
- The time of the game must be synchronized with the system time when it is played locally.
- When players from different time zones play over a network, all actions of the game must be time stamped based on every player's system and the database time should be identical and measured with common time zone.

- All players who play as team must see identical interface, level, tasks and updated points.
- Every player should have a unique id upon registering and this should be his permanent id for calculating the scores throughout all levels of the game.

12c Capacity Requirements

- The internet connection of downloading and uploading speed must be at least 25 Mbps.
- The system must not allow more than four players play as a team.
- Any desktop or laptop with basic graphic card is good for the game. The mobiles and tablets should be GPS enabled for the game to start.
- Desktop or laptop should have at least 2 GB of disk space and 2 GB of RAM.
- Mobile phones must have at least 100 MB of free internal memory for the game to install.
- DirectX 9 or higher must be installed in the desktop or the laptop.

13 Dependability Requirements

13a Reliability Requirements

- The game must resume from where it was stopped or paused.
- The game must not fail more than once per boot of the system.
- The data of the game must not be lost in event of failure.
- The game must behave correctly 98% of the time.
- In case of crash, the game should end in a fail-safe manner.

13b Availability Requirements

- The game must be up 99% of the time.
- The game must be available even in case of information update as the updated information should be released in a new version.
- Internet connection must be available to play the game over a network with remote players.
- There must be announcement regarding any unavailability of the game at least one day a head.
- There must be announcement about the availability of new version.

13c Robustness or Fault-Tolerance Requirements

- The backup power supply should be given for a minimum of 15 minutes.
- The game must restart safely and should resume the game from where it was abnormally ended.
- The data of the player must not be lost in case the game ends abruptly due to loss in internet connection.

13d Safety-Critical Requirements

- Children below the age of 5 should be allowed to play only with parental guidance.
- The game should not be played over the mobile or tablet with battery charge less than 20%.
- Proper cooling pads should be used to avoid the overheating of the system.

14 Maintainability and Supportability Requirements

14a Maintenance Requirements

- The information about the location in the game must be updated frequently to provide accurate data to the player.
- User's feedback must be reviewed frequently and developers should try to incorporate the functionalities and small changes that are feasible.
- The game developers must test the game within the span of two weeks before releasing a version.
- Game patch-fixes/updates must be performed monthly throughout the continuation of the game.

14b Supportability Requirements

- There must be at least one developer available to handle any type of technical error the player might encounter and address.
- The game must provide 'help' option which provides step by step guide to the player of how to play the game.
- There must be an option to send the displayed error to the support team directly to address the issue in least time possible

14c Adaptability Requirements

- The game must operate in any type of machine (Mobile phones, tablets, laptops and desktops) and on any operating systems.
- The game must be run on all major web browsers using https and IPv6.
- All aspects of the product are expected to be compatible with most PC hardware.
- The game initially gets released in English and later versions will have option for the user to select language (languages widely spoken) of their own choice

14d Scalability or Extensibility Requirements

- The system must be able to increase the number of the players who can log in to the game at the same from 300000 to 500000 within two years.

- The number of levels that users can play must be greater than 20 within the first two years of launch.

- The product database shall be capable to expand to address future functionality additions to the product.

14e Longevity Requirements

- The game must operate within the maximum maintenance budget for a minimum of six years.
- The game must be able to continue to run successfully without maintenance support for three more years, but the users must notify about losing supportability.

15 Security Requirements

15a Access Requirements

- Only developers should update the game functionality.
- Only developers should update the game database.
- Only developers should update the information of each location/ country.
- Only the marketing analysts should perform advertisements and distributions for the product.

15b Integrity Requirements

- The system must not allow any incorrect information about the location to be falsified.
- The system's database must have safety measures set up so that individuals who are not developers cannot modify it.
- The system must not save any personal information about the users in their database.
- The system must not allow users who are playing as team to identify other users.

15c Privacy Requirements

- The product(game) must notify players the policies that are in place with regards to information collection and it requires them to agree in order to use it before starting the game.
- The game must notify players about any changes in the policies.

15d Audit Requirements

- There must be a record which keep information about the organizations such as schools that used the game as a part of their curriculums. This is a legal document since the game is designed for education purpose.

- The game developers must work in conjunction with each other in order to obtain the necessary information to begin the audit process.

15e Immunity Requirements

- The product must be protected from any kind of SQL injections.

- The product must have individual database user accounts for all the developers.

- The product must grant the proper permissions to each of the developers.

- The product must not allow users to upload any un-authorized files through the product website.

- This game must collaborate securely with 3rd party.

16 Usability and Humanity Requirements

16a Ease of Use Requirements

- This game will have HELP tab which will help the user learn how to use the game application. It will have answers to FAQ and will help the user resolve issues that they might have while playing the game.

- When a first time user starts playing this game, the first thing that will happen is the game will start in "training" mode where the application will guide the user through different parts of the game and will explain what each part is for to better understand the game.

- Any changes the user makes the system will ask for confirmation before executing any changes. e.g. Deleting account.

- After a certain point in the game the system will ask the user to give feedback. Users may also use the HELP tap to manually reach the feedback option if they wish to. Feedback option may also be user to send queries not answered in the FAQ.

- The game will be easy to use for any new users.

16b Personalization and Internationalization Requirements

- The language will be set based on the language the operation is set to. Users will have an option to manually change the language in the settings tap if they wish to. Most languages will come preloaded with the installation of the game, if a certain language is not preloaded the user can download the language package.

- Once the user has made an account and has logged in the the user does not have have to login again, the system will automatically have the users profile logged in at the next launch of the game application. Although the default profile opened is the original user's an option to log out and login as a different user is also available in settings.

- The game will have background music playing and other sounds such as a "click" sound when pressing a button. The settings tap will also have an option to enable/disable these sounds.

- The only visual preference setting that will be available is the font size of text which is also available in the setting tab.

- In the user profile section, the user will have options to personalize their profile. There options include either choosing an avatar or uploading a picture as their profile picture, an "About me" section where they can write something about themselves and an option to display their progress in the game.

16c Learning Requirements

- Although the game will start off in "Training" mode, the user must be familiar with the platform in order to launch the game.

- It is also advised that the user does not skip through the training because that will teach them how to navigate through out the game.

- If "Training" mode is skipped the user must read through the HELP tab in order to learn the game.

16d Understandability and Politeness Requirements

- The objective of this game is to spread global warming awareness

- It will help people understand what is causing global warming

- Show what they can do their part in the real world to make their environment a safer place.

16e Accessibility Requirements

- The game can be played by any individual who are hearing impaired. It will have pop up text though out and does not have any audio that requires the user to be able to hear.

16f User Documentation Requirements

- The game will only have the HELP tab and will not have any physical manuals.

16g Training Requirements

- New users must play the game with the "Training" mode in order to understand different parts of the game.
- User must be familiar with the platform they will be playing the game on to be able to properly install and launch it.

17 Look and Feel Requirements

17a Appearance Requirements

- The game application must have a simple and easy to user interface
- The layout must be easily navigable by the users.
- It must use multi-colors and appeal to all audience.

17b Style Requirements

- The game will have a high quality graphical interface
- At the launch of the application a animated graphical logo of the game will play and fade into the interface of the game.
- All text will be legible/clear and will not interfered with other colors.
- Each level will start with a level-up animation.

18 Operational and Environmental Requirements

18a Expected Physical Environment

- The application shall be accessible by a mobile phone, desktop/laptop or a tablet.
- The application shall be available with proper internet connection and shall not be reached without internet connection.
- The game shall be played with active GPS as it is a location based game.
- The game graphic and sound levels shall be adjusted according with the device graphic and sound levels. The game shall be played even with the mute on.
- The application shall be played even in noisy environment.

18b Requirements for interfacing with Adjacent systems

- The application shall have an uninterrupted connection with the internet and GPS server.
- The application shall have a proper Wi-Fi connection with other player/device while playing multi player game.
- The application shall be able to run on even relatively low internet speed.
- The product shall be connected to the database server while retrieving the scores and while updating the newer versions of the game.
- The application shall be supported on all kinds of platforms/operating systems with same degree of performance.

18c Productization Requirements

- The application shall be installed by a novice user without help of instructions or manuals.
- The application shall be available in play store of Android, istore of Mac and Xbox of windows and is available for free across these platforms.
- The application shall be downloaded from the above stores on to the devices by the user.
- The player must be able to purchase certain features that make him/her advance faster in the game than the regular players.
- The user must have a credit/debit card to purchase these additional features.

18d Release Requirements

- The initial release will have 10 levels with 10 different locations and will be made available to the users.
- The users shall be provided with an option of feedback to the game.
- Future upgraded releases shall be modified based on the feedback received and the UI shall be improved as per the latest trends.
- Each release shall add new levels, new features and enhance the existing features but shall not cause them to fail.

- New release shall ensure the data consistency i.e. the old data shall be unaffected like the scores and user preferences.
- The user shall upgrade the new version of the game any time before the older version become obsolete.

19 Cultural and Political Requirements

19a Cultural Requirements

- The product shall not be offensive to religious or ethnic groups.
- Strictly factual data of the climate changes, global warming and pollution shall be used and no bias must be made against any location/country of each level.
- Concerns of environmentalists, social activists and geologists must be incorporated and changes must be made as needed.
- The game shall be available in majority of languages of the world to make available to the vast number of users of various background.

19b Political Requirements

- Marketing and distribution departments of the game developing company should approve the game before it is released.
- Quality of interfaces, User Interfaces, the animation and graphics should comply with the standards of the game developing company and should be on par with the competitors.
- The game developing company shall be allowed to modify or upgrade any functionality or feature of the game.
- The game developing company should ensure that there are no conflicts with any nation regarding the levels of various games.

20 Legal Requirements

20a Compliance Requirements

Employees shall not be involved in anti-competitive conduct.

Employees may not take unfair advantage of any supplier or competitor through misrepresentation of materials.

Officials should thoroughly check the facts related to different countries. And store to the database of and only if approved by the Officials. Any inconsistency with the facts should be removed immediately from the database,

The legal team will overlook all the requirements and manage future dependencies.

Committee will oversee the effectiveness of compliance programs in functional area. They set the standards and policies.

Everyone, including third party contractors, should complete a standard training procedure set by the Committee.

Financial organization is to assure appropriate controls at all levels to ensure accuracy over financial reporting and report any fraudulent activities.

20b Standards Requirements

The game shall comply with Hardware and Technical Specifications, Quality Assurance standards, Legal Compliance, Legal Procedures, Marketing and Distribution standards of all the third party vendors used for developing the game.

III Design

21 System Design

21a Design goals

Design goal is crucial part for any project. This game will be built upon a set of interface object. As speed is one of the most important part of the game, it will be given more priority throughout the system. For example, if the Database System for some reason is taking longer than expected to return a result, the game will proceed without getting latest information such as scores, points, and areas from the database. Instead of waiting for the results from database the game will rather continue with old data. Once the connectivity becomes strong, new score will be added to the database and everything will be updated in the game instantly. Implementing security regarding Unique ID will also be a priority because tempering other user's data is strictly not allowed. Keeping such things into account, design goals will be created.

22 Current Software Architecture

The Software Architecture described below will be the initial architecture for the project. Therefore, there's no current architecture for this game.

23 Proposed Software Architecture

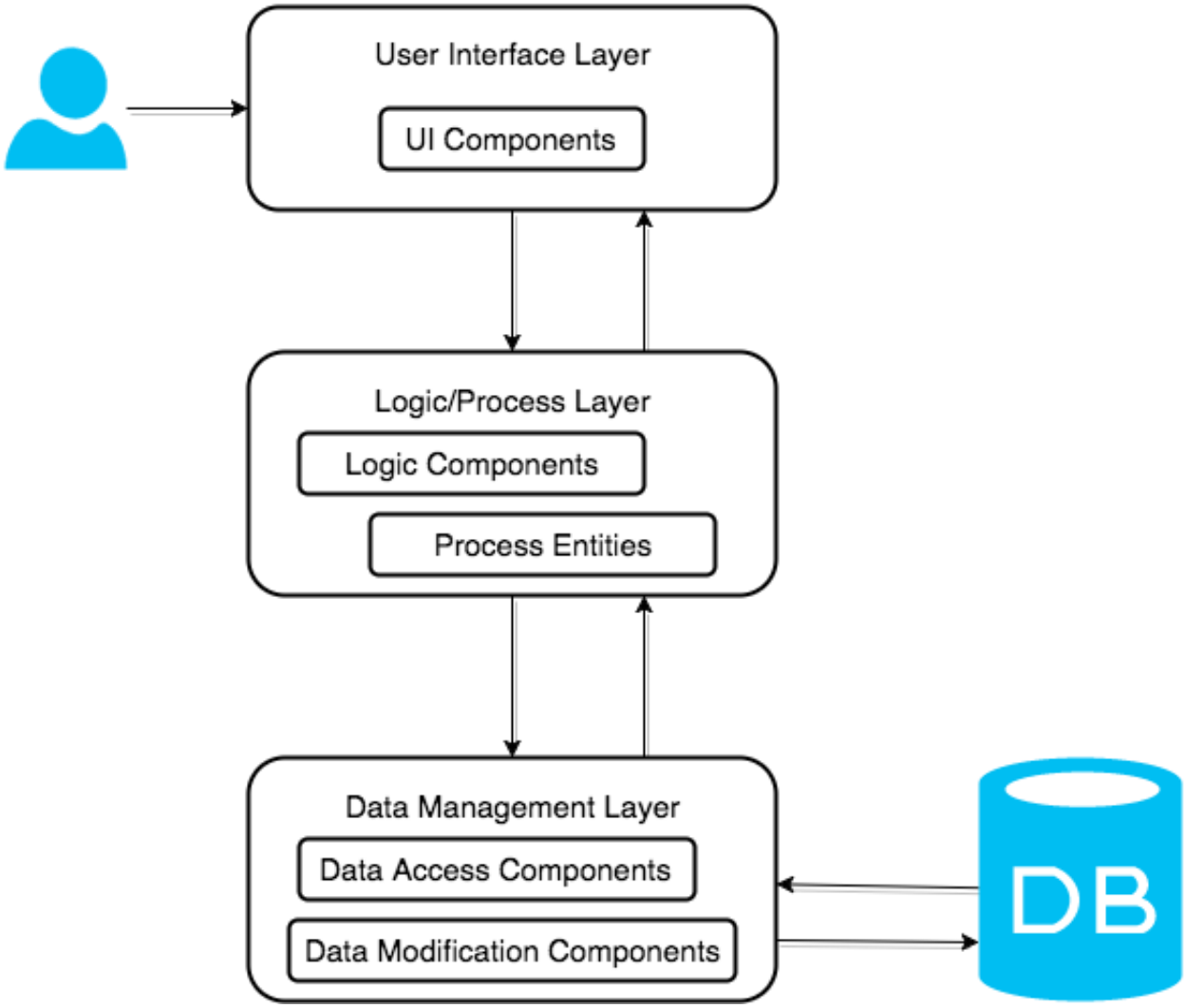
23a Overview

The initial architecture will be a multi-tier architecture. Three-tier architecture to be precise. The three tiers are

- User Interface Layer
- Logic/Process Layer
- Data Management Layer

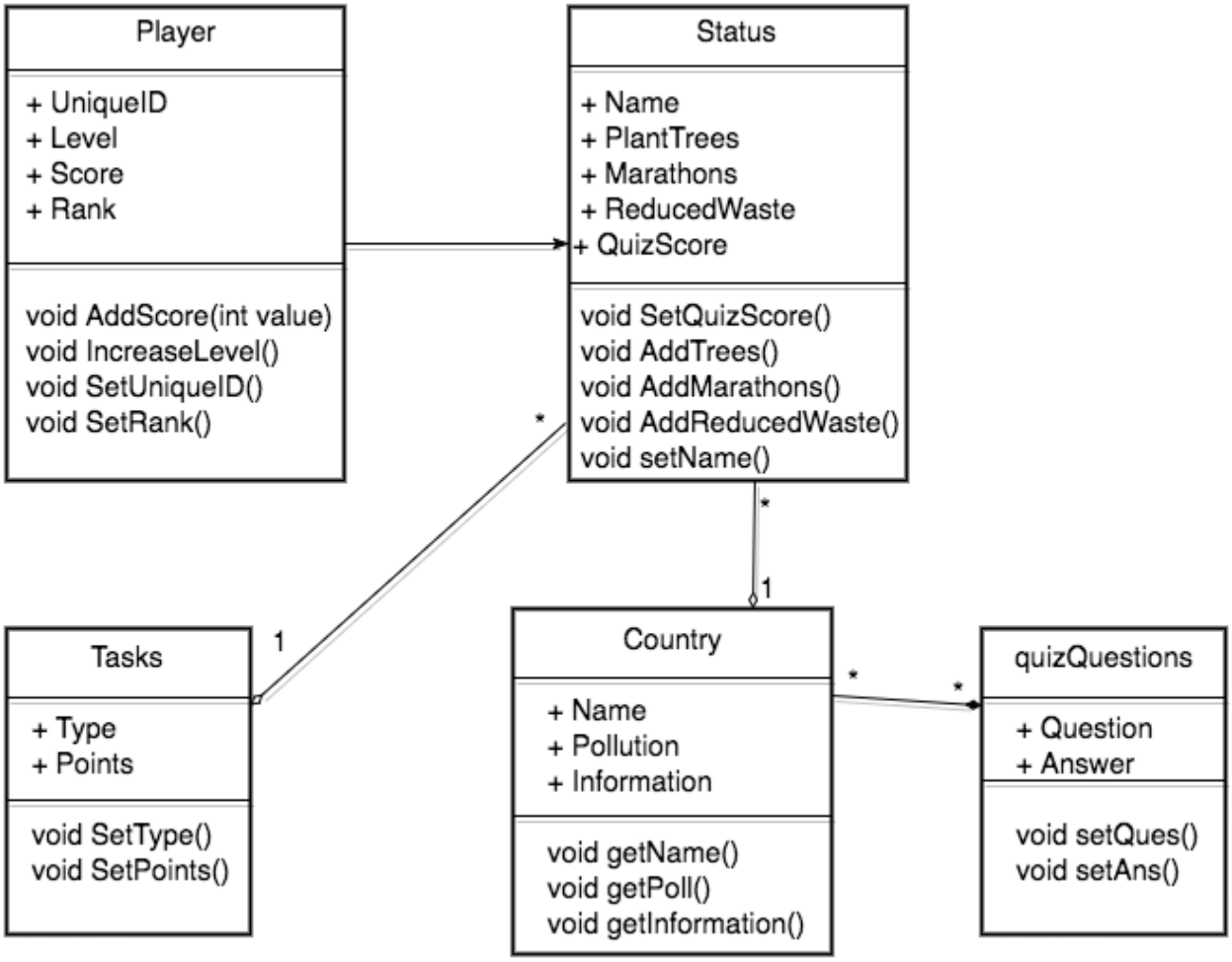
All the layer communicates with each other. User Interface Layer will consist of all the user accessible elements. This layer will consist of UI Components which will display several information such as level, score, team members, etc. Each of the components will be associated with triggering event. Everything gets triggered by the user element, therefore this will be the top tier. The elements/events will then go to Logic layer. This layer goes through all the requirements, and if the event is feasible, the information will get passed onto Data Retrieve Later. An example of the flow between these two layers will be: A user decides to plant seeds; the User Interface layer will send this information to next layer. The next layer is Logic/Process Layer, this will retrieve the information and will ask questions like "Does the user have enough amount of seeds to plant the requested amount of seeds". Logic/Process layer will have coded logic and requirements in it created by developers. The Logic/Process layer is also responsible for providing the UI components with up-to-date information. It contains Logic Components and Process entities. These help the game continue forward.

Data Management layer will handle all the data queries. This layer consists of two components. "Data Access" component will retrieve requested information from the database. "Data Modification" component will modify data in the database. It will update and retrieve the information for each account as well as store the user's information. The database will have indexes in every table. All the tables will have some sort of relation between them. This will make data modification much faster. The Logic/Process layer will communicate with Data Management layer to modify or retrieve information. Continuing the example from above, the amount of seeds will be retrieved from this layer. Validations occurs in Logic/Process layer with the help of Data management layer. The connection between each layer is shown below:



23b Class Diagrams

There will be five class in the architecture. Changes to them will be made when everything gets clear during implementation and testing stage.



Here, "Status" is the main/abstract class of system. It provides backbone to all the classes. The classes Player, Task, and Country inherit from Status. quizQuestions inherit from Country. Name attribute in "Status" class is for storing the players name. Plantrees attribute is for knowing how many trees/seeds the player has planted so far. Marathons attribute keeps track of marathons player has taken part in. ReducedWaste for knowing how much waste the player has reduced, and last attribute is Quizscore to store Score of quizzes player has taken.

The class "Tasks" has fields Type and Points in it. The methods in the class are SetType() and SetPoints. Type field is basically for storing the type of task given to player. For example, Task can be "Plant Trees/Seeds" or "Raise Awareness through Campaigns". "Points" fields are for storing points associated for that particular task. It varies based upon the type of task. "Raise Awareness through Campaigns" can have less points then "Plant trees". It depends on the level as well as the amount of work the player has done for each task. The method SetType stores the type in Type field and setPoints assigns the points to Points field. The information is retrieved from database.

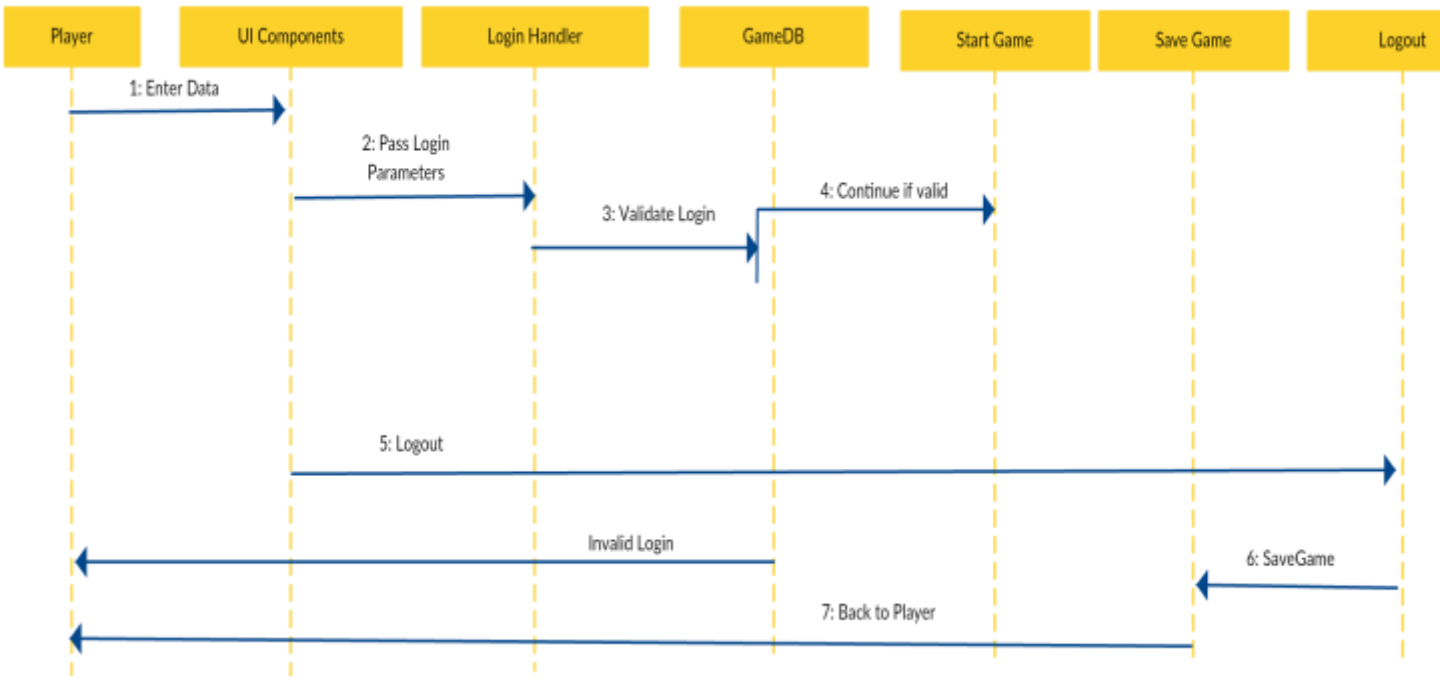
The “Country” class stores the information important for level selection. It stores the Country’s name, Information of countries such as history, and ranking in the world in regards to the pollution. quizQuestions class and Country class have many to many relation. getName() gets the name of country from database and stores it in Name field. Similary, data retrieved from method getPoll gets stored to Pollution and data retrieved from getInformation gets stored in Information string.

The “Player” class is as important as Status. It keeps track of user and differentiates everyone. It stores basic information of the player; Level is for what level currently he/she is in. Rank is for leaderboard to see where he stands among other users based upon quiz scores and participation on marathons as well as awareness. Score is for buying seeds. UniqueID is identifier for the player. Everyone has different UniqueID. AddScore method has a parameter ‘value’. You can assign the parameter a integer. That interger value will get added to Score attribute. IncreaseLevel is self-explanatory. SetUniqueID will assign a random 13 digit integer to a player. Then it will check whether the number already exists in database. If it doesn’t the id gets assigned, and if it’s already in the database, another value is assigned.

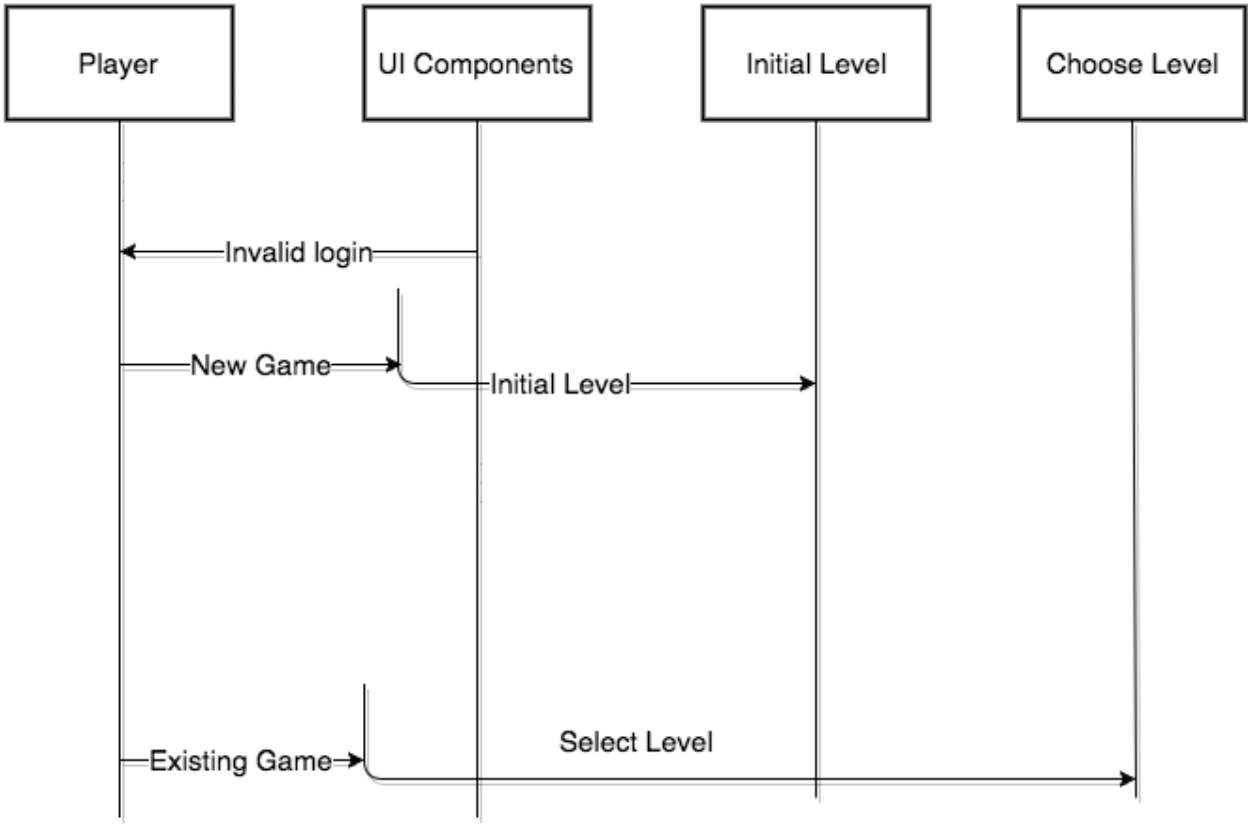
23c Dynamic Model

Sequence diagram for each use case is designed below:

Login and Logout:



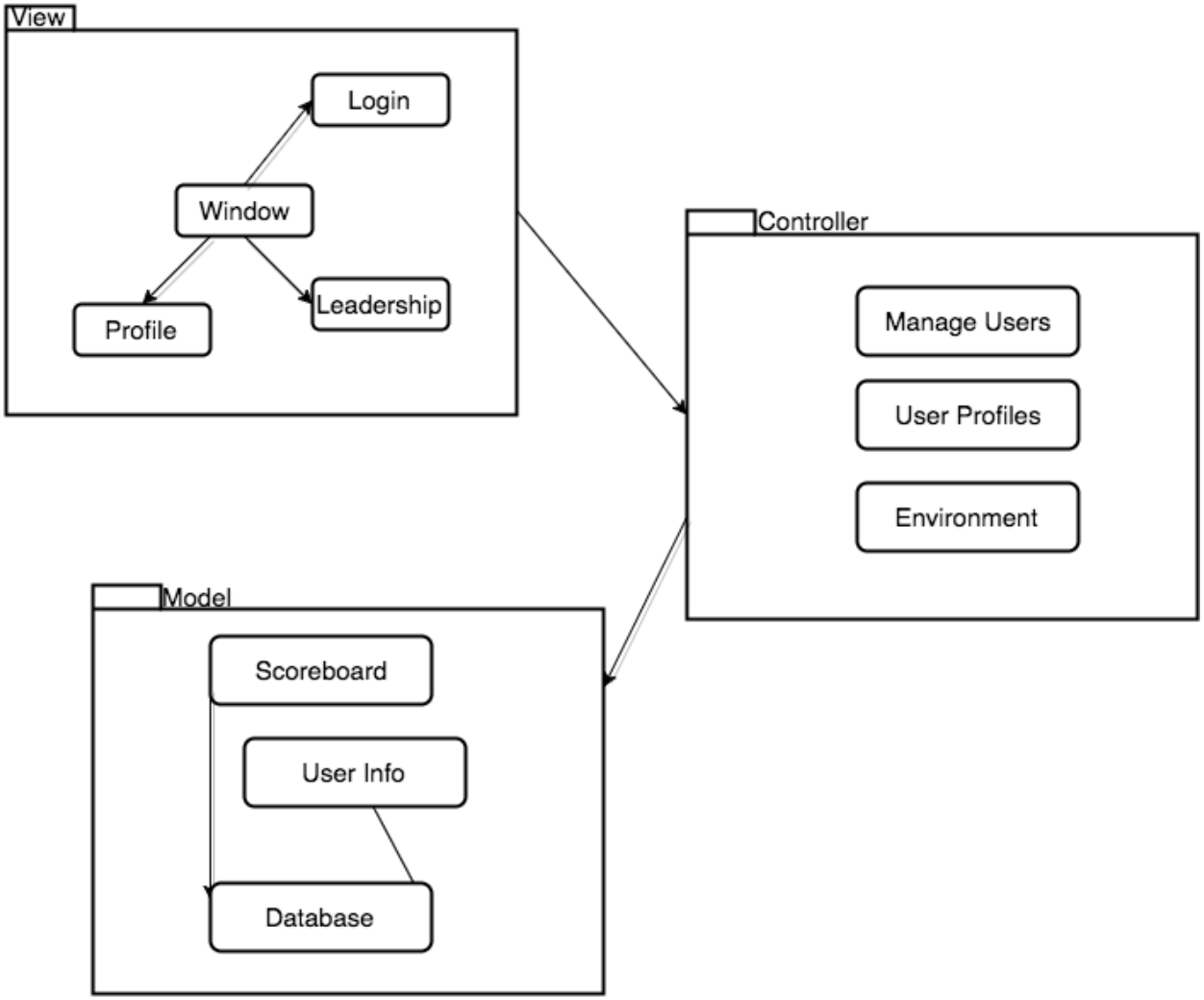
Starting New Game or Select an existing Level.



23d Subsystem Decomposition

The current design is divided into two parts. The first part is game arrangements and the other part is actual gameplay. The arrangements part takes care of organizing the database. Things like managing users, menu, environment, leaderboard, and other necessary things to for gameplay. The Gameplay part includes things such as Score, Level, Quiz, etc.

Game Arrangements:



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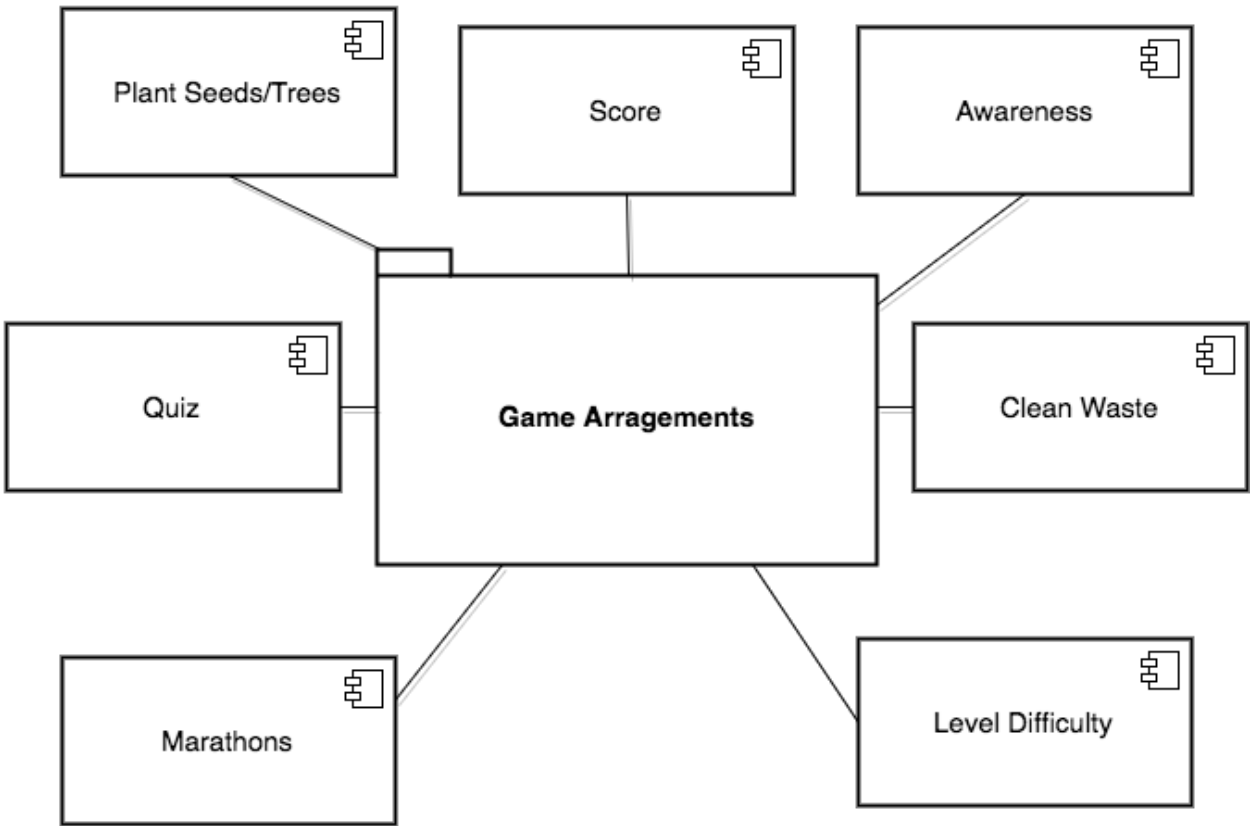
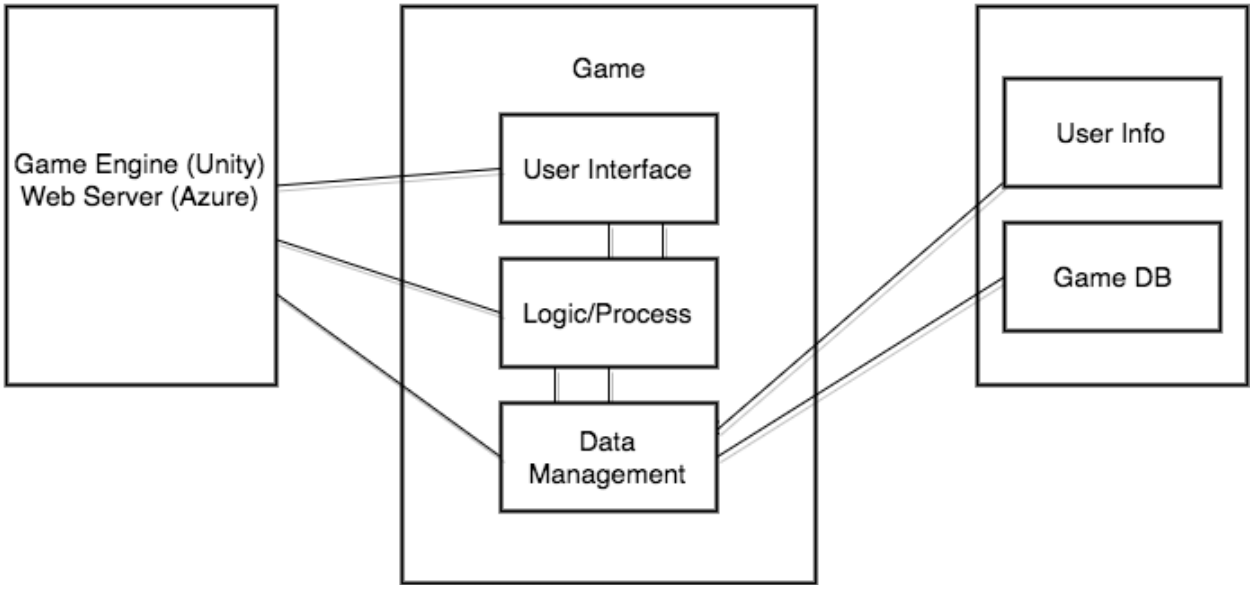
Gameplay subsystem:



23e Hardware / software mapping

As the game supports different platforms, there should be some mapping for data to be consistent.



23f Data Dictionary

Quiz: User is provided with a question and four options to choose from. It will be a multiple choice question type quiz. For each correct answer, points/coins will be added to the player's account. The duration of the quiz will be 30 seconds, The player can earn as many coins as possible.

Plane Seeds : The player will have to plant certain amount of seeds to get points towards next level.

Reduce Waste: Some locations will have a lot of waste in one place. Recycling it will give users bonus points.

Campaign: User will select different campaigns to run to raise awareness about global warming. Length of campaign will be decided by the player and coins spent. Ex. Campaigns to buy only electric cars, use solar energy, etc. This will reduce the experience required to reach next level.

Bonus Rounds: Any deficiency in points to unlock next levels can be obtained by playing these bonus rounds.

Marathon: Player will have an additional option to increase their experience level by taking parts in marathon. Activities such as running and biking will be involved.

Provide Location: Once the player has desired amount of seeds, a location will be picked by the game. Player will have to plant those seeds at that location to finish the task.

Information about the country: Player will eventually know various facts of the location/country with the information provided. As the reads the information, questions are created dynamically which will be used later in a quiz.

Leaderboard: Arranges and displays a list of user with top scores in quiz. It also sorts them by points and level.

23g Persistent Data management

For Persistent Data, A local file will be saved in case when database fails to connect or time out. The game will still be available to play. All the data will get stored in a plist file. The plist file will record the data of points, levels, and scores since the last update. As soon as the cloud database gets connected, the game will send a query to the cloud, and update the data in master database. The plist file will be unique for every user. So, if a user decides to play the game in a different device, then the player can do so by entering his uniqueID at login screen.

23h Access control and security

Regular users will not have control over the database. They can just read from the database. But developers, or the game, have access to the database. They can update the scoreboard if any invalid scores have been recorded. Or they can revert the system of it was hacked. For example, the user can only create a profile, but the game will store and save the profile in database. Another example would be Leaderboard. The can only see the list of top players, but the game will calculate as well as sort the users to display. This will provide security to both user and developer.

23iGlobal software control

This game is designed as a event driven software. Everything occurs when a UI component is triggered. It follows the control flow paradigm. An event is triggered when a user click UI component or completes the task. For example, when a user completed a task, and then predefined seeds/trees gets planted to reach next level, the "Level Up" event gets triggered automatically. The user will have a pop up dialogue informing them about the level change. Similarly, when User clicks on "Quit/Exit" button, the UI component connects to game process layer. This will then trigger the "save game" event, and the user will see logged out pop up. The game will then go back to "Welcome" screen.

23jBoundary conditions

Boundary condition play an important role in scaling the game behavior. It specifies everything from start of the game to end of the game. For this game, the player needs an internet connection. So, when the user launches the application the game should

check for an active internet connection. If a user is playing the game in mobile, some things might not be available. So when teaming up with other players, the game should make sure everything will be compatible among the team members. The game should also check for force quit situation. If a force quit was made, the game should remove the previous plist file as it might be corrupted or incomplete. Or if the user decides to quit the game, data should be save automatically.

24 Subsystem services

Store/Save Data: When player perform any action this subsystem is used to stores all of the player's data such as, the current state of the game or the amount of lifelines the player has.

Communication: This subsystem primarily handles the functionality which is responsible about the communication between the players when they play as team.

Resources: Defines each clue object as well as how it is stored within the game. For example, it defines the facts which are provided about each country in each level as well as the quizzes and the answers of the quizzes questions.

Interaction: Defines the interactions between the player and the game entities. This can be done by specifying the rules and the boundaries for each type of environment game either for single player or multiplayer players.

25 User Interface

- In the main page of the game, the user has different option buttons to select from based on what they are looking for. New users can select button "New user" which will allow them to play the game using training mode in order to understand the different parts of the game. "Start new game" button will take the user to a default level provided by the game database to start playing the game with. "Resume game" will let the user continue playing the game from where it left off. "Multiplier" allow user to play the game as team member. "Quit" button to exit the game.

- By clicking on the "Start new game" button the user will see the following interface, which provide the user with a unique ID and a Default level to start with. There will be list of the tasks that the user have to finish in that specific level and the users have to play tasks in order, as the next tasks will be locked "Unactive" until the user finish the task before.

- When the user finish the first level(default level) successfully then he/she will be provided with a list of levels(countries) to select from to start the second level. After the user select the level (country), a list of tasks of the selected level will be listed as shown in the above interface and same procedures will be repeated.

26 Object Design

26a Object Design trade-offs

Some of the objects should have singleton pattern. But it might halt the program some point.

26b Interface Documentation guidelines

User should be able to play by it on a touch screen as well as with tradition IO devices. IO devices can include mouse and keyboard. The IO device should be used for navigation and gameplay.

26c Packages

Package is only used for game arrangements.

26d Class Interfaces

```
Interface Player {
    int UniqueID, Level;
    long Rank, Score;

    void AddScore(int value) // add the given value to score attribute
    void IncreaseLevel() // Increase Score
    void SetUniqueID() // Generate a long random seq. of numbers
    void setRank() // Calculate and set the rank for leaderboard
}

Interface Tasks {
    String Type;
    Int Points;

    void SetType(String Task) // Set the Task as Type
    void SetPoints(int value) // Assign the tak points via value parameter
}

Interface Country {
    String Name, Information;
    int Pollution;
```

```
    void getName() // get the name of country from database and store to Name field
    void getPoll() // get ranking of the country in regards to pollution
    void getInformation() // get Information about the country for later use in quiz
}

quizQuestions  extends Country{
    String Question, Answer;

    void setQues() // store questions based off of information from the country
    void setAns() // store answer to the question set above.
}
```

IV Test Plans

27 Features to be tested / not to be tested

- Detection of new user so it can start in “Training” mode
- Saving/Updating user profile when the user progresses in the game
- Making sure the user isn’t falsely rewarded and check if all requirements have met before approving level-up
- Test Graphical User Interface is responsive
- The installation is done successfully
- Detection of platform
- Game play functionality

28 Pass/Fail Criteria

- Saving/Updating of the game but notify the user whether it was successfully been executed

- User must be connected to the internet at all times otherwise notify user and try again to connect.

- The user interface must perform all tasks faster than one second and must be responsive with no lags 90% of the time.

29 Approach

The testing for the **Go Geo** application will consist of unit, system/integration and acceptance level tests. The unit testing will be done by the development team as well as the dedicated test team of the application. The system and integration tests are done together and are done by the test team. The acceptance test will be done by the end users under the supervision of both the development and test teams.

Unit Testing is done by the developer and will be approved by the development team leader. Proof of unit testing (test case list, sample output, data printouts, and defect information) must be provided by the programmer to the team leader before unit testing will be accepted and passed on to the test person. All unit test information will also be provided to the test person.

System/Integration testing will be performed by the test team and development leader with assistance from the individual developers as required. The whole application will undergo system/integration test after all critical defects have been corrected.

Acceptance testing will be performed by the professional gamers with the assistance of the test team and development team leader. The acceptance test will be done for a period of one month after the completion of system/integration test process. Prior to completion of acceptance test all open critical and major defects must be corrected and verified by the customer test representative. A limited number of distributors will participate in the initial acceptance test process. Once acceptance test is complete, distributors will start marketing and distributing the final product in the market.

30 Suspension and resumption

- If the number of defects detected in a single unit or module reaches 5, the code should be worked on by the development team again as it makes no sense in wasting the resources to continue the test.
- Moreover, if a fatal error has been encountered, it would lead to termination of tests.

31 Testing materials (hardware / software requirements)

LDTA Testbed

AberroTest

Haven

SilkPerformer

Verberus

32 Test Cases

Test Id: 1

Title: Log In using the UniqueID

Purpose: verify if the ID exists in database with associated account.

Test Id: 2

Title: Use Invalid UniqueID

Purpose: Verify program doesn't let user login with invalid UserID and Account combination.

Test Id: 3

Title: Team Up

Purpose: Verify proper UniqueID is stored in a set of team..

Test Id: 4

Title: Select Level

Purpose: Verify if the user can select any level form the list of levels given.

Test Id: 5

Title: Leaderboard

Purpose: To check if the game provides correct numbers in leaderboard

Test Id: 6

Title: Choose a valid task

Purpose: Verify if the user can do the task

Test Id: 7

Title: Continue without choosing a game task

Purpose: Verify continuation of game without choosing a game mode or not.

Test Id: 8

Title: Quit a game

Purpose: Verify if the user quit a game properly

Test Id: 9

Title: Save the game

Purpose: Verify if the user can save the game and can resume it later if needed.

Test Id: 10

Title: Quit a game without saving

Purpose: To check whether the game is automatically saved on quitting or not.

Test Id: 11

Title: Level Scores

Purpose: To check if the scores displayed are correct or not in the leaderboard as well as in current state.

33 Testing schedule

Testing must be done after each feature has been completely implemented. e.g. As soon as the login feature has been implemented, testing for start of "Training" mode must be scheduled.

V Project Issues

34 Open Issues

Open issues are issues that have been raised, but up to date do not have a concrete solution. These issues might rise from requirement analysis and might be of utmost importance as they may determine the end quality of the product. Hence, these issues can distract team members from the work at hand, and often slow progress to achieve project milestones. Some of the issues but not limited to are:

- Multiple Language Support:

Problem: Currently, the game is available in English language.

Motivation: English is common language which most of the people around the word use it for communication. Therefore, as developers of educational game, we expected most of the game users know English. However, the game aim to benefit and educate all levels of peoples about Global Warming, therefore having it in different language will motivate different levels of people to use it. Thus, to benefits all levels of peoples, it is essential to provide our game in multiple languages by providing different Language options, which will help users to feel more comfortable.

- Different versions Integration:

Problem: How different levels with different tasks of the game, built by different developers of the team on different versions of the console being used, can be integrated?. Thus this lead to increasing time and budget.

Motivation: Whether technological or market wise, working in big project requires different team developer with good and different knowledge of web technologies. Therefore, developers of the team must take in consideration the work integration problem and thorough knowledge of web technologies is required.

- Internet Connectivity:

Problem: In order to play the game there should be internet connection. The game should be able to handle varying internet connection speeds. There could be instances that the internet connection is cut off abruptly while the players play the game as team.

Motivation: The player would like to play the game with the same team members. So, in such scenarios the game session of that specific player who lost the connection should be attempted to be kept active by some other means.

- Patch Updates:

Problem: Updating tasks in a level and adding new levels is demanded. The game require update, but no patching mechanism is thought of for the updates in the application.

Motivation: Changes in the project requirements like addition of tasks to a level or addition of a new level is demand. The design phase has not thought of the patching system, but it is essential for the application to have updates after the release to satisfy user requirements at all stages. Therefore, technical employee must have an amount of knowledge on how to patch code to already existing application. Moreover, have proper research of the country and its environment to reduce number of update to the level and tasks is demanded.

35 Off-the-Shelf Solutions

35a Ready-Made Products

Because Go Geo is a free game, so there will be financial problem with the development of software. Therefore, reusing an existed software will cost less, give better quality, speed up the development and cause less stressful development process as well as make the development process of the application much faster. Moreover, these are well developed software which decrease the development and research time.

In the market, there are many case tools can give a developer an insight into the standards of a case tool application and they are well developed software which decrease the development and research time. Example of Commercial off the shelf products that can be used are:

- Libraries requiring linkage into application code, for example graphics engines, Windows DLLs.
- Information retrieval applications such as hypertext and data mining tools
- Operating system utilities such as file operations and memory management
- Development environments with runtime modules, for example, Visual BasicTM and SybaseTM

- Vendor-supplied device drivers such as printers, displays, and multimedia
- Stand-alone packages such as word processors and spreadsheets

35b Reusable Components

Some design elements which are used most frequently are exhibition to broken down. Therefore, the standard interface should allow for reusable components. Bootstrap methodology in web development would aide everyone in the team from a front end perspective.

A software system that can be adapted for different customers without changing the source code of the system, such as commercial-off-the-shelf (COTS) product is required. COTS systems have generic features and so can be used/reused in different environments.

35c Products That Can Be Copied

There are many existing games in the internet that can serve and use as models for our game. By examining existing games, new ideas and solutions may present themselves. However, it is unlikely and a disadvantage to copy other games, because our game in such case will lose the creativity and the uniqueness, which will affect the players motivation of playing it.

36 New Problems

Some issues which pertaining to launch of the new software or product need to be considered are:

36a Effects on the Current Environment

One of the most important feature of the application is the continuous performance well when players play as team. So considering this fact, it is important that the servers that run the application perform and handle high loads throughout the duration and be ready to handle all number of players that has been determined by the developers.

36b Effects on the Installed Systems

There should be no mentioned effect on the installed system as the aim of the application is to have no effect on the existing system.

36c Potential User Problems

- The aims of the game is to give the users the best experience and knowledge about the Global Warming in interesting and entertainment way. A potential user problem could be to find it very intuitive in terms of the functionality, so the provided functionality might not be intuitive and interesting way for the players to learn the various issues and solution of Global Warming .
- Getting to know how potential users would respond to such kind of game once the product development would finish and the product will be ready for the market could be a problem.

36d Limitations in the Anticipated Implementation Environment That May Inhibit the New Product

Even the game developed with very minute attention to all potential design problems, the game may face problem of bad internet connection. However, the game make sure to handle this type of problem by maintain the data saved till then. The user can load back to the point from where he/she left off without any hassle or effort from his/her side.

36e Follow-Up Problems

Some of the problems that followed up include the validation of the historical facts provided about a specific country in each level of the game. These facts needs regular update and correction. Moreover, the tasks of the level maybe also need to be updated sometimes, followed the facts updated of that specific level.

Currently, the game designed to handle a team size of 50 players. Increasing the number of players who can play as team is required in the future releases of the product in case of the demand of the players to play as team increase.

37 Tasks

37a Project Planning

The structured approach presented in section 6f of this document can help to achieve a good quality, user-friendly software on time and within budget. The structure give enough time to the developer to develop the game in order to avoid the delay in finishing the product or submitting untested product.

Go Geo will be developed using Agile Development. In every sprint a tasks with a higher priority will be chosen and assigned to the team members. Each release will consist of two to three sprints, each of which will span for a period of 1-4 months. There will be regular scrum meetings which will be conducted to discuss the progress of the application and to resolve the issues encountered on the sprint tasks. A working module of the product is built, at the end of every sprint.

37b Planning of the Development Phases

Objective/goals

Some of the objectives that help to complete the Development Phase successful are building the system, testing and integrating the units into larger components , preparing the technical environment for the system and approval to progress to the Test Phase. The Development phase plan includes:

Initiate Development Activities

The Development Team of Go Geo began development by verifying selection for standards, methods and the tools that would be used through the development phase. Then documenting and resolving problems and non-conformances found in the system products and tasks with an issue-tracking process

Design Phase

In the Design Phase, Go Geo development team established the hardware/network development environment, installed, and documented each system component in accordance with the System Development Document developed.

Created test plans before code

The Go Geo team created test procedures for testing each system component (e.g., main CPU, network, software, and peripherals.)**.**

Integration Phase

The Development Team integrated the hardware and network components and test them to ensure that each aggregate of components satisfies the requirements of the final game.

Developed each module

After successful integration, the developer will start building each module based on the research on the countries (levels). At the end of the development module phase, the developers should be tested the module on the basis of test cases developed initially.

Completion of the system documentation:

- Help manual and training manual
- Release announcement
- Maintenance announcement

38 Migration to the New Product

38a Requirements for Migration to the New Product

- The new product should be independent of any previous installed product being used by the user. This is because GoGeo does not save in its database any personal information or any data related to the users.
- The new version should require to close the older version of the product and updated before the user can launch the new version (application).

38b Data That Has to Be Modified or Translated for the New System

Update the levels order based on the new list of the countries that effected by Global Warming.

Update the default level provided by the game.

Update the number of levels and the number of tasks in each level.

Update the number of players that can play the game in general and the number of player that can play the game as team.

Update the information provided in each level to describe the facts of Global Warming in that specific country(level).

Update the tasks provided in each level to describe the ways of preventing or reducing the Global Warming in that specific country.

There is no data need to be modified or translated for our application related to users(players).

There will be no such new technology used to holds the data compare to the current technology used.

39 Risks

Risks identified in our project were classified in certain categories:

Risk in Schedule

1. Unrealistic schedule
2. Missing of important tasks from the schedule
3. Inaccurate facts on various countries that lead to controversies and bad image of the product.

Risks in Requirements

1. Continually changing requirements

Risks in Product Development

1. Development of the wrong user interface
2. Wrong choice of selected technology

40 Cost

Cost of the project depended on the size and the complexity of the project. We also needed the amount of time and labor our development team put into the development of the project.

Initially the estimation was around $30000- $40000.

But after the overall project was developed, the cost of the whole project accumulated to $30000.

41 Waiting Room

Our project is an iterative development, agile methodology following type. Hence, almost all ideas will be implemented on the go with each iteration. Depending on how the end user feedback is collected and taken into account, decisions for consecutive sprints will be considered.

However, some points that are shelved for now include:

1. Shuffling of levels: It is possible that once a user is accustomed to playing the game, and gets to be aware of the levels they will be no more excitement within the game.

2. Shuffling of tasks\Multiple Challenges to accomplish the level: After successfully playing a level of the game, the user will know the flow of the events once he wish to restart the level. This could cause monotony and will eventually make our product loose customer excitement. Hence, we could provide different tasks to finish each level. In this way even a returning user will still have the element of excitement.

3. Number of levels will be incremental, but as the updates to the game continue, various different cities will be added as the new different levels of the game that result in increasing the excitement to the user.

42 Ideas for Solutions

Go Geo is an mobile application game that can be downloaded from the istore or the playstore as well as play on the desktop using google maps. Although, we could derive this idea and make this game played in consoles like play station and make it more enthralling. Multiple versions of the game can be released, each for its own type of engine.

43 Project Retrospective

Some ideas implemented went really well, whereas others could be improved. Listed below are some points under each category.

<u>Perks:</u>

· Agile Development: Since the game is released in iterative increments, it allowed us to explore the acceptance of the game. Modify parts that were not accepted well with end users whereas highlight the ones that were popular.

· Factual Data Testing: Testing the game for facts by a certified team of Geologists and environmentalists ensured that our game is valid in terms of all factual data. This ensured that our product didn't fall into legal problems as all data was backed up by proof.

· End user Feedback after each release: The incentive of feedback from our customers helped us extend our market base. Their suggestions were improved upon in consecutive releases and

this increased the popularity of the game. Any bugs, design accepts not popular were removed\ replaced by newer ideas.

Things to Improve:

· Maintenance Engineers Lower involvement in design: Since the maintenance engineers knew a little about the internal workings of the game and its design, they weren't able to solve all user queries to the efficiency we expected. Hence, it would be helpful if they were also a part of some of the design discussions and had a fair idea of the hidden aspects of the game

· Graphical Designers Input wasn't considered of high value: Many aspects of the game couldn't deliver its intended purpose because what the design team proposed had limitations that couldn't be achieved using graphics. This could be avoided by included the graphical (UI designers) into the discussions to better improve the result.

VI Glossary

VII References / Bibliography

This section describes the documents and other sources from which information was gathered. This sample bibliography was generated using the “Insert Citation” and “Bibliography” buttons in the “Citations & Bibliography” section under the “References” tab of MS Word. Creating new citations will not update this list unless you click on it and select “Update Field”. You may need to reset the style for this paragraph to “normal” after updating.Bell, J. (2012). *Underwater Archaeological Survey Report Template: A Sample Document for Generating Consistent Professional Reports.* Chicago: Underwater Archaeological Society of Chicago.

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VIII Index

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