Final Report
StandUp Game

f 25th June 2015

Delft University of Technology

Nick Cleintuar	4300947
Martijn Gribnau	4295374
Jean de Leeuw	4251849
Benjamin Los	4301838
Jurgen van Schagen	4303326

TU Delft Delft University of Technology

Challenge the future

Contents

1 Introduction

It is important for companies to keep the health of its employees in mind. Especially in office workplaces, which have a sedentary nature, there are increasing concerns to employee health (Marshal and Ramirez, 2011). Most of the employees in an office spend almost two-thirds of their time sitting (Clemes, Patel, Mahon and Griffiths, 2014).

Excessive sitting during the day can however lead to medical problems. Studies have shown that sitting for most of the day can lead to an increased risk factor for cardiovascular disease, type 2 diabetes, premature mortality as well as some cancers (Gierach et al., 2009; Thorp, Owen, Neuhaus and Dunstan, 2011). This risk factor is independent of how physically active this person is (Bankoski et al., 2011).

The problem is not just with sitting most of the day while at the job. As can be read in Clemes et al., 2014, even during lunch breaks the 'high work-time sitting' employees tend to walk little. This means that an employee that is more sedentary moves even less, even though especially that person needs to move around more.

Super Starfish Mania aims to be a tool that can help motivate people to regularly take breaks during the day. This is done through gamification. Gamification uses game elements to encourage non-game activities ranging from being more productive to living healthier (Deterding, Dixon, Khaled and Nacke, 2011).

For the game to be successful the following end-user requirements are defined, in no partical order:

Requirement	Analysis
The game has to be accessible to many people.	The game should be fun to play for as many users as possible. This means that the theme should also be something that appeals to a broad public. Otherwise there could be many people that do not relate or understand the used theme.
Only a SmartPhone is required to play the game.	The game should have as little necessary hardware as possible. Since we need to detect movement, we at least need some portable device. Since nowadays having a SmartPhone is common, we decided to make use of this.
The player has to receive a notification when a stroll is available.	A phone is something you usually put away while not using it. It is important however that the user knows when an hour has passed. By using notifications we can keep the user updated if there is a new stroll available.

During a stroll, the player should encounter a large variety of events.	To prevent the game from getting stale after a short time, the game should contain a large variety of events. By having many different events, the chance of playing the same game in repetition reduces. Thus keeping players interested in playing the game.
The player has to be able to collect a large variety of different collectibles.	If there are a lot of collectibles that can be earned in the game, the player will remain motivated. This is because he or she will want to get the best collectibles possible.
It should be possible to play together with someone else.	Playing a game alone can be fun, but playing together with someone else is even more fun. By having group events, the players increase each others motivation to play the game.
The player has to be able to change his or her Username.	Being able to personalise your account increases the feeling that the collection is actually yours. It's also used to identify yourself within a group.
Groups can be created and joined on the server.	Having a group with other people, for example friends, increases the social pressure as well as competitiveness. Play together to compete with another group.
The player can share collectibles from his or her own collection to a group.	Since groups can be made, it should also be possible to fill this group with collectibles of its members. By donating your own fish it is possible to increase the collection of the entire group.
Groups can be hosted on a dedicated server.	The server can be hosted on a personal computer. This is both to increase scalability as well as the ability to host private groups.
The player is capable of entering the IP of a dedicated server and use it as default.	Since it is possible to host a personal private server, it should also be possible to join this server. This changes the default remote server in the game, so that it only needs to be updated once.
The collection from a group can be displayed anywhere on any PC.	It should be possible to display the progress of a group. This can be done on any PC. This creates the possibility to display it in, for example, the hallway of a department.

2 Product Overview

Super Starfish Mania is a movement based game which promotes and rewards physical activity from its players. It is designed for people that live a sedentary lifestyle and need a little help and motivation to reduce this behaviour. Super Starfish Mania offers help by providing the user with the following:

Notifications Super Starfish Mania notifies the user after every hour to raise awareness about the user's sedentary habits and offers them to take a five minute physical break.

Physical Activity If the user decides to take this five minute physical break, his or her activity will be measured, and according to this measured activity, a small game might show up. This small game requires the user to perform certain movements in order to complete the game.

Rewards Upon completion of the break, the user will be rewarded with several collectibles in the form of fishes based on how well the user performed during the games. These collectibles consist of a shape and a randomised colour, which both contribute to the rarity of the collectible.

Collaboration It is also possible for users to play these small games together. A user can decide to host a game which will generate a code, the other user then simply has to enter this code on their device and press join.

Groups Users can form and join groups. These groups then contain their own collection of collectibles to which the players can donate their own collectibles. These donated collectibles will then be displayed on a big screen for everyone to see.

The notifications will raise awareness, while the physical activity will help the user break their sedentary habits. The rewards for these physical activities will keep the player compelled to keep playing while the collaboration and groups will allow the players to generate small amounts of social pressure to keep each other motivated.

In depth overview of the software can be found in chapter 4.

3 Reflection on Product and Process

Super Starfish Mania has struggled a lot during its design and development. Errors and wrong decisions were made, and the application has suffered for it.

Documentation Too much time in documentation such as sprint plan, retrospective, too less time in talking about the retrospective.

Event based game Looking back this was a lot more challenging than expected. Each game has different requirements and a different implementation and therefore is a small project on itself. Even though we created a foundation to build new events, each event takes more time than initially predicted in the planning phase.

Midterm feedback After the midterm feedback, in which we were told we had insufficient features. We should have panicked less about getting these features implemented. Instead we should have kept a cool head and kept on working systematically. This would have improved our code quality requiring less last minute fixes.

Play testing During the project we should have requested play testing a lot more and earlier in the process. This would have resulted in a faster feedback loop making it easier to adjust to the feedback when the component was still in development.

Project start up At the start of the project a lot of time was spent thinking about the game and planning for the future. While this seemed like a good idea, we only had about ten weeks to design and develop a functioning game, and planning so far into the future took up a lot of time. Planning for the future in general is a good idea, but you must not forget to keep your current situation in mind.

Refactoring code During the project a lot of refactoring was done to keep the code clean and to satisfy design principles. However this came at the price of having few features and gameplay. As a result a wake up call was issued in the last one and a half week and it became a race to implement a lot of features in a short time resulting in altering our previously clean code into less clean code.

Self explanatory Another improvement, is an easier user interface design. When explained, new users easily understood how to interact with the application. However, when the users has to explorer the application themselves, they experienced too much options at once.

Unit testing After the feature lock we had to focus on implementing the features of the midterm feedback, this resulted in less time for unit testing.

4 Description of Functionalities

The software product can be separated in the following large components:

4.1 Timers

Timers are an important part of the game. They can be used by various components in the game. This can vary from the stroll timer to Timers for events.

Timers are managed by a *TimeKeeper* and can be stored in the *TimerStore*. The TimeKeeper is an *Observerable* to which every Timer subscribes. Its purpose is to *'tick'* the Timers once every second. The TimerStore is used to access Timers.

Timers can be accessed and used as *Observables*. They notify their listeners about *start, stop,* and *tick* events.

4.2 Graphical User Interface

For the GUI we used *LibGDX*. LibGDX is a framework that is used to create games. We extracted the behaviour that is common in every scene to the *WorldRenderer*. The WorldRenderer uses *ScreenLogic*, which represent components for a *Screen*. The Screenlogic defines what is displayed on the screen as well as its behaviour.

The *ScreenLogic* has access to a *GameSkin*, which defines general purpose methods that can be used to create GUI elements like buttons and textfields.

Changing between screens is done through the *ScreenStore*. The ScreenStore caches the screens to make sure that any observers can remain active while that screen is not active.

4.3 Game Mechanics

The game consists of three major components. The first one is the *interval*. The interval is the time between *strolls*. It is important that the player is limited in the amount of times he or she can play the came to prevent the player from being distracted from work too much.

The second part is the *stroll*. The stroll is the five minute time period where the player has to move around. When the phone detects movement, there is a chance to encounter an event. This chance is higher if the player moves around more by running.

Last we have the *Events*. Events are played by moving the phone around playing various small games. Each game makes use of the accelerometer in a different way and each event has its own difficulty.

4.4 Server and Client

The *Server* is a versatile part of the program that can run either as an internal server or as a standalone remote server. This means that the same code can be used to store personal data on the phone and group data on the server. The server uses a *LocalStorageResolver* to determine how to make a connection to the database. This database is managed either by *JDBC* on Desktop or *SQLDroid* on Android.

The Client is accessible from any component in the game as a *Singleton*. It manages the connection to the server. This is done using a *state* pattern. A connection can either be *Unconnected* or *Local/Remote*.

Clients make use of *ResponseHandlers* to process a reply. This is important because the *local* and the *remote* connections have different implementations for their respective connections, but handle the reply in the same way. A ResponseHandler is an interface with a method *handleResponse()* that takes a *Response*. Within the method it is possible to determine what to do.

4.5 Multiplayer

Multiplayer connection can be established between two players on the same network. The *host* first contacts the server and gives the *IP* and *port* he is hosting on. The server then generates a random key that can be given to the other player.

The other player enters the key, and uses that to retrieve the IP and port from the server. It then connects to the host. This setup requires the two players to be connected to the same remote server as well as be on the same network. The server does not need to be on the same network as the devices.

Messaging between the two players is done both with *TCP* and *UDP*. TCP is slower than UDP, but assures that the package is properly retrieved by the other party. TCP is therefore used for sending important setup data for the event, as well as important updates like destinations. UDP however is used to send simple data that is updated many times per second, for example the rotation of a boat.

4.6 Aquarium

The *Aquarium* is another standalone application that integrates with the game. The purpose of this application is to display the collectibles earned by groups. This can be run on any PC by running the executable *.jar*.

The aquarium can connect to a given server by providing its IP. It can then display the collection of all the groups that are on this server. The connection is done by using the same Client and Server that is used for the game.

5 HCI Module - Interaction Design

5.1 Persona

Rick, administrator
Rick is a 25 year old administrator who works for a large wood sawing company. He just joined the company after finishing his administration college 2 years ago. By growing up in the era of information he is familiar with basic computer software. He uses these skills every day to administrate for the company.
He tries to work as much and fast as he can so he can go home early if he's done for the day. This causes him to only take mandatory pauses such as lunch. Being young means that his body has no trouble supporting his bad habits of no breaks and his not ergonomic chair and sitting positions, but Rick does realise that this is not a sustainable way of working. Rick lives with his girlfriend in a cozy apartment a few kilometres from the companies headquarters. He has a generally healthy lifestyle and likes to play tennis in the weekends.

Julie, receptionist
Julie is a 55 year old woman. She has been the receptionist of Swirl Candy LLP for over two decades. She works as a receptionist to make sure employees and visitors are treated with care. Being a receptionist means being stationary for most of her work hours, which can be bad for her health.

To help prevent health related issues from sitting behind the reception, Swirl Candy invested in a ergonomically designed workplace for their receptionists.

Julie is a calm person who enjoys watching movies and TV with her husband when she comes home from work. In the weekends she enjoys reading books in her reclining chair in her garden. She doesn't get much physical exercise, which she is starting to notice more and more as she is getting older and she would like to change this.

Johny, PhD candidate
Johnny is a PhD candidate doing research in the department of bio informatics. He just

started his PhD after finishing his Master study program last year. Every morning he cycles to the bio informatics lab of the university to work on his research. He has a lot of experience with all kinds of research software and is an advanced computer user. His work in the lab is very hectic causing him to move around a lot around the lab. Every two weeks he has to hand in a report with his findings and his planning for the next two weeks.

Johnny likes working for the university, but the hectic nature of the work causes quite some stress which he has difficulties coping with. He knows that regular breaks help him deal with the stress, but he has trouble enforcing these breaks while he is working. He is part of the universities swimming team. He trains twice a week in the evening and regularly participates in swimming competitions.

5.2 Context Inquiry

All three persona's could use some help with taking regular breaks and moving around. Some to help change their sedentary habits, others to take a step back and relax for a moment. They need occasional reminders to help them remember that they should take a break, but they also need to be able to continue with their work if the reminder comes at an unfortunate time. The product should feel as a welcome break rather than as a chore, and therefore the product needs to appeal to the users in such a way that they will *want* to use it. Furthermore the breaks should be short. Actual work still needs to be done, so these breaks may not occur too often and may not take too long.

5.3 Product design

To accommodate to the needs of the users to the best of our abilities we designed and implemented an android application. Once per hour, this application sends a notification to the user, inviting them to take a break. These invites will remain available until the users accepts them, so that the user can take this break whenever it suits them.

During this break the user has to move around, which will be detected by the application. While the user keeps moving around, individual events will come up, which the user can play and complete. These events are small physical exercises encouraging users to be more active and while done occasionally, may become a healthy habit. Depending on how many of these events the user is able to complete during the break, he or she will be rewarded in collectibles. These collectibles come in many different shapes and colours, some more rare than others, giving users something to strive for while playing, which in turn makes the game more compelling.

Should you find another user who happens to also be on a break, you can play an event together, which will enable users to motivate each other to keep using the application and taking regular breaks. Lastly, to strengthen the feeling of cohesion even more, groups of users can be formed in which they can maintain a collection together by donating from their own private collection. This group collection can then be displayed on a big screen in the middle of the work space, giving a feeling of accomplishment and cohesion, as well as providing for a potential meet-up location where users can gather to play together.

5.4 Usability Evaluation

We asked a couple of people with no prior experience with our application to play the game while we watched. The main issue that all users experienced is that the application is not self yet. As soon as we gave out a couple of directions of what to do people would understand and seemed to enjoy it, but without explanation it seemed a little tricky. We improved this by removing a lot of unnecessary menus, but it still could use some improvement. We hope to improve on this soon and then we will do the same experiment on new people.

Another point that is brought up is that the game currently still uses too much text to explain the application instead of actual images, even during games. This is not a major issue, but it does make the game less appealing, and is certainly something we are going to look at as soon as we are satisfied with all the functionalities in the game.

Lastly the final point is that while these people seemed to enjoy the game for the couple of minutes that they played, the variety of events is too small to keep the game interesting in the long run. Luckily creating new events is relatively simple since we already implemented all kinds of helper tools, but it does need to be done. But here the same applies as with the previous one: it is something we are going to look at as soon as we are satisfied with all the functionalities in the game.

6 Evaluation of Functional Modules and Product

In this section we discuss the different components of which our games consists. If there is anything that is not as we initially envisioned it to be, we also explain why.

Notifications The Notifications work as expected, every hour a notification shows up, even if the application has been closed.

Timers The Timers work as expected. After some issues we chose to use the Observer pattern to increase modularity and ease of use.

Activity Measurement An external library was used for the activity measurements and seems to work as expected. The only downside being that it is not hard to fake actual movement. It is also slightly delayed when changing the movement state.

Singleplayer events There are currently only two different singleplayer events available, which is extremely few, resulting in repetitive gameplay. We initially focused too much on creating a solid foundation. Creating an event takes quite some time even if it is only a small one. Although the game is solid, creating more events simply takes time that we were short on.

Multiplayer events There is currently only one multiplayer event available, which has a small bug with the hitbox resulting slightly incorrect collision detection. This is because the screen aspect ratio is normalised to a 1:1 ratio. Even though the hitbox is drawn on the proper location, it does not always properly collide with the SmallFish.

Multiplayer connection At first we would have liked to use a technology like NFC to detect two players being close to each other. Since we lacked the time to implement this, we added multiplayer connectivity through the server using a unique id.

Collectibles Collectibles work as expected, although there are currently only three different collectible shapes. Creating more collectibles only requires artwork.

Server The server works as expected. At first we implemented it only for desktop and later enabled it to run within the game as well. This was done to streamline data storage within the game. The largest problem with the server was how to test *Statements* and *ResultSets*. After a lot of trying we did not get proper tests to work and decided to leave it at that.

Client Although the class is properly written and works as expected, the client has become an extremely large class. The queries inside the Client class should have been placed in a separate class, but we did not have the time to do so.

Managing groups Groups can be created but not properly edited. The UI for the groups is basic and needs to be extended if we want to add these functionalities.

Joining groups Group collections work as we want. The player is currently limited to joining a single group. Donating fish from the players personal collection works as expected.

Aquarium The group collection display works as expected. The group that is currently displayed will update in real time with updates to the group.

There is also a new bug where if you start the application, then leave the application and then reopen the application it crashes.

7 Outlook

Super Starfish Mania contains a foundation on which expansion of the game in the form of more events and collectibles is relatively easy. Although there are some of parts that still miss some key features, it does reflect the product we envisioned.

During the demo-market we also had a lot of great feedback from the viewers. This generally came down to them being interested in the game, but their experience was that it was still missing some components.

Some of the best feedback we received was from a teacher at the TU Delft that saw the game for what it was: An almost complete game that is really close to actually being something that could capture market share.

Although the product was not exactly as we had hoped it would be, it still has become something we can be proud of. It has the solid foundation on which we can continue to build and enhance. If we were to continue the project, we would at least want to implement the following features, in no particular order:

- Visualise the story behind the game.
- Improve movement detection.
- Add animations.

- Improve the look and feel of the game.
- Make the game more self-explanatory.
- Add passive rewards for being active even when not on a stroll.
- Adds more collectibles.
- Add additional events, both single- and multiplayer.
- Support more platforms, for example iOS.
- Collectible degradations when inactive for long periods of time.

References

Marshal, S. & Ramirez, E. (2011). ”reducing sedentary behavior: a new paradigm in physical activity promotion”. *American Journal of Lifestyle Medicine*, *5*(6), 518–530.

Clemes, S., Patel, R., Mahon, C. & Griffiths, P. (2014). ”sitting time and step counts in office workers”. *Occupational Medicine*, *64*(3), 188–92.

Gierach, G., Chang, S., Brinton, L., Lacey, J., Jr, HollenBeck, A., Schatzkin, A. & Leitzmann, M. F. (2009). ”physical activity, sedentary behavior, and endometrial cancer risk in the nih-aarp diet and health study”. *International Journal of Cancer*, *124*(9), 2139–47.

Thorp, A., Owen, N., Neuhaus, M. & Dunstan, D. (2011). ”sedentary behaviors and subsequent health outcomes in adults a systematic review of longitudinal studies, 1996-2011”. *American Journal of Preventive Medicine*, *41*(2), 207–215.

Bankoski, A., Harris, T., McClain, J., Brychta, R., Caserotti, P., Chen, K., ... Koster, A. (2011). Sedentary activity associated with metabolic syndrome independent of physical activity. *Diabetes Care*, *34*(2), 497–503.

Deterding, S., Dixon, D., Khaled, R. & Nacke, L. (2011). ”from game design elements to gamefulness: defining ’gamification’”. *”In Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments”*, 9–15.