

# GAME DESIGN DOCUMENT FOR “WHEELFIT”

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# 1 Introduction:

## 1.1 The Document

This Document specifies the design of the game with a provisional Title “WheelFit”.

This Document is intended to be read by programmers, artists and producers involved in the design, implementation and testing of “WheelFit”.

## 1.2 Unique Selling Points

The intent for providing a training platform for those that are "new to the wheelchair".

There is an emphasis on wheelchair mobility.

Variety of training exercises.

Personalised workout plans.

# 2 Target System:

WheelFit will be developed for the following platforms – PC (Windows 7, Windows 8.1) and Xbox 360 (Xbox One development is a logical follow on step from here).

These platforms have been selected due to their similarities (using XNA allows the developer to export the artefact to Windows and Xbox), and their respective compatibility with the Kinect camera system.

# 3 Development System:

WheelFit will be developed using Microsoft Visual Studio (Ideally 2013), using Microsoft XNA and the Kinect SDK, in C#. The game will be developed for PC first, and then ported to the Xbox platforms. Kinect <sup>Wheels</sup>, a software library based on the Microsoft Kinect SDK, written in C#. Here is a paper on the subject - <http://dl.acm.org/citation.cfm?id=2479609> .

## 4 Specification:

### 4.1 Concept:

Wheelchair Game: "WheelFit".

Newly injured persons, who have recently been restricted to a wheelchair, are the intended primary users of this game. It will primarily be designed as a fitness/gym simulator. This will be similar to games such as Wii Fit on the Nintendo Wii/Wii U or Xbox Kinect fitness games such as Nike+ Kinect Training and Kinect Sports. Players will control the game with wheelchair movement and their voice.

### 4.2 Game Structure:

The game acclimatises players who have recently been restricted to a wheelchair to their new situation. To do this the game will provide a structure for exercise, with the game acting as a personal trainer of sorts. This will allow them to gain upper body fitness and strength to increase their ability to use the wheelchair and, ultimately, become more mobile and independent.

Levels would be completed by completed by doing a certain number of repetitions of weight lifting for weight/strength training, or increasing speed and accuracy for moving from one location to another - represented on screen by using the Kinect to use an augmented reality, markers would be placed on screen representing real world locations (another place in the same room...).

Ideally, this would be used as part of a rehabilitation plan (where possible) with the exercises set out by fitness and medical professionals.

### 4.3 Players

The game will be playable by one player initially, with two players being able to play together using Kinects multi-person tracking ability. Multiplayer will take place in a side by side split screen format, with both players being required to use "wheeled" chairs; a wheeled desk/computer chair is to be used in the event that not all players have access to a wheelchair, allowing the inclusion of non-wheelchair users into the game. There is a likely hood that player chairs will collide, however this kind of interaction already occurs with Kinect and Wii motion games, and should be taken as part of the game.

### 4.4 Game Types

The game will feature multiple game types, the manoeuvring game, strength exercising, and obstacle course.

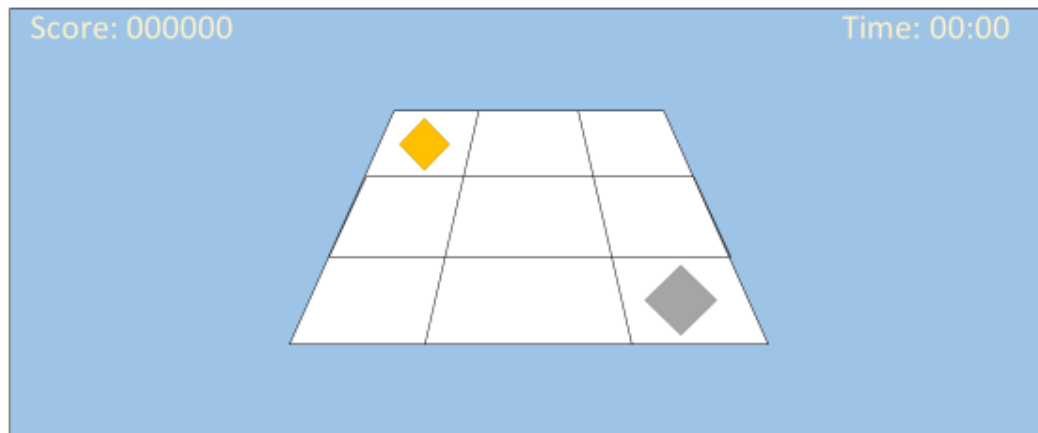
#### 4.4.1 Manoeuvring Game

##### 4.4.1.1 Description

This game will focus on developing the player's ability to move around using the wheelchair. The game space, on screen, models the physical space that the player is playing the game in, using the Kinect camera to record the room and display it onscreen. A virtual play mat where the game will be taking place will be drawn onscreen by the game, and placed "underneath" the payer. The following is a mock-up (Template) of the play screen in which the manoeuvring will take place. The blue area is where the camera will draw in the detail of the room the game is being played in; in real-time the player will be shown.

## Game Screen:

This is a mock up of the Manoeuvring game. The Game Screen will feature score and timing, and an image of the environment the Kinect can see. Over this will be placed the grid around which the player will move. The Grey Diamond represents where the player is, and the gold diamond represents where the player has to move to.



The timer will count down to show how much time is remaining for the player to move from one location to another.

### 4.4.1.2 Scoring

The scoring for this section of the game is going to use a countdown timer. The time remaining be count down from 12 seconds. The screen will only display the countdown from 10 seconds, the first two seconds being counted invisibly, “behind the scenes”. There will also be a measure for the distance to the centre of the target location, the closer the player is to the centre the lower the distance, the lower the score given. There will be a two second limit for the players to place themselves over the centre of the target location, when the player has been still for one second the distance score will be calculated. These two scores will be combined (time divided by distance, and the total multiplied by 10, to give a score out of 100), outputted and then added to the total score for the game. The maximum score for the round will be 10(seconds remaining) divided by one (the closest the player can be to the target location) = 100. If the player takes longer, for example: if there are only 7 seconds left on the clock, and the player doesn’t get close enough to the target, scoring a 2, for distance. The player will get  $7/2 = 3.5$ , multiplied by 10, giving 35 (to be added to the total score).

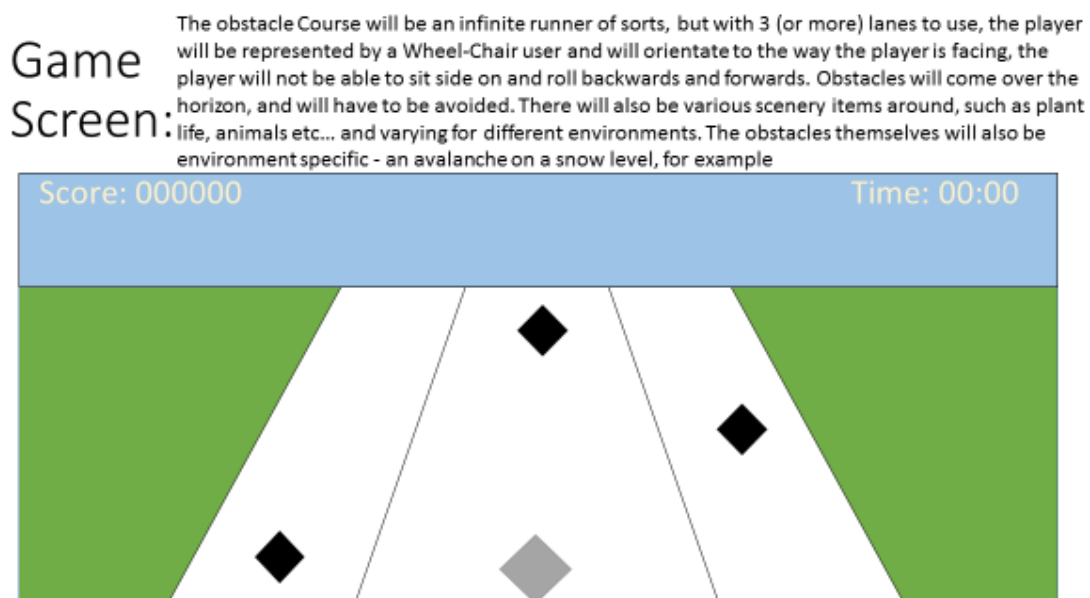
### 4.4.1.3 Player Control System / User Input

The player will control the game using the wheelchair. The onscreen representation of the player will move correspondingly to the player moving around in front of the Kinect camera. Moving towards the camera moves the player away from the on screen horizon, and moving away from the camera, moves the player towards the on screen horizon. Moving left and right correspond to the left and right of the screen. Essentially the on screen player mirrors the movement of the player in the room. In the event that the player gets “turned around” and faces away from the camera, the game will be aware of this as it will be tracking the rotation of the player, and the game will wait for the player to turn back around to face the screen/camera.

## 4.4.2 Obstacle Course

### 4.4.2.1 Description

The obstacle course is an infinite runner, with a virtual character, controlled by the player, trying to make it to the end of the course. The character will be viewed from behind, in the third person, running towards the horizon. Obstacles will litter the course, both stationary and mobile, and will have varying terrain. There will be multiple courses selectable by the player. For example a skiing slalom obstacle course, where the player has to navigate to the bottom of a mountain. Obstacles on this course include, but are not limited to, other skiers (NPC), slalom gates, trees, snow drifts and avalanches falling in from the side. There will also be a river rafting obstacle course, following a similar pattern, but within a different environment, including rocks in the river, logs and mud slides falling into the player's way, other rafters (NPC), whirlpools. In the river rafting course the player will bob up and down in the water. Below is a mock-up (Template) of the screen, green is the landscape, with appropriate flora and fauna. The black diamonds represent obstacles, and the grey diamond represents the player. Random level generation, for the obstacle spawn points, is going to be implemented; meaning each play through will be different.



### 4.4.2.2 Scoring

The player will be awarded points to their score by completing the course in the quickest time possible, with a countdown timer showing how much time there is left before the game is over (The time will be added to the score). The player's score will also be increased by successfully moving through slalom gates (without making contact) and avoiding obstacles (this will be represented by a multiplier that will increase as time counts on, and will increment by one for every 10 seconds successfully continuously avoiding obstacles, the multiplier will reset when an obstacle is hit). Aside from all of this there will be a score counter continuously increasing over time based on the players speed. The higher the speed the faster the rate of scoring, and will dynamically adjust with player speed if the player is stationary the score will not increase at all; 10 points a second at "10mph", 100 points a second at 100mph. The time remaining will be added to the speed score, and then multiplied by the score multiplier.

#### 4.4.2.3 Player Control System / User Input

To control their character in this section of the game, the player will move their wheelchair. The player's virtual character will orient to the way the wheelchair is facing, thus forcing the player to face the camera, and turn to move left and right. Moving closer to the camera will cause acceleration, and moving further away from the camera will cause the character to slow down.

### 4.4.3 Weight Training

#### 4.4.3.1 Description

In this section of the game, the player will be required to use weighted dumbbells to train their upper-body. The subsequent increase in muscle mass that should occur will increase the upper-body strength of the user. The game will use a fitness instructor to provide a structured environment for training. The instructor will be a virtual NPC; inspired by Nintendo's WiiFit, with animations and a voice (Male and female, an option in the menu will be available). The game screen will be a mirror of the player, with tracking "shadows" over where the player's arms and upper body is. The game will look for the correct positioning of the upper body during exercise, and will simply rely tracking point positions.

#### 4.4.3.2 Scoring

This section of the game will not have scoring, but will maintain a record of previous achievements. For example, how many arm curls the player has done, and how heavy the weights were. The emphasis in this section of the game is a work out regime

#### 4.4.3.3 Player Control System / User Input

The user input will be primarily using the arms in exercise motions to replicate the exercises described on screen.

## 5.0 Controls / User Input

### 5.1 Controller Types

The methods for controlling the input into the game are as follows:

- Game pad - for console AND PC
- Keyboard and Mouse - for PC
- Wheelchair for all platforms

### 5.2 Controller Methods

The wheelchair will be the main input for the game, relying on the user to be seated in the chair to play. The other controller options will be added to provide an “ease of use” functionality to the game for other environments. The game pad will be necessary for navigating the console menus, although the console does support voice commands and gesture input.

### 5.3 Menus

The main methods for control will be wheelchair based with motion sensing being used to achieve this. The cardinal directions (Forwards, Backwards, Left and Right), will be supplemented by the ability to rotate the wheelchair, and the Kinect cameras ability to detect this. In the menus, moving towards the camera will move the cursor up, and moving away will move the cursor down, rotating left and right will move the cursor in the corresponding directions. Keyboard and mouse will achieve the same results with the arrow keys/mouse cursor, and the game pad with the left control stick/D-pad. To navigate the menu, up (towards) and down (back) will be used to cycle through the options available, with rotating left being used to return to the previous area of the menu hierarchy, and rotate right being used to go deeper into the menu hierarchy.



In this example “Menu Option 1” is being selected and then altered to “Menu Option C”, or this could be an example of selecting game type “C”.

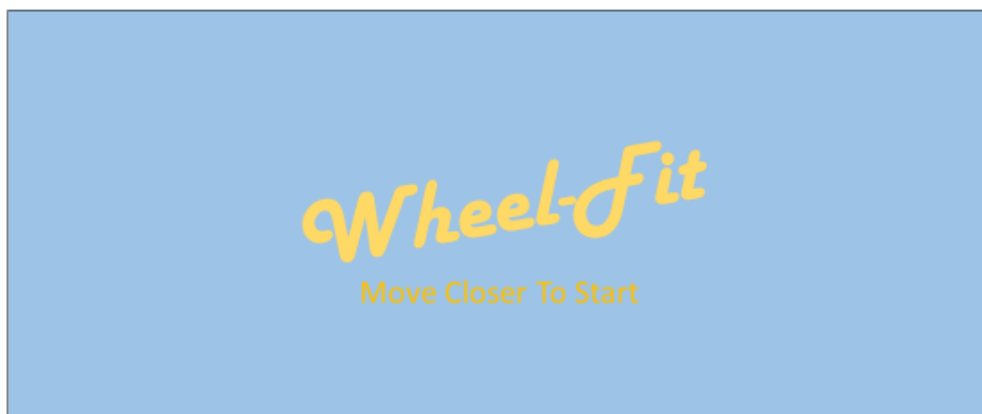


Menu Screens – In these examples, the blue areas represent an image depicting awesome action events, coupled with athletic success, but featuring characters in wheelchairs, such as this - [http://www.xblgamerhub.com/images/easyblog\\_images/985/KSR.jpg](http://www.xblgamerhub.com/images/easyblog_images/985/KSR.jpg)



Think Wii-Fit or Kinect Sports with added wheelchair, this screen should feature the title and a start function, "Move Closer to start" being the direction given. The Background will show the various activities in the game – Weight training, manoeuvring, obstacle course etc...

Start Screen:



Menu Screen:

The Highlighted Menu option will "bounce" and be a different colour to the rest of the options, the menu will be navigated by moving Towards (up), away (down), and left and right. (it will also be sensible to include keyboard and mouse, and controller support) menu options will include a settings and quit, as well as an option for each game type... The Background will have a similar theme to the Start Screen. The Menu screen will have the same layout as the pause screen, albeit with an appropriate options list.



## 5.4 Menu Selection details

Pausing the game is not necessarily an easy thing to do with a wheelchair; a number of options are available –

- Leaving the range of the camera, on doing so the game pauses and resumes when the “continue” option is selected (in menu option selection system this would be done by turning right when the option is selected).
- Saying “Pause” (if the user can speak...); the inbuilt microphone in the Kinect system can be utilised.
- Using the gamepad/keyboard, obviously this would be used as a last resort (the wheelchair being the primary controller for the game).

Other things that need to be included are –

- Game type selection
- Name input, (or using Xbox Live accounts)
- Visual settings, colour-blind options
- PC specific graphics options
  - Resolution - 1920x1080, 1366x768, etc...
  - Aspect ratio - 16:9, 16:10, etc...
- Audio settings
  - Adjust voice volume
  - Adjust music volume
  - Adjust Special Effects volume
-

## 6.0 Asset List

The Following is a list of assets that will be required for the game.

- The Visual style will be realistic, but “cartoonified”. Based heavily on Wii-Fit and Kinect Sports, both visually and aurally.
- 3 dimensional models will be required for all assets.
  - Character Models
  - Obstacle Models – See Obstacle Course game type
- A highlight animation for the manoeuvring game, this will be a beam of light emanating from the ground, flaring/changing colour as the player crosses the beam.
- A soundtrack, audio cues (for menu selection and objective completion).
- Environment models – trees and other plants, animals and other wildlife, Rocks, mountains, and so on.
- A player character (with a wheelchair) – this could be customisable, for example, using predefined models, or using a system similar to Nintendo’s Mii, or Microsoft’s Avatar systems.
- Models for objectives – location markers for the manoeuvring game, one for a completed objective, one for an unreached objective
- A “Personal Trainer” to provide advice and instruction for the arm exercises (an option for two, male and female). Whilst it would be ideal for this to be fully voiced character, training through demonstration is still a viable option.
- Voice-over for the Personal Trainer, and situational comments e.g. when the player has succeeded – for example “Good Job!” “Winner!” (More will be needed), or on selecting “start” on the main screen - “Start!”

## 7.0 Image Text

### 7.1`Start Screen

Think Wii-Fit or Kinect Sports with added wheelchair, this screen should feature the title and a start function, “Move Closer to start” being the direction given. The Background will show the various activities in the game – Weight training, manoeuvring, obstacle course etc...

### 7.2 Menu Screen

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### 7.3 Game Screen - Manoeuvring Game

This is a mock-up of the Manoeuvring game. The Game Screen will feature score and timing, and an image of the environment the Kinect can see. Over this will be placed the grid around which the player

will move. The Grey Diamond represents where the player is, and the gold diamond represents where the player has to move to.

## 7.4 Game Screen - Obstacle Course

The obstacle Course will be an infinite runner of sorts, but with 3 (or more) lanes to use, the player will be represented by a Wheel-Chair user and will orientate to the way the player is facing, the player will not be able to sit side on and roll backwards and forwards. Obstacles will come over the horizon, and will have to be avoided. There will also be various scenery items around, such as plant life, animals etc... and varying for different environments. The obstacles themselves will also be environment specific - an avalanche on a snow level, for example