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iManageCancer

*Empowering patients and strengthening
self-management in cancer diseases*

Research and Innovation Action

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citizen engagement and mHealth**

D7.3

Serious game for paediatric cancer integrated in the iManageCancer platform

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¹ **R** = Document, report (excluding the periodic and final reports), **DEM** = Demonstrator, pilot, prototype, plan designs

² **PU** = Public, fully open, e.g. web, **CO** = Confidential, restricted under conditions set out in Model Grant Agreement

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1. Executive summary

This deliverable describes the serious game for paediatric cancer patients that has been accomplished in T7.2. This demonstrator shows the fully working gameplay of the serious game for kids and demonstrates the motivational elements. This demonstrator is an essential part of the pilot for children (T9.2 in WP9).

2. Introduction

The serious game for kids is created for helping young patients to manage the impact of their disease on their psychological status. The young patients learn to focus their aggressions on their disease and not on parents, doctors, etc.. Social aspects are designed to give the patients support by their family and friends, and also by other patients. The game can be played over a longer period of time, so success can be measured with questionnaires which are part of the pilots in WP9.

The serious game for kids is realized as a classical shooter game (flying with a vessel from left to the right and shooting on obstacles and enemies) with strong social aspects, developed for mobile devices as smartphones and tablets.

The gamers fight as virtual characters virtual cancer cells with different weapons that represent the therapeutic clinical tools against cancer. In this way the message is given that weapons exist and that they can combat cancer if properly applied. Socialisation aspects are incorporated in the game to form team with co-players like parents, sisters and brothers, and friends - but also other cancer patients without this kind of relationship via the iManageCancer platform. Means are implemented in the game that support the assessment of its impact on the patients like playful answering of questions.

Parameters on the usage of the game and the results of gaming are stored in the patient's PHR. To achieve a maximum of accessibility, the demonstrator is realized on mobile hardware platforms. The cross-platform game engine Unity (www.unity3d.com) has been selected as the software development framework to rollout the game through a variety of operating system. All platform versions of the game are connected via the PHR system to make sure that all users can cooperate in the same user community. To achieve a maximum of acceptance, the game is designed to be highly attractive to the target audience. Defining attractiveness for a digital game includes multiple dimensions. Most important is an intuitive and easy-to-use user interface, a good introduction with tutorial elements, an immersive game design and an easy to identify additional value for the user.

The serious game for kids followed this original plan quite properly. Its concept and details of the implementation together with screenshots of the applications, graphical assets and artworks are presented in the following chapters of this deliverable.

The serious game for kids can be played in two modes, explorer (= patient) and supporter. The supporter mode is split into a mode for family and friend supporters, so that different tutorial introductions can be given.

The demonstrator already contains all elements of a fully working gameplay cycle. Nevertheless, more features are planned both to become a part of the pilot and for future exploitation.

One of these elements is an alternative supporter mode, a Match-3-game (like Candy Crush), which finds more acceptance by elderly people or people who don't like shooter games. Also there are plans to add functionality that improves the long-term motivation of the player:

- Three level of difficulty and more goals that than be reached within the game
- More types of extra weapons and shields to add more variety to the gameplay
- Different types of vessels that can be achieved for longterm playing

3. Summary of user scenario and requirements from D2.2 and D2.3

3.1. Workflow for parental use: preparation

The flow of operations for the preparation of the game for children (by the parent) consists of the following steps:

- 1) The user taps on a link from the iManageCancer platform or opens the app store from the mobile device directly
- 2) The user taps on the game in the appstore to download and install it for free.
- 3) The user starts the game by tapping on the game icon
- 4) The user is requested to register an account to the iMC platform or logging in with an existing account.
 - a) The user chooses to register: a browser window opens with the official platform registration screen.
 - b) The user chooses to login: He enters login and password. After this, the game sessions can be started without any visible login.
- 5) The user logs in to the iMC platform
- 6) The user selects the serious game for kids module
- 7) The user configures the use of the serious game for kids
- 8) The user gives the device to the child (the patient)

After this action, the game device is ready for playing. The game sessions can be started without any visible login, also without internet connection.

Transferring a game status to another device can be done by a similar procedure. As soon as the player is logged in on another device, all account-related game data becomes available.

The password of the app cannot be changed or edited without knowing the original password. This guarantees that the child can't do changes on its own as long as the parents do not want this.

3.2. Workflow for children's use

- a. The user sees the game title and logos
- 1) The user starts the app for the first time (does not appear when parents already logged in for the child)**
- a. The user has to register once to play the game
 - i. The user has to choose a unique nickname and an avatar picture
 - ii. The user has to indicate his email address and has to create a password
 - b. After that the user can login with his account (not necessary instantly after registration)
 - i. He can also leave the app over the "leave button"
 - c. The user has to choose a game mode: explorer/patient or supporter.

a) The user chooses the explorer mode, the first dashboard is shown

- i. The dashboard menu opens with several static and dynamic elements (these dynamic elements can be changed with a horizontal swipe gesture)
 - ii. Each dashboard page contains a header (not scrollable), content area (vertical scrollable) and a footer (not scrollable navigation dots)
 - iii. The user can swipe horizontal to go the next or previous dashboard page
 - iv. There are 6 Dashboards with the following dynamic elements available
 - a. Page 1 = Wall Posts (News)
 - b. Page 2 = Highscore
 - c. Page 3 = Inventory
 - d. Page 4 = Scrapbook
 - e. Page 5 = Supporter
 - f. Page 6 = Logout und Help
2. If the user taps on the avatar picture:
 - a. A submenu opens where an avatar picture can be selected from a choice of 10
 - b. The user selects an avatar picture
 - c. The user can also change his picture
 - d. The user can edit his name
 - e. The user can select a picture from his device to use it as avatar
 - f. A picture from the device will not show in the avatar list, only at the dashboard
 3. If the user taps on the mail button:
 - a. The main dashboard view appears. Here you can see all your latest messages
 - b. The user taps on a message
 - c. The message appears on the screen.
 - i. If the message includes a reward, the reward is added to the inventory
 - ii. If the message includes a new supporter, the player can add it to his supporter list.
 4. If the user taps on the Options button:
 - a. The main options menu appears. From here the default language and some game settings can be changed
 5. If the user views the wall posts screen:
 - a. New supporters are displayed
 - b. The user can view received gift boxes send by supporters
 - c. ... and opens them by tapping on it
 - d. The user sees if a supporter changed his/her name
 6. If the user views the highscore screen:
 - a. The game highscores appear
 7. If the user views the inventory screen:
 - a. The user can see a list of available special weapons and power-ups
 8. If the user views the supporter screen:
 - a. A list of all supporters which have supported the user at least one time
 - b. The user can change the supporter Avatar
 - c. The user deletes a supporter

- i. The supporter is deleted
- 9. If the user views the help screen:
 - a. The online help appears
 - b. And the IMC Platform Code
- 10. If the user views the scrapbook screen: (scheduled as a future enhancement)
 - a. The user can go to the arena, a location at the human brain where all explorers (each explorer by himself) can fight against a special boss cancer cell to receive an achievement which will be shown in the user's scrapbook
 - b. All special boss cancer cells the explorer killed in the arena will be stored in the scrapbook
 - c. The scrapbook contains 9 slots, so the explorer has to play at least 9 weeks to kill all special boss cancer cells
- 11. The user taps on the play button:
 - a. The level selection screen appears
 - b. The user selects a level
 - i. The extra selection screen appears
 - 1. The user selects one or more extras for using it in the level
 - 2. The user confirms the dialog and closes it
 - ii. The level starts
 - 1. The user controls the vessel with moving the finger over the screen
 - a. The vessel moves in any direction
 - 2. The user fires on the cancer cells with the fire button (automatically)
 - a. Missiles appear and hit the cancer cells
 - 3. The user selects extras
 - a. The extra (armour or weapon) becomes active
 - 4. The user selects the stop button
 - a. The level stops
 - 5. The user successfully navigates through the level and finally succeed the boss monster.
 - a. The level is won, the next level can be selected

d. The player chooses the supporter mode

- i. Select explorer mode: shows only up, when the user starts the app for the first time or when a supporter is no longer supporter of someone.
- ii. The user chooses the supporter mode, the first dashboard is shown:
 - 1. The dashboard menu opens with several static and dynamic elements (these dynamic elements can be changed with a swipe gesture)
 - 2. Each dashboard page contains a header (not scrollable), content are (vertical scrollable) and a footer (not scrollable navigation dots)
 - 3. The user can swipe horizontal to go the next or previous dashboard page
 - 4. There are 5 Dashboards with the following dynamic elements available

- a. Page 1 = Wall Posts (News)
 - b. Page 2 = Highscore
 - c. Page 3 = Inventory
 - d. Page 4 = Explorer
 - e. Page 5 = Help
5. If the user taps on the avatar picture:
 - a. A submenu opens where an avatar picture can be selected from a choice of 10
 - b. The user selects an avatar picture
 - c. The user can also change his picture
 - d. The user can edit his name
 - e. The user can select a picture from his/her device to use it as avatar
 - f. A picture from the device will not be shown in the avatar list, only on the dashboard
6. If the user taps on the mail button:
 - a. The main dashboard view appears. Here you can see all your latest messages
 - b. The user taps on a message
 - c. The message appears on the screen.
 - i. If the message includes a reward, the reward is added to the inventory
 - ii. If the message includes a new supporter, the player can add it to his supporter list.
7. If the user taps on the options button:
 - a. The main options menu appears. From here the default language and some game settings can be changed
8. If the user views the wall posts screen:
 - a. newsfeed is shown
 - b. Backings from the supporter are shown
 - c. If an explorer has cancelled the connection
 - d. Can view if the explorer changed his/her name
9. If the user views the highscore screen:
 - a. The shooter game highscore appears
 - b. The match tree game highscore appears
10. If the user views the inventory screen:
 - a. He can see a list of available special weapons and power-ups
11. If the user views the explorer screen:
 - a. A list with all supported explorers
 - b. The user can add an explorer
 - c. The user can delete an explorer
12. If the user views the help screen:
 - a. The online help appears
13. The user taps on the play button:
 - a. The level selection screen appears
 - b. The user selects the shooter game**
 - i. The extra selection screen appears
 1. The user selects an extra for using it in the level
 2. The user confirms the dialog and closes it
 - ii. The level starts

1. The user controls the vessel with the joystick field
 - a. The vessel moves in any direction
2. The user fires on the cancer cells with the fire button
 - a. Missiles appear and hit the cancer cells
3. The user selects extras
 - a. The extra (armour or weapon) becomes active
4. The user selects the stop button
 - a. The level stops
5. The user successfully navigates through the level and finally succeed the boss monster.
 - a. The level is won, the next level can be selected

e. The user closes the app with the back button on the device.

3.3. Use case overview

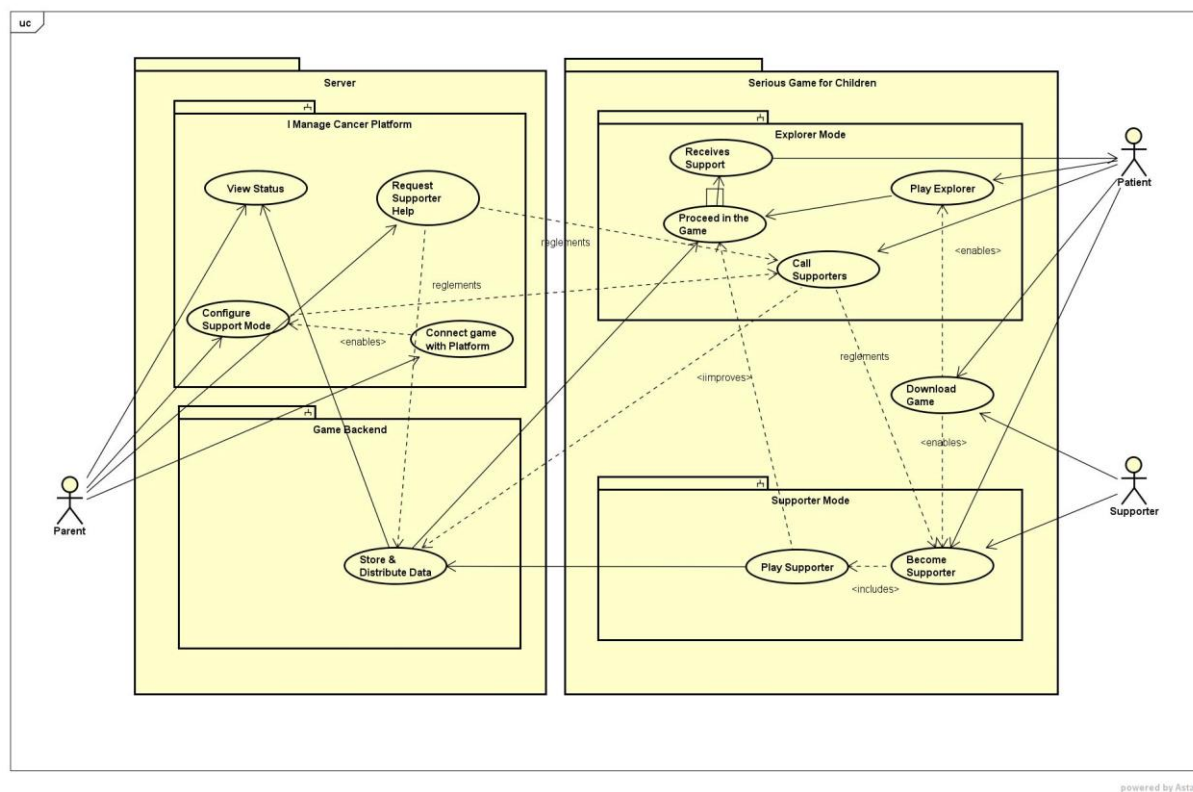


Figure 1: Use cases diagram of serious games for children.

Use Case ID	UC.SGC.1	Priority	REQUIRED
Use Case name	Playing Explorer and/or Supporter in the Serious Games for Children		
Scenarios	G1		

Actors	Patient, Supporter, Parents	
Brief description	Player plays the game to get psycho-emotional support from the game. Supporters improve that support.	
Trigger	Actor's demand	
Pre-conditions	<ul style="list-style-type: none"> • Patient has access to a mobile device (tablet, smartphone). • Patient has access to WIFI or directly to the internet 	
Post-conditions	-	
Successful end condition	<ul style="list-style-type: none"> • Patient gets support from the supporters and from the game mechanics itself. • Supporters give support to the patients (and become satisfied by this) 	
Fail end condition	<ul style="list-style-type: none"> • Patient doesn't play the game because they don't feel the psycho-emotional support 	
Relationships	Extends -	Include -
Basic flow: Patient	Step	Actions
	1	The patient downloads the game
	2	The parents of the patient connect the game to the platform (Registration + Login)
	3	The support mode configuration is written to the PHR
	4	The patient invites supporters
	5	The supporter status is written to the PHR
	6	Invited Supporters join the explorer
	7	Supporters support the explorer (the patient)
	8	The patient proceed in the game
	9	The patient gets psycho-emotional support from the game
Alternative Flow: Supporter	Step	Actions
	1	The supporter downloads the game
	2	The parents of the patient connect the game to the platform (Registration + Login)
	3	The supporter joins the explorer
	4	The supporter supports the explorer
	5	Support success is written to the PHR
	6	Game backend configures enhanced explorer game levels (based on supporter's success)
	7	The patient proceeds (faster) in the game
Alternative Flow: Mass support	8	The patients get psycho-emotional support from the game
	1	The patient downloads the game
	2	The parents of the patient connect the game to the platform (Registration + Login)
	3	The parents of the patient connect the game to the platform
	4	The parents mark a certain event in the PHR and call for mass support

	5	The support mode configuration is written to the PHR
	5	The patient confirms the mass call for supporters
	6	The supporter status is written to the PHR
	7	All supporters can join the explorer
	8	All supporters can support the explorer
	9	The patient proceeds very fast in the game
	10	The patients get strong psycho-emotional support from the game
Usage frequency	High	
User interfaces	Game App	
Notes and issues	-	

3.4. Definition of requirements

In the following the technical requirements are defined, which can be derived from the use cases of the scenario. All of these requirements are addressed.

Requirement ID	REQ.SGC.1	Priority	HIGH
Requirement name	Support of games distribution		
Type	FUNCTIONAL		
Use cases	UC.SGC.1		
Description	iManageCancer system should provide a link to distribution stores for the serious game for children. Stores should allow to download and install the game on mobile devices		

Requirement ID	REQ.SGC.2	Priority	MEDIUM
Requirement name	GUI for connecting and configuring the game		
Type	FUNCTIONAL		
Use cases	UC.SGC.1		
Description	iManageCancer system should provide a GUI for creating connections and configuring the game.		

Requirement ID	REQ.SGC.3	Priority	MEDIUM
Requirement name	iManageCancer system provides configuration details to the PHR		
Type	FUNCTIONAL		
Use cases	UC.SGC.1		
Description	iManageCancer system should send configuration details to the PHR		

Requirement ID	REQ.SGC.4	Priority	HIGH
Requirement name	iManageCancer system provides support results to the game for explorer user		
Type	FUNCTIONAL		
Use cases	UC.SGC.1		
Description	iManageCancer System should provide a mechanism to provide supporters results to the explorer via the backend		

Requirement ID	REQ.SGC.6	Priority	HIGH
Requirement name	Supporter Management for the explorer		
Type	FUNCTIONAL		
Use cases	UC.SGC.1		
Description	Game App should provide functionality for adding and removing supporters.		

Requirement ID	REQ.SGC.7	Priority	HIGH
Requirement name	Playing the explorer game		
Type	FUNCTIONAL		
Use cases	UC.SGC.1		
Description	Game App should provide functionality for playing the explorer game		

Requirement ID	REQ.SGC.8	Priority	HIGH
Requirement name	Immersive gameplay		
Type	NON-FUNCTIONAL		
Use cases	UC.SGC.1		
Description	Gameplay of the app should be immersive and capable of supporting the player's cure process and configure his mind-set in a supporting way.		

Requirement ID	REQ.SGC.9	Priority	HIGH
Requirement name	Explorer Management for the Supporter		
Type	FUNCTIONAL		
Use cases	UC.SGC.1		

Description	Game App (explorer mode) should provide functionality for selecting explorers, and start playing for them.
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Requirement ID	REQ.SGC.10	Priority	HIGH
Requirement name	Playing the supporter game		
Type	FUNCTIONAL		
Use cases	UC.SGC.1		
Description	Game App should provide functionality for playing the supporter games		

Requirement ID	REQ.SGC.11	Priority	HIGH
Requirement name	Immersive gameplay of the supporter game		
Type	NON-FUNCTIONAL		
Use cases	UC.SGC.1		
Description	Gameplay (supporter mode) of the App should be immersive and give the impression to the supporter that he helps the explorer.		

4. Technical implementation

4.1. System concept

The “serious game for kids” is played on mobile devices as smartphones and tables. Supported are newer devices which allow 3d graphics.

The game for kids also is connected to a game backend in the internet. This server is responsible for all the data transfer between explorers and supporters, and all account interaction. The game backend does not contain the account database, its just an interlink to the PHR, the Personal Health Record.

All account information is stored in the PHR DB. From there you can choose several options, which are made for parents to control the app (like “enabling/disabling supporters” and more).

The game backend transfers all relevant in-game events to the audit trail.

A static connection to the internet is not necessary while using the app, it’s only mandatory for registration and the first login. Of course, the use of the social features needs an internet connect too. But the use case is defined in a way that the child takes the smartphone to the hospital and has only limited access to WIFI or Internet. To make social features possible under this circumstances, the social interaction is buffered whenever a device cannot connect to the internet. As soon as a connection can be established, data is uploaded and downloaded.

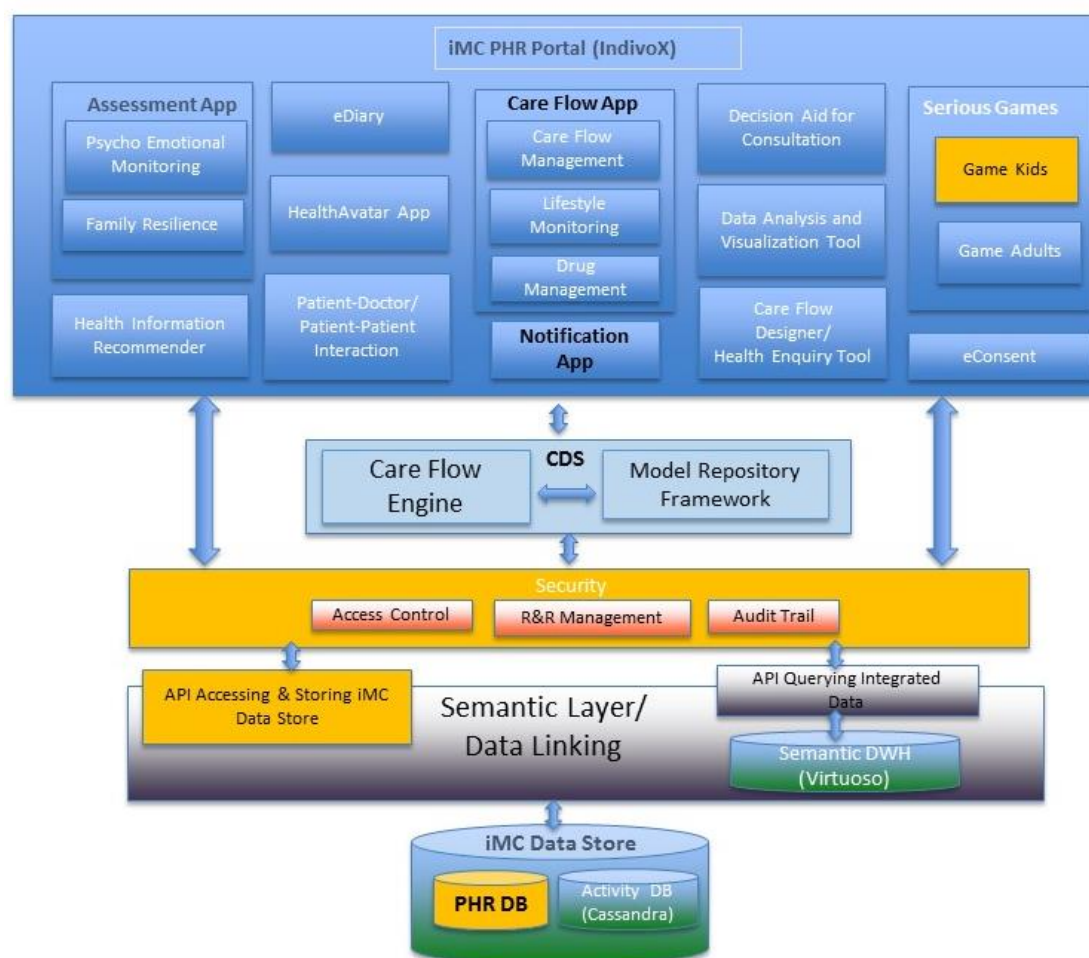


Figure 2: The serious game for kids in the whole platform architecture

4.2. Serious game for kids from player's perspective

The serious game for kids is an essential part of the iManageCancer platform, but it is a separate app which can be, once it's published, downloaded from the app stores from Google or Apple. The game cannot be started without registration and/or login to the iManageCancer platform, because it contains several social aspects which are handled via the PHR.

So the first essential step after starting the app is following the registration process (or logging in when registration is already done before). After this first attempt, the player doesn't need to login visible, because the game always does that in the background after each start of the app.

4.2.1. Choose the game mode

There's one central decision in the game which has to be done as a first step in the game: Choosing if you are an explorer (= patient, the child with cancer) or a supporter. The supporter decision is divided into relatives and friends (other children with cancer who play for their friends in hospital will choose the 'friends' mode). The main difference between these two supporter modes is the text introduction, because relatives needs more explanation and a clearer idea what the game is good for.

For the design of this central menu we defined several requirements:

- It should make clear, that the explorer/patient mode is reserved for children with cancer. This is why we write clearly "I'm a patient"
- It should make clear that everyone could be a supporter (the differentiation between relatives and friends is just made for a better introduction of different player types).
- It should show a very positive attitude and give the player confidence for the battle.
- It should be highly attractive, especially for the parents and the younger children. This is why we chosen a style which is close to the style of actual animation movies.
- It should inspire the player to start the game, so it has to be highly attractive.

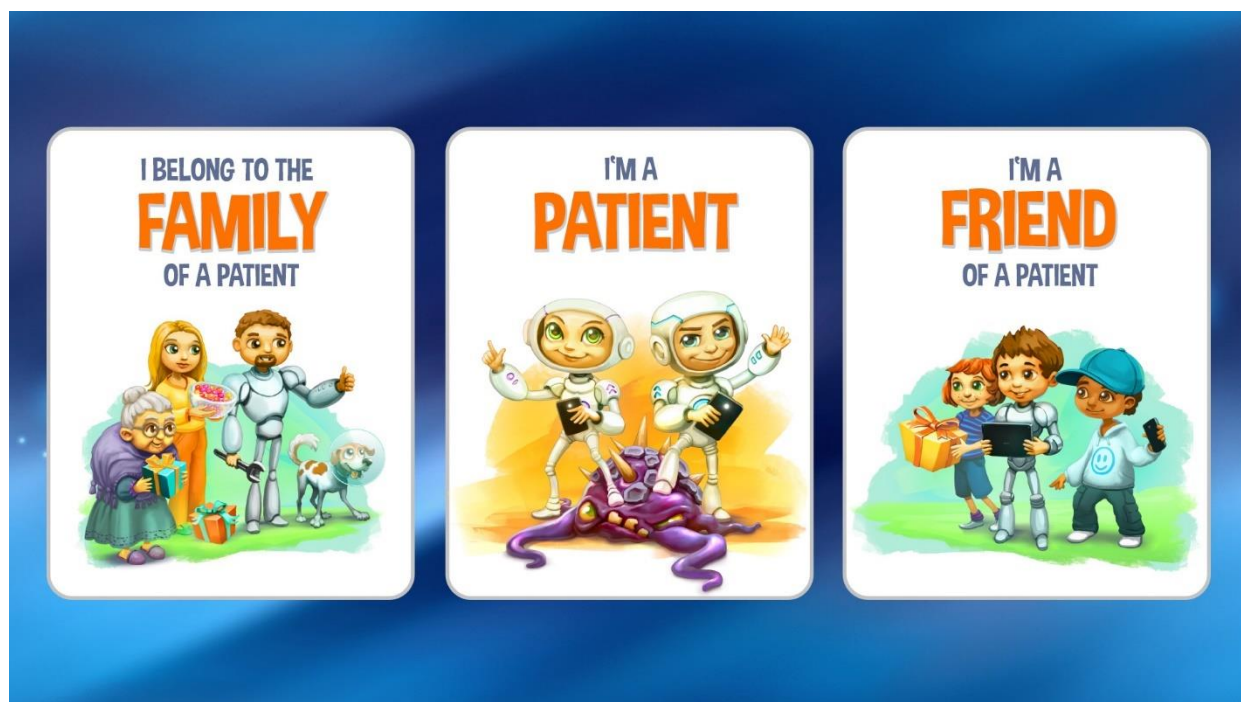
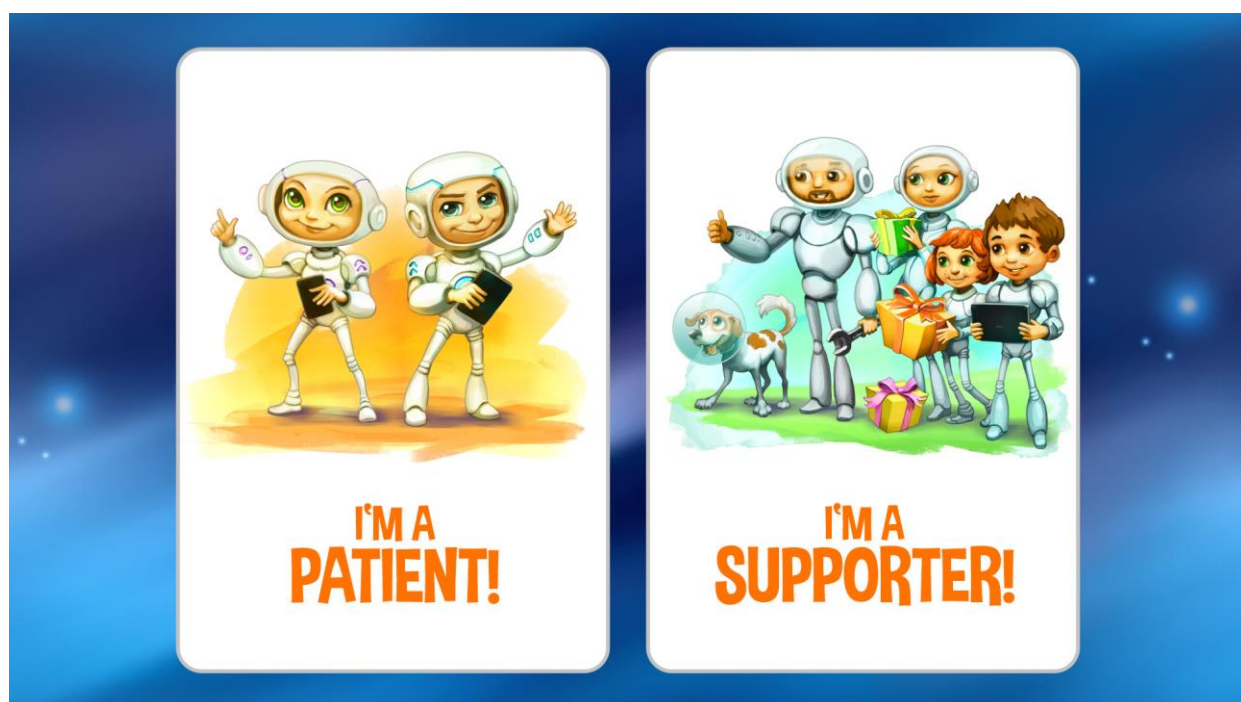


Figure 3: Selecting a game mode



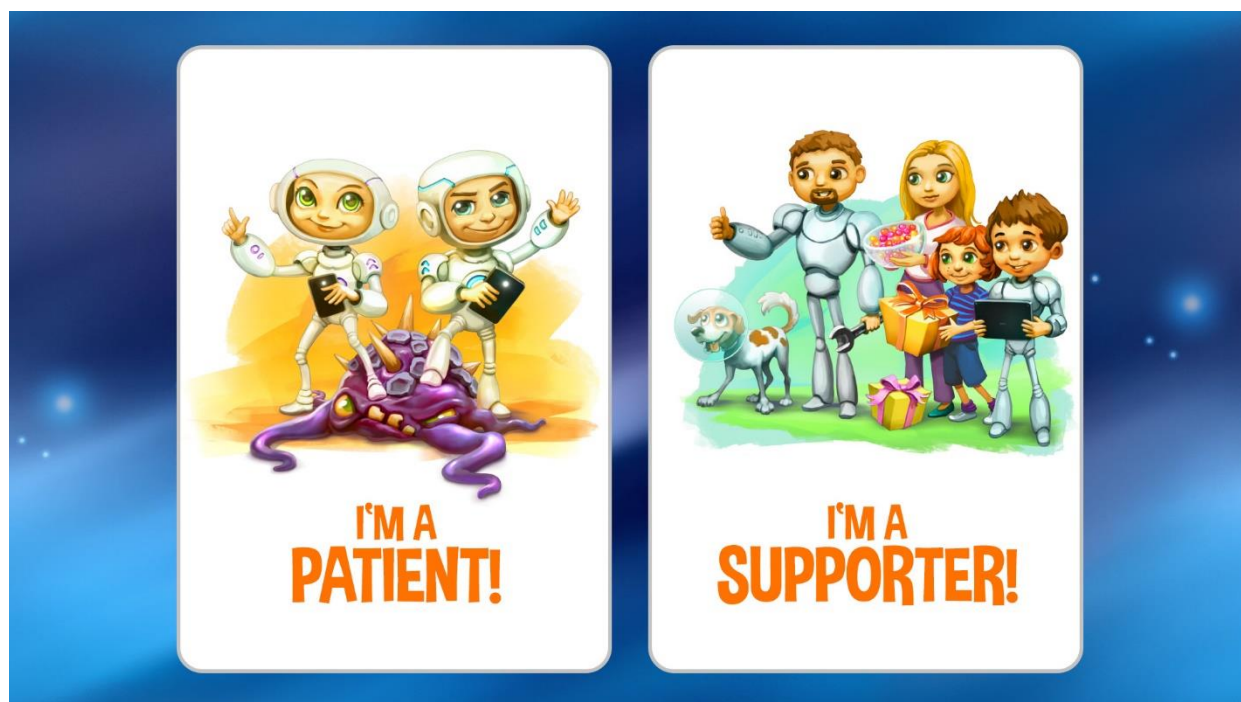


Figure 4 +5 +6: Example for an iterative design process: Earlier versions of the menu

4.2.2. Wallpost dashboard

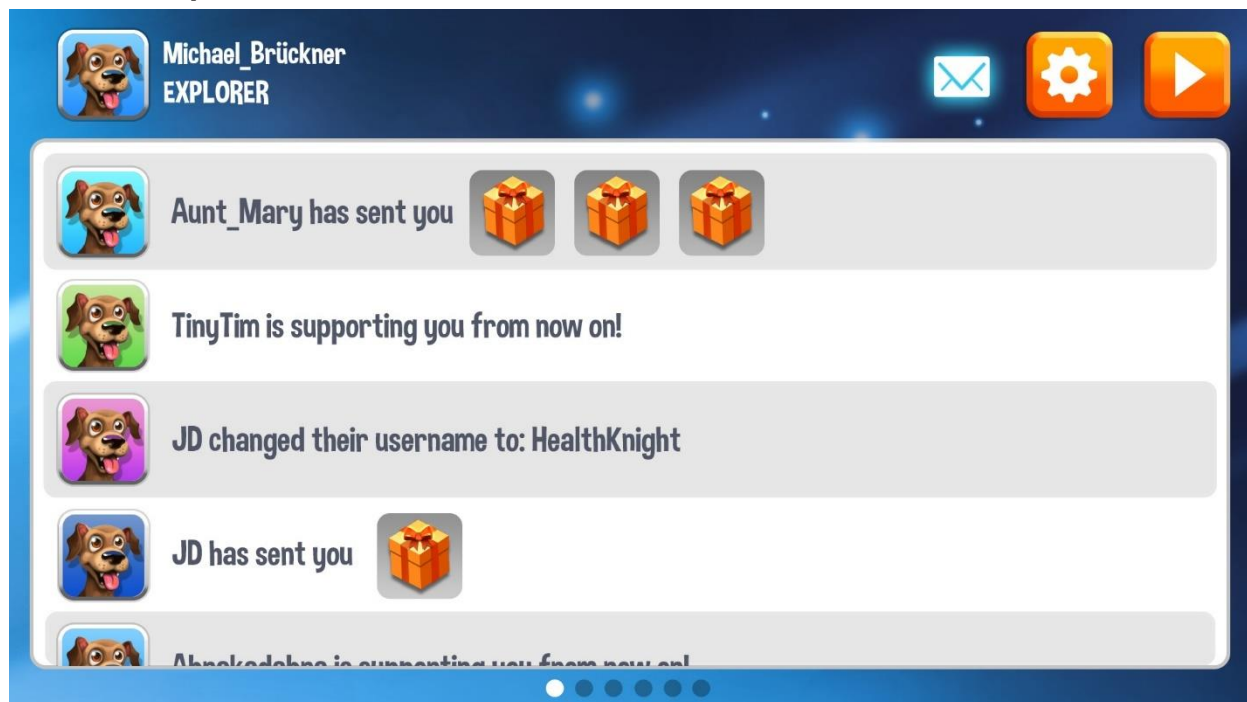


Figure 7: Wallposts with information from the supporters

For the design of this central menu we defined several requirements:

Design

- Background is blue (in all of the Dashboard screens), because blue correspond to the style and colour of the submarine and forms a perfect contrast to the dangerous red cancer cells, obstacles and so on. Furthermore, red is the in-game colour and logically it stands for blood. There are not many parts of the body that are blue, so this colour wasn't occupied and gives a good contrast.
- Supporters and Patients choose from predefined avatar pictures. The pictures show funny animals in comic style, because kids should choose something they love (cat, dog...). That's the reason why there are no pictures which are relatable to a specific gender. We only allow predefined Avatar-pictures, because user-defined pictures could be a possible way to send "messages" from supporter to explorer, which may are not appropriate. Finally, there's no direct communication in the game, no text, no pictures that can be self-designed, no voice etc.. Any direct communication has to be done via other communication channels, e.g. What's App. The only communication ingame is via the giftboxes.
- A supporter can send giftboxes likes special weapon icons and/or power-ups. The giftboxes look like presents because of its universal content and to arouse the kid's curiosity. Moreover, giftboxes will be send by grandma's and mother's. A present builds up a positive association. (a special weapon may does this not)

Giftboxes works as described here:

- The user can tap on each of the gift boxes to open it
- The screen will be greyed out and the according gift box appears and get opened with an animation

- The content (special weapon icons and/or power-ups) of the box appears with an animation
- A "Close"-button shows up at the end of the last animation
- The user must tap on the "close"-button to close the view and to return to the dashboard with the wall posts
- The gift box will be replaced by its content
- Multiple content of the same type will be merged (e. g. 2x special weapon X from box A and 2x special weapon X from box B = 4x special weapon X) to save space

4.2.3. Selecting a level

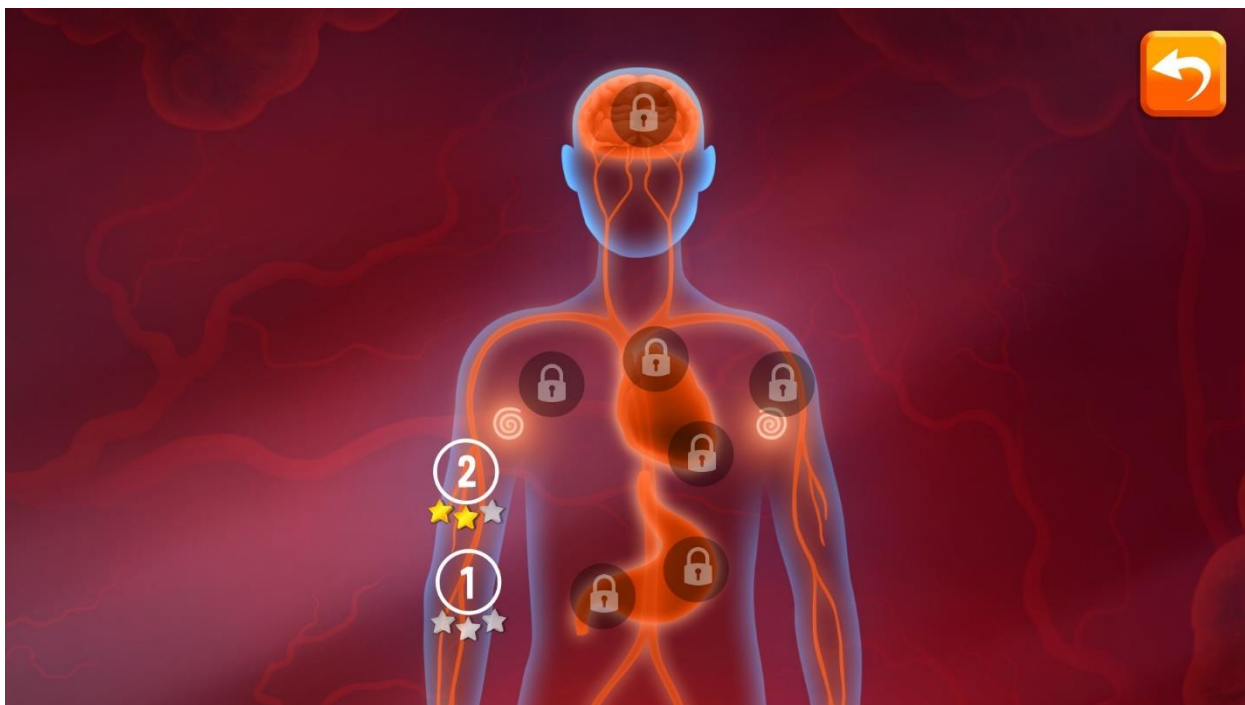


Figure 8: Selecting a level

Design

- An x-ray image of a human (unisex) body is used as level map (screen is vertical scrollable)
- The figure has a unisex design, because players can be male or female.
- Only the organs of the according locations are visualized
- The user can select any unlocked level at the level map for playing
- An unlocked level is displayed as a white circle with the level number on it
- A locked level is displayed as a red circle with the level number on it and an additional security lock
- Only level one is unlocked at the beginning
- The user must finish a level successfully to unlock the next level
- The maximum number of levels is nine
- The levels appear at 5 points of the human body (points where cancer can be located):
 - Capillary Vessels
 - Stomach

- Sweat Glands (future enhancement)
- Heart (future enhancement)
- Brain (future enhancement)

Level Number	Assigned Location inside the Human Body
1	Capillary Vessels
2	Capillary Vessels
3	Stomach
4	Stomach
5	Sweat Glands
6	Sweat Glands
7	Heart
8	Heart
9	Brain

4.2.4. Extra inventory

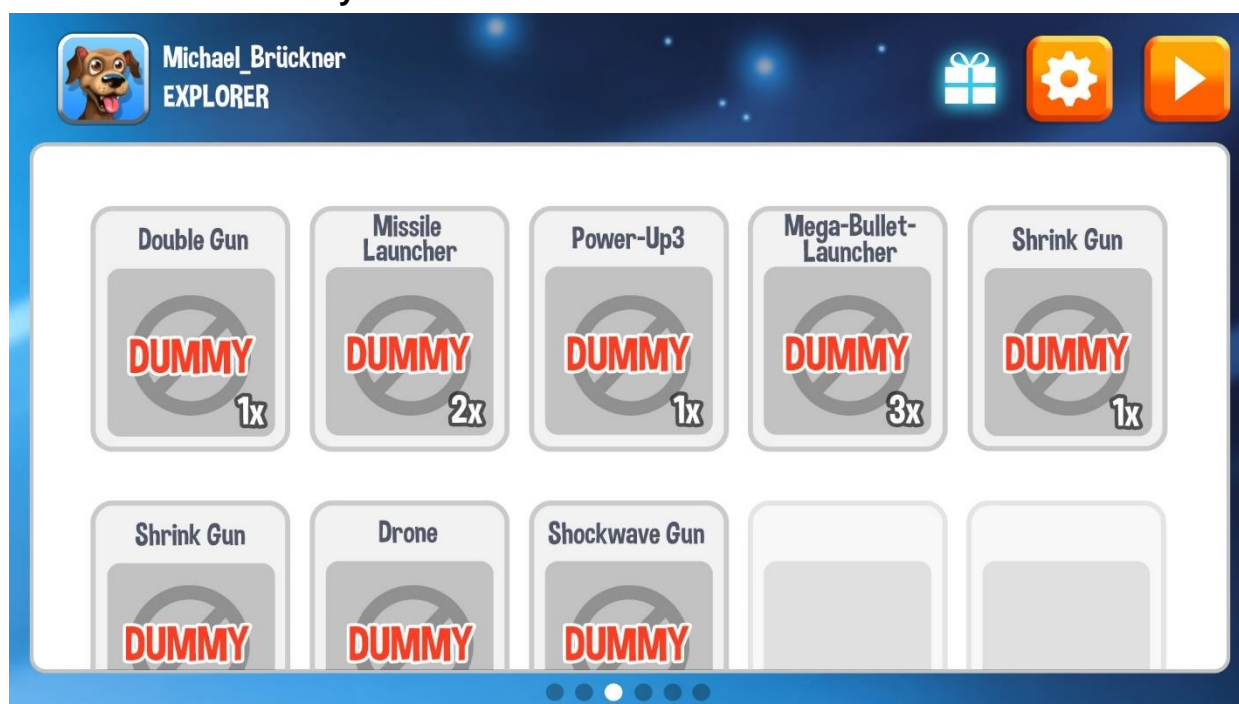


Figure 9: List of collected extras in the player's inventory

Extras can be collected by the player or send to him by supporters. The extras can be gift boxes containing special ammo and/or power-ups

- There are five different types of gift boxes in the game which differ in design and size
- The supporter can collect gift boxes in the shooter game

- Collected gift boxes will automatically send to the selected explorer when an internet connection is available (otherwise they are stored locally until an internet connection is available again)
- The explorer can only collect gift boxes in the shooter game if he has not at least one active supporter
- A supporter will be listed as active if he supplies an explorer with a minimum number of gift boxes per week that could contain special weapons and/or power-ups
- Sent gift boxes appear as wall post at the dashboard of the selected explorer

4.2.5. Selecting extras



Figure 10: Selecting an extra weapon or armour

In this menu, the player specifically chooses those weapons and armour he/she will need to fight against specific cancer cells in the different levels of the game.

The design of this menu looks like a high technology repair and assembling shop.

According to that:

- The number of special weapons is limited
- The user can shoot with the standard weapon or a special weapon
- The user can have different kinds of special weapons in the inventory
- The user can change the weapon at any time in a level if a special weapon is available
- The standard weapon retracts and the selected special weapon appears
- The special weapon disappears and the standard weapon appears automatically again if the ammo of the active special weapon is empty

Overview of special weapons that will be available in the game:

- Cryogun: Icy blue energy balls (/snow balls/icicles maybe with snowflake particle effect) that damage cancer cells as well as freezing them in place for 3 seconds.
- Cryosurgery uses a liquid nitrogen spray or a very cold probe to freeze and kill abnormal cells.

- Nanoshells: Player shoots small, grenade-like projectiles that explode on collision damaging the cancer cell and other cancer cells within a specific radius. Nanoshells are being used in the laboratory to thermally destroy tumors from the inside. Scientists apply near-infrared light that is absorbed by the nanoshells, creating an intense heat inside the tumor that selectively kills tumor cells without disturbing neighboring healthy cells.

4.2.6. Scrapbook

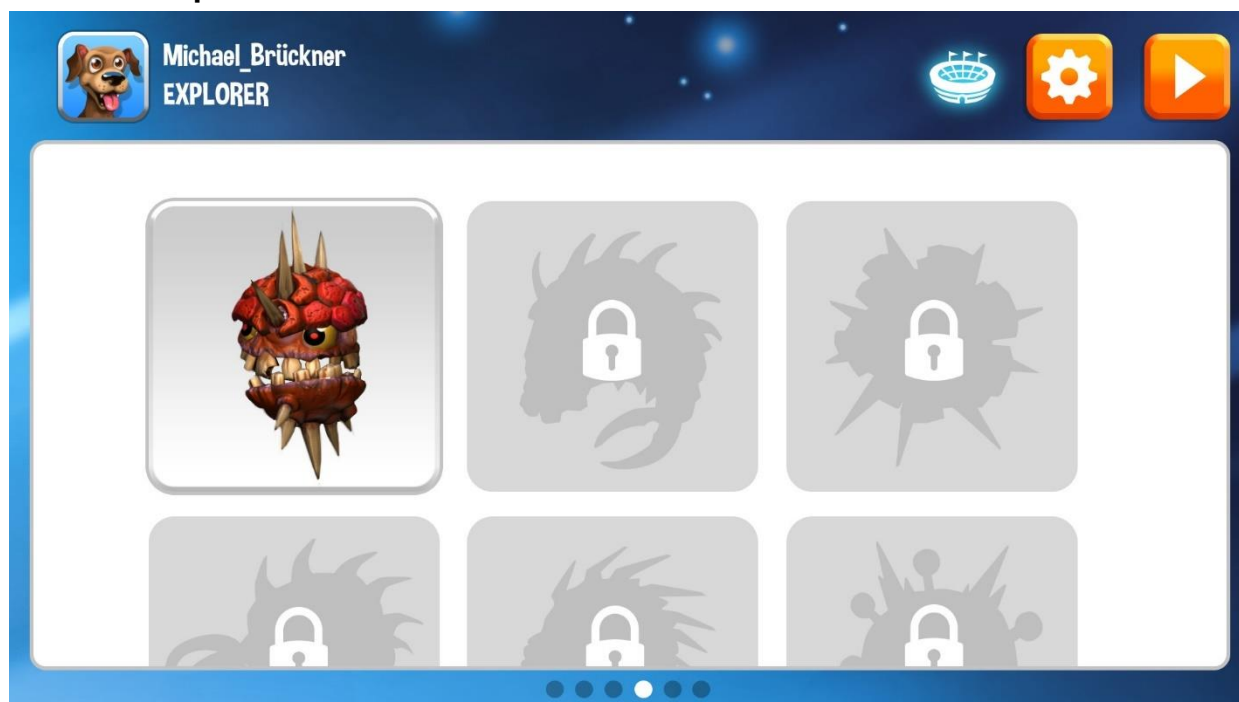


Figure 11: The scrapbook shows all gladiator cells you already fought

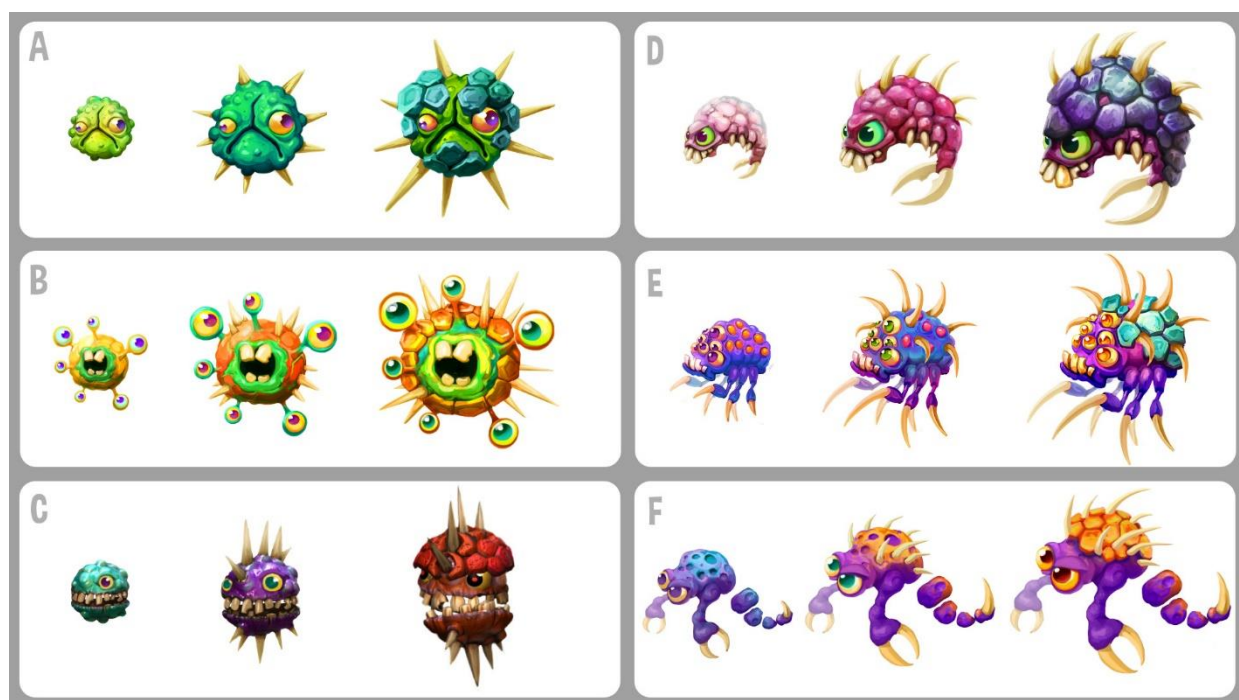


Figure 12: Cancer Cell Overview (2d versions)

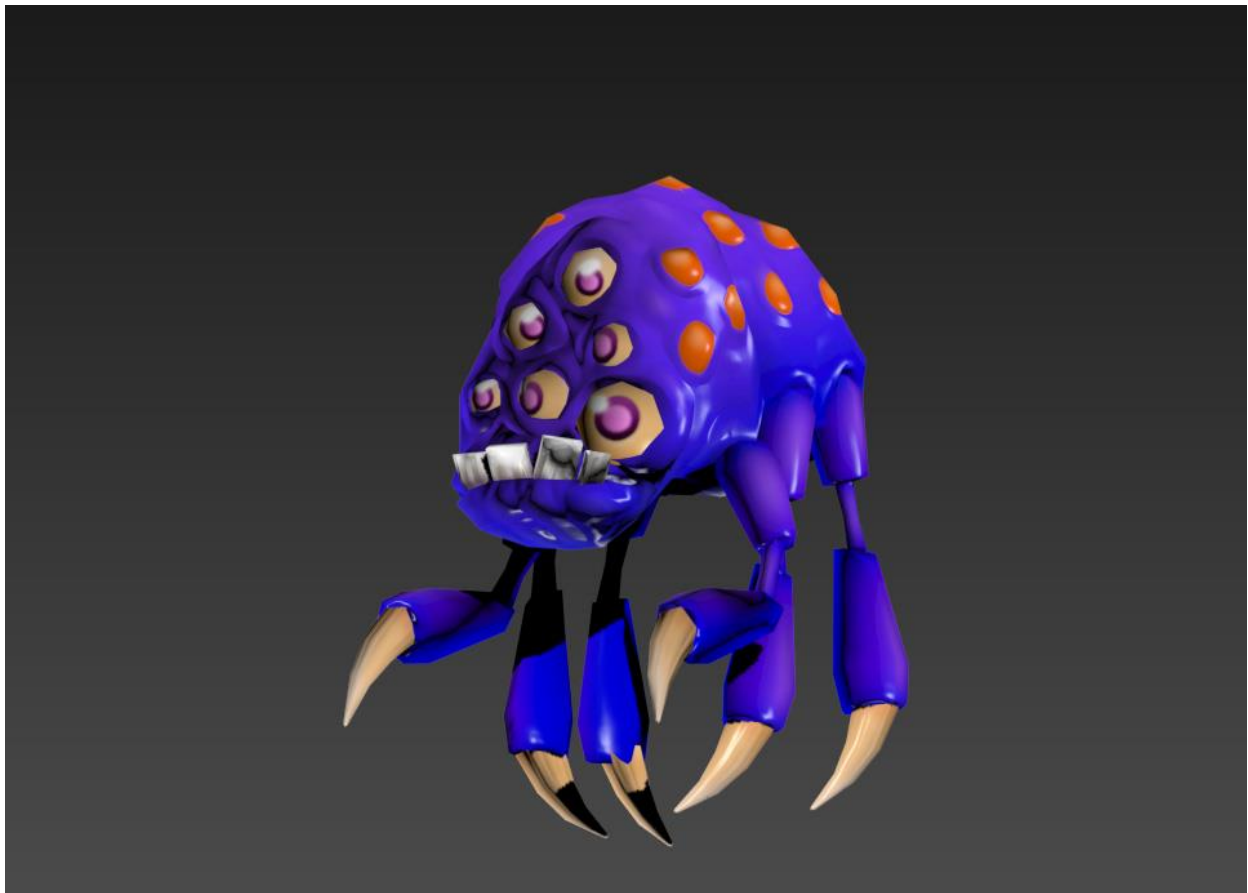








Figure 12 - 19: Series of 3d cancer cells in the variants basic and boss enemy

Cancer Cells look spooky, but in a way, that do not cause the kids to be frightened. Have been designed in comic-style with eyes, teeth, so the look spooky and funny at the same time.

Every Design in the Game has a relation to the real world of the patient. So, the cancer cells have tentacles, humps, etc.

There are three types of difficulties of cancer cells and nine types for every difficulty:

Standard Cancer Cells

- The game contains nine different types of standard cancer cells
- The boss and gladiator cancer cells base on these nine meshes
- The standard cancer cells differ in the design, animations, move speed, size, power and if they can shoot or not
- Each of the nine standard cancer cells has a value from one to nine which defines its degree of difficulty related on the above listed parameters (formula need to be created)
- The degree of difficulty defines also the score when they got killed as well as which kind of gift box they can drop

Boss Cancer Cell

- The game contains nine different boss cancer cells
- The boss cancer cells base on the standard cancer cell meshes
- The boss cancer cells meshes are made out of separately body parts which have to be destroyed one by one by the user
- The body parts will be destroyed in a fix order independent where the cancer cell is hit by the user
- The boss cancer cells are at least twice as big as the standard cancer cells
- A boss cancer cell appears only at the end of the assigned level nowhere else
- The boss cancer cells differ in the design, animations, move speed, size and power
- Each of the nine boss cancer cells has a value from one to nine which defines it's degree of difficulty related on the above listed parameters (formula need to be created)
- The degree of difficulty defines later also the score when they got killed as well as which kind of gift box they can drop
- The degree of difficulty defines the level in which the boss cancer cell will appear

Gladiator Cancer Cells (Explorer Mode Only)

- The game contains nine different gladiator cancer cells
- The gladiator cancer cells base on the boss cancer cell meshes
- The gladiator cancer cell meshes are made out of separately body parts which have to be destroyed one by one by the user
- Each gladiator cancer cell is wearing an armor (e. g. like a big helmet or metal plates)
- The gladiator cancer cell has a similar size like the boss cancer cells

- The body parts will be destroyed in a fix order independent where the cancer cell is hit by the user
- A gladiator cancer cell appears only in the arena which is only available in the explorer mode
- Each gladiator cancer cell is assigned to a fix slot in the scrapbook
- Each of the nine gladiator cancer cells has a value from one to nine which defines it's degree of difficulty

4.2.7. High score menu

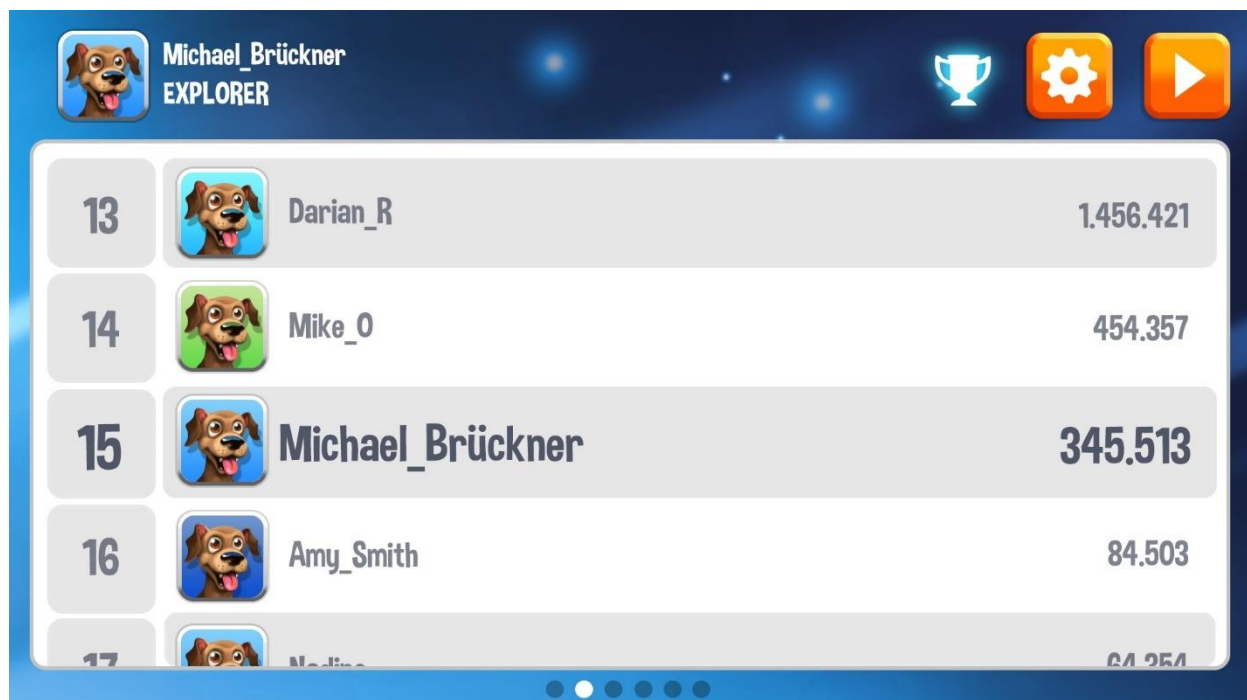


Figure 20: The highscore screen

- There's a highscore screen in the game, because it motivates players to play, and allows them to compare to other players.
- Each of the two game modes (explorer and supporter) has its own global highscore list
- A user can only see the highscore list of his/her selected game mode
- The highscore will be the result of all highscores in each of the nine level
- Each user has a local copy of the global highscore list on his/her device to access it even when he/she is offline
- The local copy of the global highscore list will be updated automatically every time when opening the app and if there is an internet connection available
- The user results will also be updated at this time and also every time the user got a new highscore (this requires also an internet connection)
- If there is no internet connection available, all new highscore data will be stored on the local device of the user until an internet connection is available again
- Layout of an entry in the highscore list:
 - [Ranking] [Avatar Image] [Player Name] [Score]

- The position of the user will be highlighted and the list scrolls automatically to the position of the entry every time the user opens the according page in the dashboard

4.3. General information about the shooter level design



Figure 21: Playing the game itself

Number of Levels

- The shooter game contains four level
- Each level can be finished with one, two or three stars. The better you play, the more stars you get. It's very hard to get 3 stars, but collecting extra weapons helps a lot.

Level Construction

- All levels will be prebuild by level designers, not generated by algorithms
- The level design will not change in the game
- The level construction includes the following tasks:
 - Background assembling (layer, tiling)
 - Obstacles placement (fix and moving)
 - Spawn points placement (cancer cells and collectables including the type definition)
 - Testing on target devices (degree of difficulty, layout, fun factor)

Game Objects

- Title Set (background images, obstacles)
- Cancer Cells
- Submarine
- Gift boxes
- Special weapons

- Tokens (special weapons & power-ups)
- HUD

Restrictions

- The maximum number of standard cancer cells at the screen is limited to eight

Camera

- Perspective: third person side view
- Move direction: left -> right
- The camera perspective does not change in the game
- The move direction of the camera does not change in the game
- The camera scroll speed changes only the user activated a turbo booster

Level Size

- The playtime for each level should be around 3 minutes (plus the fight with the boss cancer cell)

Background

- The background of a level consists out of three layers
- The layers follow the camera at a different speed to create "depth" (parallax scrolling)
- The background layers have no physics

Midground - the midground contains the following game elements:

- Submarine
- Obstacles
- Cancer cells
- Collectables (gift boxes, special weapon and power-up tokens, energy packs)
- Friendly and enemy fire

Foreground

- The foreground contains game elements which block the view on everything behind it (e. g. blood cells, nerves...)

The Submarine is designed deliberations:

- It's a submarine because it dives through the blood veins and so on of the body
- The submarine is metallic because it is not part of the body. It makes clear that the player makes a journey through his body
- The submarine is created in 3D
- All users will have the same basic submarine
- Special ammo will be fired with special weapons which will appear as add-on at the submarine while activated
- The submarine will explode when the shield energy is smaller or equal to zero

5. Conclusions

A fully functional demonstrator of a serious game for kids has been accomplished. It is based on the PHR and the user management of the iMC platform. The demonstrator shows all core gameplay characteristics of the game. The demonstrator also matches all technical requirements of the pilot for kids in iManageCancer (Task 9.2), like ingame questionnaires and an activity log/audit trail that is stored on the iphr.care platform. The development of the demonstrator will proceed with more social features, another game variant especially for elderly players (called “Match Three”) and more game content for a more longtime appealing game.

Appendix

6.1 Tile sets

Each Leveltype (Capillary Vessels, Stomach Sweat Glands, Heart, Brain) has a special tile set and includes props and obstacles.

They give the player a **stylistic sense where** he is located in the body

The following descriptions are examples for Level one

- Tile
 - Located: Background
 - Consists of:
 - Blood (transparent fluid)
 - Capillary vessels
 - Dead tissue
- Props
 - Located in mid- and background
 - All props will be created in 3D
 - These game objects can't collide with the submarine
 - These game objects are used as "decoration" or to cover cancer cells or the submarine when they are placed in the foreground layer
 - Props can collide only with other props at the same layer
 - Props can also be used as obstacles
 - Props are:
 - Red Blood Cell
 - Located: Back- and foreground
 - Moves from right to the left (speed will be defined randomly within a given minimum and maximum speed values)
 - Can collide only with other blood cells
 - Covers cancer cells or the submarine when they are placed in the foreground layer
 - White Blood Cell
 - Located: Back- and foreground
 - Moves from right to the left (speed will be defined randomly within a given minimum and maximum speed values)
 - Can collide only with other blood cells
 - Covers cancer cells or the submarine when they are placed in the foreground layer
 - Spidery Vein Branches
 - Located: Back- and foreground
 - Remains on a fixed position (defined by the level designer)
 - Covers cancer cells or the submarine when they are placed in the foreground layer
- Obstacles
 - All types of obstacles will be placed by the level designer
 - Obstacles are:

- Antibody
 - The antibody will be stick to the submarine for five seconds (up to three antibodies can stick at the submarine at the same time).
 - This will slow down the submarine during this time by 20% by each antibody.
 - Real World Relationship:
 - Antibodies attack foreign bodies, so also the submarine like in the movie
- Cholesterol
 - The submarine will be reflected from the cholesterol.
- Dead Red Blood Cell
 - The submarine slows down by 50% for one second when it collides with a dead red blood cell. The dead red blood cell shatters and the remaining parts of the dead red blood cells fade out.
- Macrophages
 - The spike becomes broken, the broken parts moves away and fades out. The submarine slows down to 60% of its original speed. The energy shield loses 20HP.
 - Real World Relationship:
 - Macrophages are a type of white blood cell that engulfs and digests cellular debris, foreign substances, microbes, cancer cells, and anything else that does not have the types of proteins specific of healthy body cells on its surface. So it is plausible it damages the player on contact.



Figure 22: Tile set, props an obstacles Level 1 and 2 – Capillary Vessels