D4.1.3

UPDATED SCENARIOS CORRESPONDING TO EVALUATIONS IN D7.6.2

January 2015

ABSTRACT

This document gives updated scenarios for the "Pervasive Game Platform", as they are evaluated in D7.6.2

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	Marcel Lancelle, ETHZ
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EXECUTIVE SUMMARY

This document updates the "Pervasive Game Platform" reference applications that are evaluated in D7.6.2. It shall be understood as a companion to the later. It refines scenarios described in D4.1 and D4.1.2.

LIST OF AUTHORS

Organisation	Author
Disney Research Zurich	Stéphane Magnenat
ETH	Marcel Lancelle, Fabio Zünd
Disney BLRK	Kenny Mitchell
DNet	Boris Pokric

TABLE OF CONTENTS

ABBREVIATIONS

AR	Augmented Reality
CG	Computer Graphics
FI	Future Internet
FI-PPP	Future Internet – Public Private Partnership
GPS	Global Positioning System
GPU	Graphics Processing Unit
HCI	Human Computer Interaction
iOS	Apple iDevice Operating System
LED	Light Emitting Diode
POI	Point of Interest
SE	Specific Enabler
SLAM	Simultaneous Localization and Mapping
XML3D	Three Dimensional Extensible Markup Language
TTS	Text To Speech
FA-TTS	Flexible and Adaptive Text To Speech
Saas	Software as a Service

1 - INTRODUCTION

This document updates the description of the "Pervasive Game Platform" reference applications that are evaluated in D7.6.2. It shall be understood as a companion to the later. It refines scenarios described in D4.1 and D4.1.2. As its sole goal is to make sure that readers of D7.6.2 have a clear understanding of the precise scenarios being evaluated, it only lists these ones.

1.1 - Terminology

The following terminology is used:

Enabler: Software module or web service providing well-specified functionalities, accessible and usable by application developers through clearly described APIs (Application Programming Interfaces).

Generic Enabler (GE): An enabler realized by the FI-WARE project or its follow-up sustainability project.

Specific Enabler (SE): An enabler realized by the FI-CONTENT 2 project. Specific Enablers may be layered on top of, or otherwise make use of, Generic Enablers. Please refer to the definition of a FI-CONTENT 2 SE from Deliverable D6.1 Architecture specification.

Platform: A comprehensive combination of technology infrastructure and Generic and Specific Enablers capable of hosting and supporting development of application software.

Application or **Application software**: Software layered on top of one or several platforms for realizing tasks for end-users.

Scenario: Description of foreseeable interactions of users with one or several applications.

Experiment or **Experimentation**: Concrete test with actual users of one scenario in one of the experimentation sites within a given time frame.

Functional requirement: Either calculations, technical details, data manipulation, processing or other specific functionality that define what a system is intended to accomplish.

2 - TABLETOP AR GAMES

Figure 1: Augmented Resistance

Figure 2: Live Inspector

FI content

Tabletop Augmented Reality Games (Augmented Resistance, AR Travelers and Live Inspector)		
Category/topic/context	Tier 1 – Digital Consumer Products	
Owner(s)/contacts	Stéphane Magnenat, Mattia Ryffel, Chino Noris, Kenny Mitchell	
Abstract	In this scenario, we consider the augmentation of traditional board games with the help of mobile devices. AR Tracking is used to situate the device with respect to the board. Real objects are mixed with virtual ones. For example, a light-probe system is used to capture the light of the environment, and uses it to illuminate the virtual content, obtaining a better matching of the virtual elements to the real ones. Or a physical robot is programmed through augmented reality.	
Detailed description	This scenario is part of tier 1, which targets augmented-reality games based on toys, fashion, and other physical products. These games use part of the physical product as a known and structured environment (level), which is populated with virtual elements displayed on a handheld device. This tier includes a limited number of networked uses. When two or more players are physically located at the same place, they can play over local network. The physical toy or board is shared and acts common base to localize all players. Each player has a unique view of the game, based on where they are located as well as what role they have in the game, which may influence what information they have access to. Alternatively, a leaderboard system is used for player to compete at the level of points collected in the game. In this case, the smart phone device communicates the outcome of a play to a server, and the server stores the result associated with a unique ID of the player. Finally, this scenario also explores rich user-generated content, for instance by allowing users to program the behaviour of an educational robot through augmented reality.	
Justification for inclusion of scenario	Audience/cultural criteria	The target audience for Toys and Board games includes children and teenagers. The maturity and complexity of the virtual content can be tailored to appeal to a wide range of users, accounting for various age groups. Adults may be involved in their children's game and play more complex roles, or assume the role of teachers in the case of agent programming.
	Commercial criteria	This scenario builds on top of the existing business of tabletop games and toys (for instance an education robot), and adds the aspect of apps for the mobile devices. Different models can be considered, where the mobile app and its content can be sold or redeemed through a physical token sold within the physical toy box. New content can be sold separately in the future, to keep the game up to date.

Tabletop Augmented Reality Games (Augmented Resistance, AR Travelers and Live Inspector)

	Academic criteria	This scenario demonstrates: • A new level visual quality for augmented reality games and serves as an example of advanced video game content for further research. • The understanding the critical elements to achieve a smooth and interesting gameplay in such a setup. • A new level of user involvement through the allowing rich user-generated content, for instance agent behavioural programs.

Planned experimentation

	Experimentation site(s)	Zurich
	Estimated schedule	Several instances developed and deployed, in particular Augmented Resistance (AR tower defence), AR Travelers (multiplayer AR shooting) and Live Inspector (educational robot programming), latest study results available in M22.
	Maturity of implementation	Production ready
	Content, provider, availability	Provided by DRZ, ETH and BLRK • Augmented Resistance, AR Travelers: available to partners • Live Inspector: available on github

Functional requirements and their candidate enablers

Functional requirement	Candidate enabler	GE/SE/Gap
Low-latency Context Aware Rendering	Reality Mixer – Reflection Mapping	SE
Synchronization of the Game World for Multiplayer	Game Synchronization	SE
User created content	Visual Agent Design	SE
User Authentication	Identity Management	GE
Competitive and Collaborative Ranking	Leaderboard	SE
	Socio-Aware Ranking	Gap

Performance requirements

Type	Requirements
Hardware	Recent handheld device with powerful processor, good camera, GPS, gyroscopes and accelerometers. An autonomous mobile robot (Live Inspector)
Software	• Fast (~50Hz) object recognition of known objects. • Fast lighting estimation (50 Hz). • Real-time (30Hz) rendering • Leaderboard system on server to cope with dozens of users
Miscellaneous	**Network:** A bandwidth of 1 Mbps is required

3 - CREATING SLAM-BASED AR GAME USING WEB CREATOR TOOL

Creating SLAM-based AR Game using Web Creator Tool (ARvatar)		
Category/topic/context	Tier 2: Location Based Games	
Owner(s)/contacts	Boris Pokric	
Abstract	The ARvatar game will be completely developed in a web creation tool called ARTool. Once developed, other users will be able to modify it and deploy on their mobile phones. Each player chooses an ARvatar, which is a 3D model that can only be seen through an AR view. The ARvatar will be displayed on a global plane detected by the SLAMflex SE component (for example a street pavement or a table top). The appearance will (or can) depend on many factors but initially it will reflect the environmental conditions locally. This will be determined by the ekoNET service used within the game. The ARvatar appearance (i.e. image) can be shared with other people via social networks, such as the Social Network SE or Facebook, directly from the game.	
Detailed description	The ARvatar game demonstrates how the web tool ARTool can be used to create engaging AR applications. The ARTool aims to dramatically simplify the development and deployment of AR applications by utilising pre-defined templates, components and modules enabling the creation of cross-platform applications with minimal or no programming effort required. The basic concept is that the conventional development of AR applications requires a high number of resources and tasks whereas the ARTool dramatically reduces both of these aspects, and shortens the development time from several months to several days only. By combining this tool with other components such as Unity3D, AR engines such as SLAMflex and appropriate content, end users can design and deploy diverse range of AR applications. The SLAMflex engine will initially enable detection and tracking of a global plane on which the AR content can be superimposed, while the Unity3D engine will provide the necessary physics features. The ARvatar game is based on marker-less AR tracking where the AR content is superimposed on a global plane detected (e.g. on a street pavement or on a table top). Each user chooses its own ARvatar from a set of available 3D models. The ARvatar's appearance can be influenced by many factors but initially it will be dependent on the meteorological parameters determined by the ekoNET service. This is an IoT device connected to the ARTool platform providing real-time measurements on different meteorological parameters such as temperature, air pressure, humidity and air quality. Depending on the temperature and air quality, the ARvatar's appearance will be modified accordingly. The users can view the ARvatar and share the view with other users via Facebook.	
Justification for inclusion of scenario	Audience/cultural criteria	The target audience for ARvatar are end users with a mobile phone and a Facebook account. The game should also raise the awareness of air quality in the cities. The available ARTool project that can be deployed on users' smartphones should attract people wishing to develop their own games but not having expert knowledge related to the application development.

Creating SLAM-based AR Game using Web Creator Tool (ARvatar)		
	Commercial criteria	City administrations aiming to raise awareness of air quality, marketing agencies promoting certain products and requiring rapid AR application development and deployment.
	Academic criteria	Researchers requiring a rapid AR application development and a deployment tool including features supporting the Internet of Things (IoT).

Planned experimentation		
	Experimentation site(s)	Zurich
	Estimated schedule	December 2014
	Maturity of implementation	First phase being finalised, October 2014
	Content, provider, availability	DNET

Functional requirements and their candidate enablers		
Functional requirement	*Candidate enabler*	*GE/SE/Gap*
Cloud service for AR application development	ARTool	SE
SLAM-based AR used for the detection of global planes	SLAMflex	SE
IoT Thing Discovery	Configuration Management	GE

Performance requirements	
Type	*Requirements*
Hardware	- Smartphone with a camera and with at least a dual-core CPU - ekoNET device
Software	Browser access to ARTool cloud service ARTool player mobile application (Android or iOS)
Miscellaneous	

4 - ATTRACTIONS DRIVING CONTENT SHARING

Figure 3: ARpix, Reality Mixer cinema attraction study.

Attractions Driving Content Sharing – (ARpix)		
Category/topic/context	Tier 2: Location-based Games	
Owner(s)/contacts	Kenny Mitchell, Marcel Lancelle, Fabio Zünd	
Abstract	ARpix application scenario augments photos taken on a mobile device with virtual characters so that they look realistically part of the real world and may be shared with friends on social networking sites.	
Detailed description	A commercial quality application delivered on Android and iOS to coincide with a film release. The app allows fans to line-up and take pictures of the film's marketing billboards located in cinema foyers, and then integrates the film star, digitally augmented into the real photo. The photos are aligned using real-time augmented reality tracking and reality-mixer techniques. When the camera button is clicked, a full resolution photo is rendered to yield the highest quality image as a memorable keepsake for guests.	
Justification for inclusion of scenario	Audience/cultural criteria	Tying into media release schedules and contemporary stories & films, this scenario is intended for broad appeal.
	Commercial criteria	Sharing content associated with billboard/poster/standee content to provide an online viral marketing route associated with media/product advertising and conversion

Attractions Driving Content Sharing – (ARpix)

		to in app purchases.
	Academic criteria	Realistic character rendering in augmented reality is a new level of context aware content on the future internet.

Planned experimentation

	Experimentation site(s)	Zurich
	Estimated schedule	Demonstration: April'13 Internal, User Study: April'13 and July'14, New York event: June'14.
	Maturity of implementation	Production Ready
	Content, provider, availability	Provided by BLRK. Installation platform demonstration not for source distribution. MIG'14 paper results.

Functional requirements and their candidate enablers

Functional requirement	Candidate enabler	GE/SE/Gap
Realistic augmented reality virtual character appearance	Reality Mixer – Camera Artifact Rendering	SE
	Reality Mixer – Reflection Mapping	SE
Poster image tracking	Augmented Reality – Image Marker Tracking	GAP
Social network sharing	Social Network	GAP

Performance requirements

Type	Requirements
Hardware	Recent handheld device with powerful processor, good camera, GPS, gyroscopes and accelerometers.
Software	For a satisfactory user experience, the tracking and rendering frame rates should be at least 15 Hz.
Miscellaneous	**Scalability**: It is preferable to have models with low numbers of polygons, to keep the seamlessness of the AR component.

5 - LOCATION BASED VIRTUAL REALITY

Figure 4: Location-based virtual reality.

Location based Virtual Reality (Skye Wars VR)		
Category/topic/context	Tier 2: Location Based Games	
Owner(s)/contacts	Kenny Mitchell	
Abstract	This scenario proposes location-based games game built to provide user experimentation of Tier 2 games and demonstrate the commercial opportunity of low cost VR experiences with free roaming with crouching and standing movements.	
Detailed description	*SkyeWars VR* is a location-based game built to provide user experimentation of Tier 2 games and demonstrate the commercial opportunity of low cost VR experiences with free roaming with crouching and standing movements. The player is transported into an epic space battle. Standing on an observation platform the battle unfolds with two opposing alien armies. The leader of an alien faction teleports onto the platform for a close up encounter, eye-to-eye. The player is immersed in the advanced interactive 3D content viewed with Oculus DK1 head mount displays.	
Justification for inclusion of scenario	Audience/cultural criteria	All ages are likely to enjoy this novel experience, which transports the player from the real world to a galaxy far far away.
	Commercial criteria	The space of virtual reality games has exploded recently with Facebook's purchase of OculusVR. This scenario frees the players from being seated at a desktop PC into a wider space of play at a low-cost to consumers.

	Academic criteria	Tracking over a playspace is a challenge for computer vision, tracking methods and gameplay definition. We delivered new results in combined tracking approaches for extreme low latency.

Planned experimentation

	Experimentation site(s)	Zürich
	Estimated schedule	July 2014
	Maturity of implementation	Beta under testing
	Content, provider, availability	Provided by BLRK

Functional requirements and their candidate enablers

Functional requirement	Candidate enabler	GE/SE/Gap
High speed low latency tracking	Augmented Reality – Fast Feature Tracking	SE

Performance requirements

Type	Requirements
Hardware	- PC with Wi-Fi capability for server processing (e.g. Mac Book Pro laptop) - One or more mobile computers with Wi-Fi for body mounted client processing (e.g. Mac Book Air) - One or more Head Mounted Displays (e.g. Oculus DK1) - One or more webcams connected to the server (e.g. Logitech 920)
Software	For VR scenario with a satisfactory user experience, the tracking and rendering frame rates should be at least 120 Hz (60z per eye)
Miscellaneous	**Network**: There should be a low network latency to receive inertial measurements and transmit the Fast Feature Tracking corrected yaw orientation. Wireless N or greater standard. **Scalability**: The location-based scenario is suitable for a single person to a small group of people according to Wi-Fi bandwidth.

FI content

6 - AUGMENTED REALITY IN THE WILD

Figure 5: Skye Wars, the first FI-PPP application to be released on the iTunes Store.

Augmented Reality in the Wild (Skye Wars)		
Category/topic/context	Tier 3: City-Wide Games	
Owner(s)/contacts	Kenny Mitchell, Chino Noris	
Abstract	Skye Wars merges an advanced markerless tracking system with augmented reality launched to enhance the SKYE experience at SIGGRAPH 2013 Computer Animation Festival. Point your camera at the moon (or any other single colored object) and witness an epic battle to defend the humanity!!! Shoot the enemy star ships with the Skye laser and see who can get the highest score. But watch out for friendly fire! The ability to track objects anywhere in the wild or around a cityscape is illustrated by this scenario.	
Detailed description	The Skye Wars scenario shown at the 2013 SIGGRAPH conference – the premier international event on computer graphics and interactive techniques is the first app developed on the FIcontent pervasive games platform. Skye Wars combines the elegant and energy efficient flight of a blimp with the precise handling characteristics of a quadcopter. Internal LEDs are used for the creation of aerial visual effects and provide a color target for the first demonstration of the Augmented Reality - Fast Feature Tracking enabler. In order to fully enjoy robots and graphics meeting in mid-air, the conference attendees downloaded the Skye Wars app. Thanks to the SIGGRAPH presence and audience interest, the iTunes page of the app has become really popular: the Augmented Reality app has reached 2000 downloads. A great goal for the first FI-PPP app released on iTunes.	
Justification for inclusion of scenario	Audience/cultural criteria	The target audience for the Anahiem (California) event was the most- respected technical and creative people from all over the world gathered for SIGGRAPH premier graphics conference.
	Commercial criteria	The specific aerial robot tracking application represents a new business model for large-scale gatherings and events. The markerless tracking ability of the Augmented Reality - Fast Feature Tracking enabler battle tested in public large-scale event is applicable to the widest range of general purpose tracking scenarios with broad commercial applicability.
	Academic criteria	The blob tracking method developed for this scenario uses a GPU reduction method for fast localisation of the centre of a tracked colored region. This combined with a moment of

		integral analysis of the camera image may be novel and the basis for further novel tracking algorithms.

Planned experimentation

	Experimentation site(s)	Anaheim, CA
	Estimated schedule	*Deployment July'13 Study July'13 Source Release Sept'13*
	Maturity of implementation	*Deployed*
	Content, provider, availability	Provided by BLRK, DRZ, ETH. Released on App Store (http://bit.ly/SkyeAR), pending Unity Asset Store

Functional requirements and their candidate enablers

Functional requirement	*Candidate enabler*	*GE/SE/Gap*
Tracking of objects defined by their color in contrast to the background	Augmented Reality - Fast Feature Tracking	SE

Performance requirements

Type	*Requirements*
Hardware	Recent handheld device with powerful processor, good camera, GPS, gyroscopes and accelerometers. In addition, for one location with around 50 active users we estimate to use one powerful server to compute the physics simulation. A robot that can navigate through space, with an embedded light source to enable tracking.
Software	For a satisfactory user experience, the tracking and rendering frame rates should be at least 20 Hz. The software should also support interactive rendering of models with thousands of polygons.
Miscellaneous	A physical particle simulator that can cope with the computation for thousands of particles is required on the client.

7 - CITY-WIDE ECONOMIC GAME (GNOME TRADER)

Gnome Trader		
Category/topic/context	Tier 3: City-Wide Games	
Owner(s)/contacts	Marcel Lancelle, Fabio Zünd, Mattia Ryffel	
Abstract	Gnome Trader is a city-wide location aware Augmented Reality resource trading game. Food can be bought from and sold to Gnomes hidden in newspaper boxes all around the cities. Gardener gnomes produce food and sell it to the player at a dynamic price. Gnome families are waiting for the player to bring them food and will pay more as their storage gets low.	
Detailed description	This scenario is a tier 3 game and demonstrates new ways of Augmented Reality games. Using the combination of GPS and a simple form of image based localization, the mobile device's location and orientation is known with high accuracy. For the Zurich test site, newspaper boxes in Switzerland will be used. They depict a very distinct and ubiquitous logo, which can be used as a strong image marker. Pointing a mobile device running the game at the newspaper box gives the illusion that a gnome lives inside the box.

In the game the player carries a virtual bag with limited size and gold. The player's goal is to make profit by strategically trading with the appropriate gnomes. Each gnome offers to trade resources (peas or nuts) with a price based on the amount of resources it currently owns. That is, if a producing gardening gnome has only a few resources left, it will ask for a high price per resource. On the other hand, if its storage is almost full (because nobody has purchased any resources recently) it will sell its resources to the player at a very low price. For the buying gnome families the process is exactly inverted. This economic system yields an interesting multiplayer aspect: Player A could choose to not go to the gnome living close to the player's house and wait until the resources are sold at a very low price. But player A's plan is threatened by player B, who also waits for a better price for the same gardener gnome but will buy the resources just a bit of time before player A does. The price development needs to be carefully balanced for a good gameplay.

With enough money, the player can upgrade his bag to be able to carry more resources at once. This will increase his trading efficiency. With the Leaderboard SE integrated the players can compare their trader level and experience with each other. Gnomes are automatically registered and added to the game if enough players visit a new newspaper box that is not already registered in the database. Hence, the game can grow autonomously. Apart from normal server administrative tasks, no other developer intervention is necessary.

Advanced features are planned. For example player-to-player trading is a very important feature that will greatly increase the multiplayer aspect of the game. An achievements system (meta-goals) would have a strong positive effect on gameplay. | |
| Justification for inclusion of scenario | Audience/cultural criteria | Children as well as adults with access to a smart phone with internet connection are likely to enjoy this game. |
| | Commercial criteria | Similar games might be interesting for advertisement for |

Gnome Trader		
		specific locations. Each gnome could advertise a different product.
	Academic criteria	Player interaction on a city-wide scale is novel and serves as an example for further research.

Planned experimentation		
	Experimentation site(s)	Zurich, Barcelona
	Estimated schedule	Beta September 2014, Deployment December 2014
	Maturity of implementation	Beta under testing
	Content, provider, availability	*Content will be provided by ETHZ and DRZ*

Functional requirements and their candidate enablers

Functional requirement	*Candidate enabler*	*GE/SE/Gap*
Coarse grained location of area of interest	Point of Interest	GE
Realistic augmented reality content	Reality Mixer – Camera Artefact Rendering	SE
Realistic audio in context	Reality Mixer – Augmented Audio	SE
Marker-less tracking city-wide	Augmented Reality – SLAM	Gap
Player competition	Leaderboard	SE

Performance requirements

Type	*Requirements*
Hardware	Recent handheld device with powerful CPU and GPU, good camera, GPS. In addition, for one location with around 50 active users and 500 gnome locations we estimate to use one basic web-server running apache, PHP, and MySQL.
Software	For a satisfactory user experience, the tracking and rendering frame rates should be at least 20 Hz.
Miscellaneous	**Network**: There should be a low network latency to quickly transfer the state of the game to the mobile devices. **Scalability**: We expect to have at most a few dozen active users per site.

8 - CITY-WIDE SCAVENGER HUNT GAME (TREASURE HUNT)

Treasure Hunt		
Category/topic/context	Tier 3: City-Wide Games	
Owner(s)/contacts	Marcel Lancelle, Fabio Zünd, Mattia Ryffel	
Abstract	Treasure Hunt Zurich is a city-wide Augmented Reality scavenger hunt game that is played in the city of Zurich, Switzerland. The player is sent on a quest that leads through the city to find a hidden treasure. The locations are found with the help of text descriptions and clues. At several locations throughout the quest Augmented Reality puzzles have to be solved in order to continue.	
Detailed description	The player found an old journal that turns out to be enchanted. It has a consciousness and communicates with the player through the text written inside of it. Hundreds of years ago it used to belong to an adventurer that has hidden all his riches somewhere in Zurich. The journal, which has no use for gold and is tired of being lonely for centuries, agrees to guide the player to the treasure. Yet, it wants to make a game out of it. Four pieces of a treasure map were hidden in the city. Each one is protected by a puzzle, which is invisible to human eyes. Luckily, the journal emits a magical aura that surrounds the player and allows him see those hidden secrets. The player has to locate and access all map pieces to assemble the map and find the hiding location of the treasure.	
	This tier 3 scenario explores the use of Augmented Reality (AR) technology in the context of pervasive city-wide mobile games. A fully functional city-wide AR treasure hunt game is developed together with a framework, which assists in building similar games. It is implemented using the Unity game engine and Vuforia. The game resembles a traditional scavenger hunt where players sequentially navigate to several locations by following hints. Here, AR is used to augment building facades with virtual puzzles on the device's screen. Solving a puzzle unlocks the next hint to find the next location.	
	The player's position is tracked using GPS. When the player arrives at a puzzle location and enables the camera, the position and orientation is estimated to a very high degree by state-of-the-art AR algorithms.	
	The player's path is recorded and the time needed to complete the quest as well as the number of hints requested are captured. After finishing the game a high-score is calculated and submitted to a leaderboard, thereby allowing players to compare their performance to each other.	
Justification for inclusion of scenario	Audience/cultural criteria	Children as well as adults with access to a smart phone with internet connection are likely to enjoy this game.
	Commercial criteria	Similar games might be interesting for advertisement for specific locations. Each puzzle could advertise a different product.
	Academic criteria	Player interaction on a city-wide scale is novel and serves as an example for further research.
Planned experimentation		
	Experimentation site(s)	Zurich

Treasure Hunt		
	Estimated schedule	Beta September 2014, Deployment December 2014
	Maturity of implementation	Beta under testing
	Content, provider, availability	Content will be provided by ETHZ and DRZ

Functional requirements and their candidate enablers		
Functional requirement	*Candidate enabler*	*GE/SE/Gap*
Coarse grained location of area of interest	Point of Interest	GE
Realistic augmented reality content	Reality Mixer – Camera Artifact Rendering	SE
Marker-less tracking city-wide	Augmented Reality – SLAM	Gap
Player competition	Leaderboard	SE

Performance requirements	
Type	*Requirements*
Hardware	Recent handheld device with powerful CPU and GPU, good camera, GPS.
Software	For a satisfactory user experience, the tracking and rendering frame rates should be at least 20 Hz.
Miscellaneous	**Network**: There should be a low network latency to submit the high-scores to the leaderboard. **Scalability**: Not an issue.

9 - CITY WIDE AUGMENTED REALITY STRATEGY GAME

TODO: Marcel Update (Outdoor Tower Defense)	
Category/topic/context	Tier 3: City-Wide Games
Owner(s)/contacts	Marcel Lancelle, Fabio Zünd
Abstract	Each player can select one volume of space in a street in the pedestrian zone. The start and end points for a marble are fixed on the boundary. The player will combine virtual 3D models of components in a creative way to get the marble across the own volume. These marble runs of all players are linked and can be viewed and tested by inserting virtual marbles at any start position.
Detailed description	This scenario is a tier 3 game that will demonstrate new ways of Augmented Reality games. Using the combination of GPS and image based localization, the mobile device location and orientation is known with a good accuracy. This will likely work best in a pedestrian zone street. A park or forest will probably not work very well due to the properties of the vision-based tracking. We will prepare at least one location in a Zurich pedestrian zone for this type of tracking. Eventually, the system should learn by itself and extend this region.
	The envisioned game play enables users to place virtual content to a location so that other users can also see them. In this setup, the game is collaborative and requires many users to increase the length of the marble run. Instead of a marble, a domino run and other physically moving prebuilt components can be used. A challenge is the physically-based simulation of the run. Players should be able to insert marbles at any of the start points. This simulation might be too time-consuming for a mobile device. Instead, this simulation could run on a server and the simulation results can be streamed with a small constant delay to the mobile devices. In case of the marble run, only the trajectory of the marbles and triggers of some sound effects need to be sent. The requirements for this scenario are very similar to other ideas such as virtual graffiti or other location-based arts projects.

Justification for inclusion of scenario	Audience/cultural criteria	Children as well as adults with access to a smart phone are likely to enjoy this sort of game. With a limited number of patches there might be a motivation to be quick to 'own' a prominent location or one that has a special meaning to the player or is e.g. on the way to work. Once the creation is finished, the player can guide friends and show his achievement.
	Commercial criteria	Similar games might be interesting for advertisement for specific locations.
	Academic criteria	Physical interaction on a city-wide scale is novel and serves as an example for further research.

Planned experimentation		
	Experimentation site(s)	Zurich
	Estimated schedule	Deployment July'14 Study July'14 Source Release Sept'14
	Maturity of implementation	Concept
	Content, provider, availability	Content will be provided by ETHZ and DRZ

Functional requirements and their candidate enablers		

TODO: Marcel Update (Outdoor Tower Defense)		
Functional requirement	*Candidate enabler*	*GE/SE/Gap*
Coarse grained location of area of interest	Point of Interest	GE
Realistic augmented reality content	Reality Mixer – Camera Artifact Rendering	SE
Markerless tracking city-wide	Augmented Reality – SLAM	Gap
Player competition	Leaderboard	SE
Performance requirements		
Type	*Requirements*	
Hardware	Recent handheld device with powerful processor, good camera, GPS, gyroscopes and accelerometers. In addition, for one location with around 50 active users we estimate to use one powerful server to compute the physics simulation.	
Software	For a satisfactory user experience, the tracking and rendering frame rates should be at least 15 Hz. For a physics simulation, time steps must be short but the rate must also be at least 15 Hz.	
Miscellaneous	**Network**: There should be a low network latency to quickly transfer the state of the physical simulation to the mobile devices. **Scalability**: We expect to have at most a few dozen active users per site and plan to use physics that are simple enough to achieve this. The results can potentially be streamed to many more observers.	

10 - CONCLUSION

This document gives an updated description of the "Pervasive Game Platform" reference applications that are evaluated in D7.6.2. It is understood as a reading companion to the latter.

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