



D4.1

SCENARIO, FUNCTIONAL AND TECHNICAL REQUIREMENTS - RELEASE 1

September 2013

ABSTRACT

This document describes use cases developed in the “Pervasive Game Platform” (1st release). The scenarios are composed of technologies grouped into key strategic areas for interactive entertainment, including virtual and augmented reality environments on the Future Internet.

This document is a deliverable of the FI-CONTENT 2 integrated project supported by the European Commission under its FP7 research funding programme, and contributes to the FI-PPP (Future Internet Public Private Partnership) initiative.

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EXECUTIVE SUMMARY

This document specifies the “Pervasive Game Platform” reference applications. The main use cases introduced in this document have been identified with all WP4 partners, technical partners and experimentations site owners. The scenarios are composed of technologies grouped into key strategic areas for interactive entertainment, including virtual and augmented reality environments on the Future Internet.

The Reality Mixer group of enablers deals with seamless context aware presentation of content blended with the real world, including audio, visual and physical axes. The Augmented Reality group of enablers deals with recognition and tracking of targets in real-time for locating internet sourced content with sufficient accuracy for realistic mixing with the real world. The Game Content group of enablers is composed of advanced authoring enablers to aid rapid construction of connected experiences. Finally, Games with Things deals with connectivity to real objects instrumented either actively (such as RFID/digital IDs) or passively (such as through object recognition).

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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

1 - INTRODUCTION

1.1 - Overview

In phase 1 of FI-CONTENT and in firmly establishing WP4 for phase 2, we have created and described our 3-tiered scenarios that, together, address the main types of today's content for the Game Platform; we have extracted from them architectural and technical requirements for the FI-CONTENT 2 platform, as well as the liaison with the Core Platform. From this list of phase 1 requirements, we have built the FI-CONTENT 2 architecture and identified the needed building blocks, namely enablers that will fit the use case scenarios. The enablers are divided in two types: generic and specific enablers. Generic enablers are common to most use case projects linked to FI-WARE while specific ones are specific to the FI-CONTENT 2 project.

The goal of WP4 is to draw upon and refine earlier requirements towards building the open Games Platform for games and virtual worlds. Careful consideration with depth is employed in scenario specification, application platform development, content preparation and management, deployment and establishing user testing criteria and analysis of feedback.

In this document, we present the specification of game platform scenarios, which will provide real world basis for dissemination, and distribution of the open game platform. These application scenarios are thus defined here and will be implemented to serve as early trials of the platforms. The specifications are comprised of the following,

- Tiered definition and detailed description of scenarios of the Pervasive Game Platform according to commercial, academic and cultural criteria
- Functional and Technical specification of enablers of the Pervasive Game Platform

We assess the list of generic and critical specific enablers and distinguished between the first stage release of initial enablers to apply within the game platform and next key stage enablers within release 2, as follows,

1.2 - Release 1 : Pervasive Game Platform Enablers

- Advanced UI - 3D Web Services (Generic Enabler – FI-WARE)
- Advanced UI - Data Flow Processing (Generic Enabler – FI-WARE)
- Identity Manager (Generic Enabler – FI-WARE)
- Reality Mixer – Reflection Mapping (Specific Enabler – FI-CONTENT)
- Reality Mixer – Camera Artefact Rendering (Specific Enabler – FI-CONTENT)
- Leaderboard (Specific Enabler – FI-CONTENT)
- Games with Things - Spatial Matchmaking (Specific Enabler – FI-CONTENT)
- Augmented Reality – Fast Feature Tracking (Specific Enabler – FI-CONTENT)
- Augmented Reality – Marker Tracking (Specific Enabler – FI-CONTENT)
- Social Network (common Specific Enabler – FI-CONTENT)
- Game Synchronization (Specific Enabler – FI-CONTENT)

1.3 - Release 2 : Pervasive Game Platform Enablers

- Game Content - Sketch-based Game Design (Specific Enabler – FI-CONTENT)
- Game Server (Specific Enabler – FI-CONTENT)
- Augmented Reality – Image Feature Tracking (Specific Enabler – FI-CONTENT)
- Augmented Reality – SLAM (Specific Enabler – Gap/Open Call)
- Augmented Reality – Skeletal Tracking (Specific Enabler – Gap/Open Call)
- Advanced UI - Hardware Support (Generic Enabler – FI-WARE)
- Point of Interest (Generic Enabler – FI-WARE)
- Reality Mixer – Simulation Continuum (Specific Enabler – FI-CONTENT)
- Reality Mixer – Augmented Audio (Specific Enabler – FI-CONTENT)

- Networked Virtual Characters (Specific Enabler – FI-CONTENT)
- Internet of Things (Generic Enabler – FI-WARE)
- Object Storage (Generic Enabler – FI-WARE)
- Efficient Middleware (Generic Enabler – FI-WARE)

1.4 - Referenced Documents

This document draws upon and references the following phase 1 requirements documents.

- FI-CONTENT-WP4 001 D4.3.doc
- FI-CONTENT-WP4 001 D4.1.doc

1.5 - Terminology

The document uses the term *functional requirement*. The usage of the term is intended to be in line with the definition provided by Wikipedia, extract: “*Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish*” [1]. Functional requirements are defined for Specific Enablers and for the scenarios that are built on the basis of the Specific Enablers. The functional requirements shall provide checkpoints in order to evaluate the state of maturity of the technical systems.

Functional Requirements are indexed. This allows the referencing requirements across documents. Indexes are assigned as follows:

Parameters	< Indicator – Use-case area>.<Indicator – Scenario or SE><Numerical>.< Indicator – Requirement><Numerical>
Values	<TV SC G>.<S SE><Numerical>.<R><Numerical> <ul style="list-style-type: none"> • TV – Social Connected TV Platform • SC – Smart City Guide Platform • G – Games Platform • S – Scenario • R – Requirement • Numerical – 1,2,3, ...
Examples	<ul style="list-style-type: none"> • G.S1.R1 (identifies the first requirement of the first scenario of Game Platform) • G.SE3.R2 (identifies the second requirement of the third SE of Game Platform)

In the tables in chapter 2 the labels “GE”, “SE”, “Gap” and “Application” are used to categorise candidate technologies that come into consideration for the implementation of the functional requirements that have been identified for each of the scenarios. The labels have the following meaning:

GE	The label is used for enablers provided by the FI-WARE platform.
SE	The label is used for technology components that are developed as part of the Social Connected TV Platform. SE labelled technology components are made available via the Social Connected TV Platform to SMEs and third party developers.
Gap	The label is used to indicate that currently there is no candidate technology available to come up with the functional requirement.
Application	The requirement is implemented on application level.

2 - GAME SCENARIOS

2.1 - Tier 1 – Digital Consumer Products

2.1.1 - Tabletop Augmented Reality Games

Tabletop Augmented Reality Games (Augmented Resistance)		
Category/topic/context	Tier 1 – Digital Consumer Products	
Owner(s)/contacts	Chino Noris (DRZ), Kenny Mitchell (BLRK)	
Abstract	<p><i>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. 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.</i></p>	
Detailed description	<p><i>This scenario build is part of tier 1, which targets augmented-reality games based on toys, fashion, and other physical products. These games use 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.</i></p>	
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.
	Commercial criteria	This scenario builds on top of the existing business of tabletop games and toys, 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.
	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.
Planned experimentation		
	Experimentation site(s)	Zurich
	Estimated schedule	Demonstration July'13. Study December'13

Tabletop Augmented Reality Games (Augmented Resistance)

Maturity of implementation	Production ready
Content, provider, availability	Provided by DRZ & BLRK

Functional requirements and their candidate enablers

Functional requirement	Candidate enabler	GE/SE/Gap	
G.S1.R1	Low-latency Context Aware Rendering	Reality Mixer – Reflection Mapping	SE
G.S1.R2	Synchronization of the Game World for Multiplayer	Game Synchronization	SE
G.S1.R3	User Authentication	Identity Management	GE
G.S1.R4	Competitive and Collaborative Ranking	Leaderboard	SE
		Socio-Aware Ranking	Gap

2.1.2 - Seamless Augmented Reality on the Web

Seamless Augmented Reality on the Web (Star Tours)

Category/topic/context	Tier 1 – Digital Consumer Products	
Owner(s)/contacts	Stefan Lemme (DFKI), Kenny Mitchell (BLKR)	
Abstract	<p><i>This scenario is part of tier 1, which targets augmented-reality games based on toys, fashion, and other physical products. It shows a setting of animated virtual star fighters around the Death Star toy on the web. The scenario showcases the seamless incorporation of virtual objects into an augmented reality scene based on toys by adapting the lighting model according to the physical environmental lighting conditions.</i></p>	
Detailed description	<p><i>The seamless incorporation of virtual objects into an augmented reality scene requires a light probe to measure surrounding lighting conditions. Thus, a lighting model according to the physical environmental lighting conditions can be applied to rendered virtual objects. Therefore, we utilize the Reality Mixer - Reflection Mapping SE to extract the light conditions from a camera image and create the respective lighting model. Furthermore, the estimation of the camera pose relative to the physical toy requires an augmented reality tracking method provided through one of the Augmented Reality enablers. This scenario runs completely on the web and utilizes the Advanced-User Interface GE to render 3D-scene content with XML3D and Xflow.</i></p>	
Justification for inclusion of scenario	Audience/cultural criteria	<p><i>The main audience for seamless augmented reality applications are players who claim to a high-degree of immersive gaming experience. Games, incorporating virtual objects into real world settings, need to mimic the appearance of physical objects, even if they are virtual, in order to achieve a seamless augmented reality experience to the player.</i></p>

Seamless Augmented Reality on the Web (Star Tours)

	Commercial criteria	<i>Games, incorporating virtual objects into real world settings, may attract additional players through the increased immersive experience while playing. In addition to that, in mixed reality applications real world places may become important within game levels. Thus, an advertisement of the game attached to the respective physical object might attract new players.</i>
	Academic criteria	<i>Measure physical properties of objects and simulating a similar behaviour of virtual objects is a well-established research field in computer graphics. But the seamless mix-up of physical and virtual objects in augmented reality applications is a challenging task and the subject of current research in the field of computer graphics and vision.</i>

Planned experimentation

Experimentation site(s)	n/a
Estimated schedule	<i>Ready as showcase in Nov. 2013</i>
Maturity of implementation	<i>First Prototype</i>
Content, provider, availability	Content will be provided by DFKI and BLRK. Bi-lateral demonstration not for test site study.

Functional requirements and their candidate enablers

Functional requirement		Candidate enabler	GE/SE/Gap
G.S2.R1	Camera pose estimation for augmented reality	Image Feature Tracking	SE
		Marker Tracking	SE
G.S2.R2	Simulation of environmental lighting condition for virtual objects	Reflection Mapping	SE
G.S2.R3	3D-scene rendering on the web	Advanced-User Interface	GE

2.1.3 - Virtual Character Synchronization on the Web

Virtual Character Synchronization on the Web (Spider Demo)

Category/topic/context	Tier 1 – Digital Consumer Products
Owner(s)/contacts	Stefan Lemme (DFKI), Kenny Mitchell (BLKR)
Abstract	In this scenario a picture on a table or ground is augmented with a virtual simulated spider character crawling on it. Multiple players, each having a unique view of the game through their handheld devices, share the state of the spider. The scenario takes advantage of today's web technologies on mobile devices to augment the camera image based on the marker, mix it with a virtual character and perform efficient scene updates across multiple devices.

Virtual Character Synchronization on the Web (Spider Demo)

Detailed description	<p><i>This scenario is part of tier 1, which targets augmented-reality games based on toys, fashion, and other physical products. It shows a virtual animated spider character synchronized between multiple client devices on the web. The scenario showcases a synchronization mechanism based on a network communication capability, which allows efficient updates on the web. Therefore, the scenario takes advantage of the Efficient Middleware GE, which handles and hides all the network functionality from the game developer. Moreover, it utilizes an AR tracking enabler to estimate the camera pose of the mobile device in relation to the physical objects used as marker. The actual rendering of the augmented scene is done by XML3D together with Xflow using the Advanced-User Interface GE.</i></p>	
Justification for inclusion of scenario	Audience/cultural criteria	<p>The usual serialize/transfer/deserialize method to propagate updates within a game setting is a difficult task for game developers. An easy-to-use synchronization mechanism for overcoming this approach is interesting for inexperienced game developers. Together with state-of-the-art efficiency this might become relevant for professional game developers as well.</p>
	Commercial criteria	<p>Almost all multiplayer games rely on an approach similar to the described one. For these, an out-of-the box solution provides interoperability on different platforms and maybe with existing games.</p>
	Academic criteria	<p>An abstraction layer across different platforms and architectures providing an easy-to-use and common interface while preserving a maximum of efficiency is a challenging task and subject of current research.</p>

Planned experimentation

Experimentation site(s)	n/a
Estimated schedule	<i>Ready as showcase in Nov. 2013</i>
Maturity of implementation	<i>First Prototype</i>
Content, provider, availability	Content will be provided by DFKI and BLRK. Bi-lateral study/demonstration not for test-site study.

Functional requirements and their candidate enablers

Functional requirement	Candidate enabler	GE/SE/Gap
G.S2.R1 Camera pose estimation for augmented reality	Augmented Reality - Image Feature Tracking	SE
	Augmented Reality - Marker Tracking	SE
G.S2.R2 Simulation of environmental lighting condition for virtual objects	Reality Mixer - Reflection Mapping	SE
G.S2.R3 3D-scene rendering on the web	Advanced-User Interface	GE

2.2 - Tier 2 – Location Based Experiences

2.2.1 - Attractions Driving Content Sharing

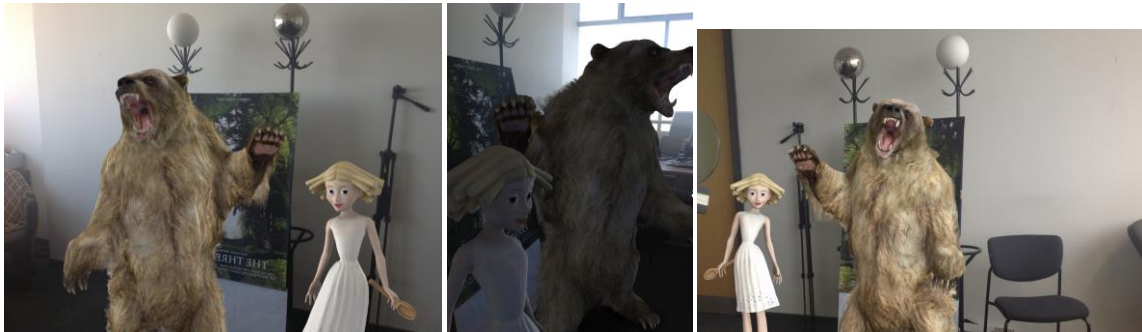


Figure 1 ARpix, Reality Mixer cinema attraction study.

Attractions Driving Content Sharing – (ARpix)		
Category/topic/context	Tier 2: Location-based Games	
Owner(s)/contacts	Kenny Mitchell, Marcel Lancelle	
Abstract	<i>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.</i>	
Detailed description	<i>A commercial quality application delivered on Android and iOS to co-incide 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 and a memorable keepsake for guests.</i>	
Justification for inclusion of scenario	Audience/cultural criteria	<i>Tying into media release schedules and contemporary stories & films, this scenario is intended for broad appeal.</i>
	Commercial criteria	<i>Sharing content associated with billboard/poster/standee content to provide an online viral marketing route associated with media/product advertising and conversion to in app purchases.</i>
	Academic criteria	<i>Realistic character rendering in augmented reality is a new level of context aware content on the future internet.</i>
Planned experimentation		
Experimentation site(s)	Zurich	
Estimated schedule	<i>Demonstration April'13 Internal User Study April'13</i>	
Maturity of implementation	<i>Production Ready</i>	
Content, provider, availability	Provided by BLRK. Installation platform demonstration and bi-lateral study not for source distribution.	
Functional requirements and their candidate enablers		
<i>Functional requirement</i>	<i>Candidate enabler</i>	<i>GE/SE/Gap</i>

Attractions Driving Content Sharing – (ARpix)			
G.S3.R1	Realistic augmented reality virtual character appearance	Reality Mixer – Camera Artifact Rendering	SE
G.S3.R2		Reality Mixer – Reflection Mapping	SE
G.S3.R3	Poster image tracking	Augmented Reality – Image Marker Tracking	SE
G.S3.R4	Social network sharing	Social Network	GE

2.2.2 - Immersive Control Systems

Immersive Control Systems (Dragon Flight)		
Category/topic/context	Tier 2: Location-based Games	
Owner(s)/contacts	Chino Noris, Kenny Mitchell	
Abstract	<p><i>In this scenario, we consider an installation of the size of a small room, where one or more users interact with a game application. The user is standing in the middle of the room and his body posture is tracked. Anybody motion is transmitted to a virtual character, like a dragon, which is displayed on a screen, projected on the wall, or displayed via a head-mounted display that the user is wearing. The user controls the character to complete certain tasks.</i></p>	
Detailed description	<p><i>Motion tracking has been introduced to the masses via new devices such Nintendo Wiimote, Playstation Move, and XBox kinect. These devices offer the developers a simple way to capture the motion of different part of the body. On top of that, products such as the Oculus Rift and Google Glass are pushing head-mounted display technology for virtual and augmented reality. This technology can be used to create an immersive control system, where the user can impersonate a fantasy creature, like a dragon, and use his or her body to control the creature in a natural way. To achieve this, one has to solve the problem of mapping the motion of a human body to the body of the target character, whose topology may be different. We envision a simple mapping where specific body parts are mapped in a one-to-one fashion. For instance, in case of a dragon, the motion of the arms could be mapped to the wings, so that the user could easily control the speed and range of the wing waving.</i></p>	
Justification for inclusion of scenario	Audience/cultural criteria	<p><i>The primary audience for such an application is children. It is a common thing to see a child using his arms as wings, mimicking a plane or a bird. For an adult audience, the control system has to be deep enough so that mastery is possible. This involves adapting the difficulty of the task at hand so that there is actually a challenge involved to push for the user to learn how to beat it.</i></p>
	Commercial criteria	<p><i>In the console market, the push for interactive motion tracking devices has happened and is being pushed even further with the next console generation.</i></p>
	Academic criteria	<p><i>This use case is a simple example of HCI problem and, if generalized, deals with the problems of mapping different</i></p>

body topologies and of creating a control system that can be used efficiently by the users.

Planned experimentation

Experimentation site(s)	Zurich
Estimated schedule	During November-December 2013
Maturity of implementation	Pending Prototype
Content, provider, availability	The content will be provided by BLRK, DRZ, ETHZ.

Functional requirements and their candidate enablers

Functional requirement		Candidate enabler	GE/SE/Gap
G.S4.R1	Realistic augmented physics	Reality Mixer – Simulation Continuum	SE
G.S4.R2	Realistic augmented audio	Reality Mixer – Augmented Audio	SE
G.S4.R3	<i>Body movement context awareness. Existing commercial solution by Zingfu (http://zigfu.com/en/zdk/unity3d/)</i>	Augmented Reality – Skeletal Tracking	Gap
G.S4.R4	Player competition	Leaderboard	SE

2.3 - Tier 3 – City-Wide Gaming

2.3.1 - Adjacent Player Discovery

Adjacent Player Discovery (Agent vs Agent)

Category/topic/context	Tier 3: City-Wide Games
Owner(s)/contacts	Jim Callin, Chino Noris
Abstract	<i>The third tier targets city-wide games in which larger numbers of players interact in unstructured environments. GPS is used to direct players to point of interest. AR Tracking is used to find particular objects and elements and recognize them with a smart phone. The game logic involves writing and reading hidden messages that only appear when the phone recognizes the appropriate image. Two factions play against each other.</i>
Detailed description	<i>Testing will take place in Zurich, and possibly Barcelona and Cologne. The game should be constructed so that it can be played in different cities, i.e. the game-play should treat POIs independently of their actual historical context. All devices are connected to a server, and can query for the relevant data based on their GPS location. The data will consist of the images for AR tracking that the players have to find, as well as the actual game content (messages, audiovisual content, etc.). Locally, the smart phone will use the camera and try to match the video content with one of the images received. When a match is found, the AR data is displayed, revealing the virtual content to the players who can then decide on their next move. The user can then decide to destroy the message or replace it with an answer. The smart phone will communicate to the server the alteration. This use of GPS and AR Image tracking supports different gameplay elements, such as scavenger/treasure hunt, and agent-to-agent message exchange.</i>

Justification for inclusion of scenario	Audience/cultural criteria	<i>The target audience includes teenagers and young adults with a passion for outdoor activities, team games, and exploration. The game involves exploring the city, possibly in a time-critical manner (to beat the opposing team), so fit individuals may find it more appropriate. The game can be adapted for less physical exercise by making riddles more complicated, making the difficulty of solving a puzzle outweigh the need for fast travelling between POIs.</i>
	Commercial criteria	<i>The game gives an incentive for people to explore specific POIs. A city or region may benefit by attracting more visitors through the popularity of the game. POIs may present users with real world and virtual world advertisement.</i>
	Academic criteria	<i>This scenario may combine with other enablers to enable novel interaction designs.</i>

Planned experimentation

Experimentation site(s)	Zurich, Barcelona, Cologne
Estimated schedule	August 2014
Maturity of implementation	Pending Prototype
Content, provider, availability	Content will be provided by DRZ, ETHZ, and GOBO

Functional requirements and their candidate enablers

Functional requirement		Candidate enabler	GE/SE/Gap
G.S5.R1	To find players and POI in geographically similar locations in a unified manner	Spatial Matchmaking	SE
G.S5.R2	IoT Thing Discovery	Configuration Management	GE
G.S5.R3	Synthesize complex events based on simple events and logic	Complex Event Processing	GE
G.S5.R4	User Authentication	User Management	GE
G.S5.R5	Via spatial matchmaking find players	Point of Interest	GE

2.3.2 - Augmented Reality in the Wild



Figure 2 *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	<p><i>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.</i></p>	
Detailed description	<p><i>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.</i></p>	
Justification for inclusion of scenario	Audience/cultural criteria	<p><i>The target audience for the Anaheim (California) event was the most- respected technical and creative people from all over the world gathered for SIGGRAPH premier graphics conference.</i></p>
	Commercial criteria	<p><i>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.</i></p>
	Academic criteria	<p><i>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.</i></p>
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

Augmented Reality in the Wild (Skye Wars)

Functional requirements and their candidate enablers

Functional requirement		Candidate enabler	GE/SE/Gap
G.S6.R1	Tracking of objects defined by their color in contrast to the background	Reality Mixer - Fast Feature Tracking	SE

2.3.3 - Augmented Reality Physics Games Downtown

Augmented Reality Physics Games Downtown (Augmented Marble Run)

Category/topic/context	Tier 3: City-Wide Games	
Owner(s)/contacts	Marcel Lancelle, Chino Noris	
Abstract	<p><i>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.</i></p>	
Detailed description	<p><i>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.</i></p> <p><i>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.</i></p>	
Justification for inclusion of scenario	Audience/cultural criteria	<p><i>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.</i></p>
	Commercial criteria	<p><i>Similar games might be interesting for advertisement for specific locations.</i></p>
	Academic criteria	<p><i>Physical interaction on a city-wide scale is novel and serves as an example for further research.</i></p>

Augmented Reality Physics Games Downtown (Augmented Marble Run)

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

Functional requirement		Candidate enabler	GE/SE/Gap
G.S7.R1	Coarse grained location of area of interest	Point of Interest	GE
G.S7.R2	Realistic augmented reality content	Reality Mixer – Camera Artifact Rendering	SE
G.S7.R3	Markerless tracking city-wide	Augmented Reality – SLAM	Gap
G.S7.R3	Player competition	Leaderboard	SE