Free-viewpoint Immersive Networked Experience

D2.3 End of Project Scenarios

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1. Public Executive Summary

The purpose of this document is to report the work achieved in WP2 regarding the user scenarios for both professional and non-professional users. The research detailed in this document corresponds to the work done in Task 2.4, during the first half of the project.

This document completes the deliverables D2.1 and D2.2 where we started considering the user scenarios.

The document is organized as follows:

- Introduction of the document and overview of the kind of users.
- Description of the professional user scenarios.
- Description of the non-professional user scenarios
- Conclusions

2. Introduction

2.1. Objectives of the project

The FINE project is aimed at providing the final TV user a more immersive viewing experience by designing and implementing some new production tools for the broadcast industry and new end-user interactive applications which will both incorporate new free viewpoint technologies.

More specifically, if a real-world scene is filmed continuously by several cameras located at fixed positions around the scene, the researched technologies will be able to deliver virtual video sequences from any viewpoint. The fixed cameras show only a limited range of predefined points of view. The idea of the project is to allow a user to freely choose the point of view from which he/she would like to see the scene and to let the system reconstruct the view that would be captured if it were possible to put a camera at this chosen point of view.

2.2. Users scenarios

This document describes the user scenarios for the FINE system.

In the context of product design and development, a user scenario is a story, a sequence of events or actions, where a user interacts in some typical or expected way with a product or system. The scenario explains how the user can reach a specific objective with the system.

Its description often contains the main goal followed by the user and the list of actions undertaken with the possible outcomes/answers from the system. Most of the time, it is also necessary to give some context information.

I reproduce here (see http://sites.google.com/site/superuserfriendly/templates/scenario-template) a description of what a user scenario is (from Gessica Tortolano http://sites.google.com/site/superuserfriendly/gessica-tortolano-resume):

"A User Scenario tells a story about how a user will interact with an application. This narrative description includes information about the user, a history of the situation, and descriptions of the experiences, choices and outcomes of the interactive process. This information assists in defining the structure and interface design for the best possible experience for the site's users.

A set of User Scenarios can be created to describe the majority of user interactions with the application. This set includes examples from each user task profile. Together, the scenarios establish the high-level scope of a project by representing the essential functionality that is required by the application.

Each User Scenario follows a targeted persona and solution goal. The scenario will describe how a specific persona would accomplish his/her tasks and goals.

User Scenarios are used to explore and communicate the likely actions of users when interacting with the application. Development of User Scenarios helps the design team understand the motivations of users and the functions that will compliment their motivations. User Scenarios can suggest new functional requirements."

2.3. FINE users

The FINE project initially targeted two classes of users; broadcast professional users and non-professional users[1]. We now propose an additional extension to the non-professional user class: the arena user, who is essentially a non-professional user who is at the arena and viewing the event live.

2.3.1. Professional users

These systems will be used by professional broadcast operators and directors for the live production of sport events (like football matches for instance) or for any delayed show production of the same kind of sport events.
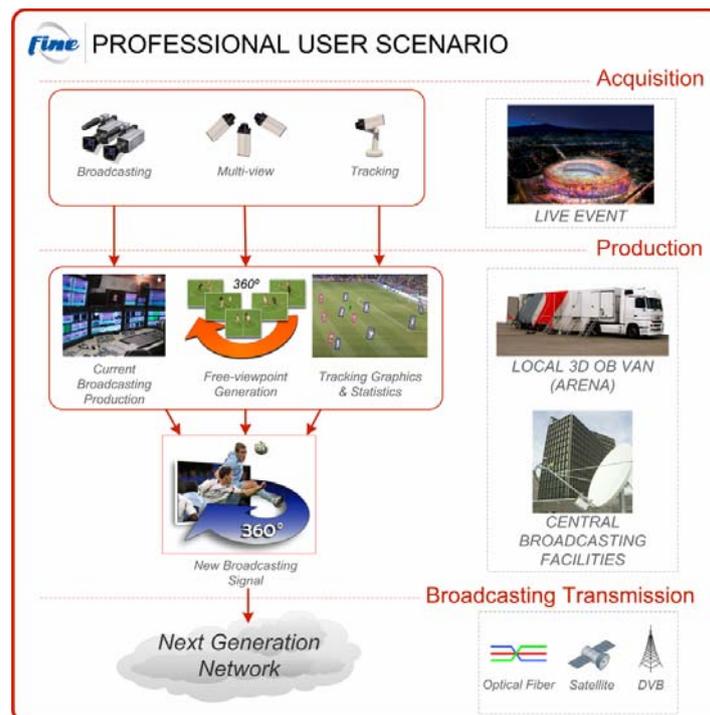
Figure 2-1: Professional user scenario: The professional user localised on the OB VAN or on the broadcasting facilities will have new production tools providing the ability to generate free-viewpoint scenes.

During the broadcast production of a sport event, the cameraman, operators and directors (the professional users) work within one or several broadcasting facilities

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[1] In previous documents the non-professional was referred to as the home user.

(studios) or OB Vans (which are mobile studios). The FINE project will modify the usual broadcast environment to accommodate the additional requirements concerning

- the storage and delivery of new video and metadata streams,
- the computing power needs for constructing the free viewpoint sequences.
- the user interface to freely choose the virtual point of view.

Inside a FINE-enabled OB Van at the arena, the producer demands a new view point to show a better view of a concrete event. To produce this, the View Synthesis Process requests from the FINE server all the video signals and metadata needed, then the novel views are generated and stored on the server where the Broadcast exhibition engine will retrieve it. The operator of a new EVS-Video System will command the View Synthesis Process to get the new reconstructed view points under direct demand.

Second, in order to enhance the quality of the experience (QoE) of the spectators, an alternative production is remotely done at separate broadcasting facilities. In this case a producer there wants to review the same event but from another view-point. In order to achieve this remote production, the original broadcast signal, along with the video signals from the specialized cameras and all necessary metadata would need to be received. A new edited signal is produced and broadcasted locally.

Practically speaking, the professional users will operate a new "Remote" (the command console for the "virtual" camera). This virtual camera console, which has been described in the deliverable D6.2 ("FINE D6.2 3D Video Server First Version.pdf") and is depicted in Figure 2-2, will enable the broadcast operators to choose the position and orientation of the virtual camera.

Figure 2-2 : Ideal UI for the free-viewpoint capability in the OB Van or at any broadcasting facility (Virtual Cam Console)

The professional users will also interact occasionally (during the setup of the system for instance) with the configuration (web) interface.

2.3.2. Non-professional users

These technologies will also be integrated in applications for the non-professional users, which will have the capability to change the viewpoint of what they are watching.

A. Home users

The primary focus will be on PC-based use, possibly through an application, though preferably as a browser plug-in. We can distinguish between two main PC-based scenarios:

1. The first case concerns computer-graphics animations based on results from tracking data and human motion capture. The user will be able to specify the view interactively, or alternatively choose to watch the view determined by a system that automatically controls the virtual camera position, angle and field-of-view, similar to sports computer games. This scenario will be available both as a live service and as a means of replaying highlights. This can be considered to be a major extension of Tracab's existing web-based services.

2. The second non-professional user scenario will allow the 3D visualization of the scene in real-time via a photorealistic rendering on the user's PC. The ability to change the viewing angle will also be central in this case. This represents a very ambitious goal that combines the whole range of activities in FINE.
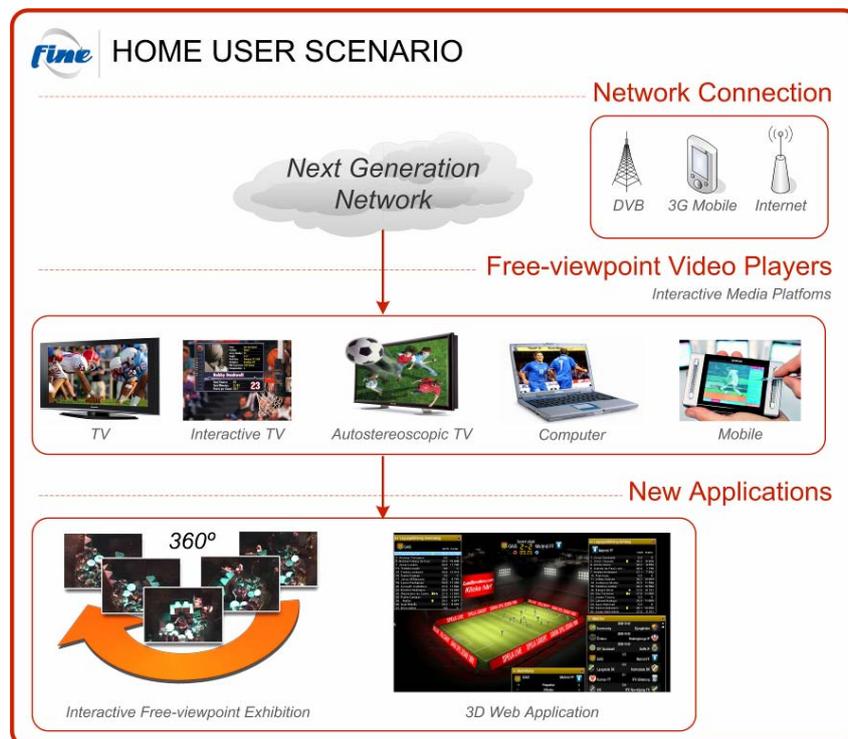

Figure 2-3 : Non-professional user scenario: new possibilities to interact with TV, computers and mobiles will be open.

The Figure 2-3 shows the new possibilities for non-professional users. FINE will provide them new ways to interact through Internet. Potential applications include iTV and mobile. Non-professional users will be able to produce new viewpoints of live events.

B. Arena users

The FINE project brings together leading edge technology in media, information technology and networks. These areas are all developing fast and in different directions and the landscape for potential end-user experiences of FINE, especially within the mass markets (in the FINE project labelled "non-professional users"), is constantly being redrawn.

An example of the fast shifting environment is the fact that since the initial FINE user surveys were conducted, the general user behaviour as well as design and computing power of larger mobile devices, so called surf pads, has exploded. The driving forces are headed by major user electronic vendors such as Apple (iPad) Samsung (Galaxy) and more. This development opens for further potential mobile end-user scenarios of FINE. One such scenario that has been identified by BitManagement and Tracab is what we will henceforth refer to as the Arena User. Here we describe the arena user scenario and the potential value adding contributions that the FINE project could bring to it.

The Arena User is defined as **someone being present at and experiencing the actual event captured by FINE content acquisition**. The existence of this user is actually somewhat contradictive to the previous user survey where it is stated that "86% of the test persons would not use it in the arena itself", however, we strongly believe that the changed surf pad landscape has / will affect this significantly. Furthermore the existence of this user is assumed through the following statements discovered through the work so far in the project:

1. The FINE content acquisition setup is a fairly complex one. Taking this fact into consideration when trying to envisage the commercial outcome derived from the system would, at least initially, point to larger events with a wide interest and thereby also a huge amount of people experiencing the event on site

2. The increasing penetration of surf pads would implicate that a growing portion of these on site people would also be owners and users of a surf pad

3. Arena owners are constantly improving the IT infrastructure of their premises in order to attract events and audience to their arenas.

A number of statements from the user survey give hints about how the FINE content could be received and packaged for the Arena User:

- Statement 3.3: 91% of the test persons would like to see what a player sees.

- Statement 3.6: 53% of the test persons would like focus on a particular player.

- Statement 3.9: 62% of the test persons were more interested to view the outputs of the system, rather than creating their own.

- Statement 4.10: 50% of the test persons would like receive output on a notebook/iPad.

- Statement 5.2: 81% of the test persons would use the system in a social environment.

- Statement 5.4: 72% of the test persons would like to share the footage with friends.

- Statement 5.5: 47% of the test persons would like to share the footage with a community.

- Statement 5.7: 50% of the test persons would like to view footage from friends.

- Statement 6.1: 72% of the test persons would like to use it while viewing a game live.

- Statement 6.2: 47% of the test persons would like to use it delayed.

- Statement 6.3: 78% of the test persons would like to use it after the match.

- Statement 8.2: 88% of the test persons would use it for enjoyment.

- Statement 8.3: Only 22% of the test persons would use it for creating sequences.

- Statement 9.1: 84% of the test persons think that it would increase their enjoyment of football.

- Statement 9.2: 91% of the test persons think that they would use it.

Based on the above we strongly believe that there is a possibility for exploiting FINE content as a non-professional user on site in the arena.

3. Professional users scenarios

3.1. Technical overview

There exist several complementary technical approaches to solve the problem of providing free viewpoint video:

1. The first method interpolates the views coming from the real cameras that surround the requested virtual camera field of view. The result is aimed to be photorealistic. The method will be applicable if the virtual camera viewpoint is not too far from the real camera viewpoints. In addition, this method may or may not make use of some information about the 3D geometry of the scene (essentially the depth of the pixels) in order to enhance the quality of the free viewpoint video. This method may or may not be real-time depending on the kind of algorithms for computing the required 3D information.

2. The second method extracts, from the 2D images, the texture and the geometry in order to reconstruct a 3D model of the scene. Then, it projects back this model to the requested virtual camera field of view and adds the adequate textures. Basically, the result is aimed to be real-time but not photorealistic. However, as the rendering technologies are progressing, by using last generation GPU, we can expect to reach an almost photorealistic free viewpoint sequence in real-time in the near future.

So, in the chosen architecture, both methods (implemented in the different computing modules) run in parallel and provide for each user request a free viewpoint video:

1. One of them, the 3D rendered video, is available for any virtual camera viewpoint and is computed in real-time but is not photorealistic (yet).

2. The other, the interpolated video, is only available for some particular virtual camera viewpoints (which are in the neighborhood of the real camera viewpoints) and is photorealistic but is not always real-time.

These two free viewpoint videos are sent to the "Free Viewpoint Broadcast Exhibition" that manages what the user will receive.

3.1.1. Professional user choices

Indeed, in an ideal world, the users would prefer to always have at their disposal photorealistic live free viewpoint videos. But, depending on the kind of camera viewpoint/viewpath requested, and as explained in the previous section on the technical constraints, this is not possible in all cases.

We cannot expect that the user chooses wisely the adequate free viewpoint computation method. He/she should not need to know anything concerning the advantages or drawbacks of the view interpolation compared to the 3D animation methods (for instance). In addition, in the future, the comparative merits of the computation methods could change or the system could be extended with new free viewpoint methods.

So, for the system to be scalable and future-proof, it is necessary to let the user make a choice he/she can understand;

- Photorealistic or not?
- Live or delayed?
- Any point of view or only a restricted range?

We may then express the technical constraints in the user's language:

- If the user requests photorealistic and live free viewpoint videos, then the system will restrict the range of reachable virtual camera viewpoints (possibly drastically).

- If the user requests photorealistic but not necessarily live free-viewpoint videos, then the system will also restrict the range of reachable virtual camera viewpoints (the admissible range should however be greater than in the previous case) and the user will have (in some cases) to wait for the effect to be ready. It means that the free viewpoint videos will be used for replays and not for live broadcasts.

- If the user requests live but not necessarily photorealistic free-viewpoint videos, then any virtual camera viewpoint is reachable and the user will be able to monitor in real-time and/or to play-out live free viewpoint videos (which are not necessarily photorealistic).

- If the user does not restrict the range of virtual camera viewpoints and requests, whenever possible, photorealistic free viewpoint videos, then the system will have to combine both computing methods for delivering the free viewpoint videos (live or not depending on the user preferences).

So, in addition to specifying the virtual camera viewpoint (and the start time and duration of the free viewpoint sequence in case of replay), this technical constraint might force the user, in some circumstances, to also specify if he wants photorealistic images or if he wants the result immediately (live), or if he wants completely free viewpoint videos.

3.1.2. Free viewpoint results

Finally, the user could receive several free viewpoint results; one for each of the modules which is able to compute the whole requested sequence or any part of it.

All results will be stored as clips on the FINE server and will share the same time code.

If necessary, a play-list will be automatically prepared.

3.2. Broadcast professional workflows

The system is designed so that it can be used equally well for "live event" workflows as for "post event" ones. Relatively to the workflow to which the system will be affected, the accuracy of the virtual output and the way it will be used/integrated in professional production may widely differ, but the corresponding user-scenarios in themselves are very similar.

3.2.1. Post event Free Viewpoint

The main characteristic of the "*post event*" Free Viewpoint workflows is that the system calculation resources are not limited by a real-time constraint, so that the degree of photorealism of the virtual output will be higher than in a real-time situation. This also implies that the range of virtual video effects will be significantly wider.

3.2.2. Live Free Viewpoint

The main characteristic of the "*live event*" Free Viewpoint workflows is that the system calculation resources are restricted by a real-time constraint, so that the degree of photorealism of the virtual output will be lower than in post-event situation. This also implies that the range of virtual video effects will also be significantly reduced.

However, it is not impossible that the evolution of the technology will enable the same kind of photorealism in future live workflows than in actual post-event workflows.

3.3. Free viewpoint usage scenarios

3.3.1. Free Viewpoint Image

The following user scenario describes how the operator creates Free Viewpoint images. This can be achieved either by defining a custom virtual viewpoint[2], or by selecting a predefined one, i.e. either the operator defines a new virtual viewpoint or he chooses one in a predefined list. Optionally, he may update a predefined virtual viewpoint and add this to the list of predefined virtual viewpoints.

A. Custom Virtual Camera definition

1. The operator selects a particular timecode (e.g. by using a touch screen "ruler" or progressive bar and/or console jog)
2. The monitoring interface displays a preview of the image ingested by a real camera by means of the 3D simulation engine.
3. The operator defines, by means of the touch screen and the console, a virtual camera position, orientation and field of view.
4. The monitoring interface produces immediately (without latency) a preview of the requested virtual image by means of the 3D simulation engine; in addition,

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[2] By Virtual viewpoint, we mean the definition of the parameters that set the position, the orientation and the field of view of the virtual camera.

the system gives information about its capability to compute the requested virtual image in real-time and/or in a photorealistic way.

5. The operator requests for the virtual image to be stored on the server or repeats step 3.
6. The server stores the virtual image that is available for playout or delivery purposes.
7. The operator may save the custom virtual viewpoint, so that it is available in the predefined virtual viewpoint list.

B. Predefined Virtual Camera selection

1. The operator selects a particular timecode (e.g. by using a touch screen "ruler" or progressive bar and/or console jog)
2. The monitoring interface displays a preview of the image ingested by a real camera by means of the 3D simulation engine.
3. On the touch screen, the operator selects from a list a predefined virtual viewpoint.
4. The monitoring interface produces immediately (without latency) a preview of the requested virtual image by means of the 3D simulation engine; in addition, the system gives information about its capability to compute the requested virtual image in real-time and/or in a photorealistic way.
5. Optionally, the operator modifies the predefined virtual viewpoint.
6. The monitoring interface produces immediately (without latency) a preview of the requested virtual image by means of the 3D simulation engine; in addition, the system gives information about its capability to compute the requested virtual image in real-time and/or in a photorealistic way.
7. The operator requests for the virtual image to be stored on the server or repeats step 3.
8. The server stores the virtual image that is available for playout or delivery purpose.
9. If the operator has modified the predefined virtual viewpoint, he may save the new virtual viewpoint, so that it is also available in the predefined virtual viewpoint list.

3.3.2. Free Viewpoint Video - Static Virtual Camera

There are several ways to produce virtual video. We will describe the most important ones in the following sections.

In these user scenarios, the virtual viewpoint (or the selected one in a predefined list of virtual viewpoints) is fixed for the whole duration of the virtual video clip. Either the operator defines a new virtual viewpoint or he chooses one in a predefined list. Optionally, he may update a predefined virtual viewpoint and add the one in the list of predefined virtual viewpoints.

A. Custom definition of virtual viewpoint

1. The operator selects a particular timecode IN (touch screen "ruler" or progressive bar and/or console jog?)
2. The monitoring interface displays a preview of the image ingested by a real camera by means of the 3D simulation engine.

3. The operator defines, by means of the touch screen and the console, a virtual camera position, orientation and field of view.
4. The operator defines a duration (or a timecode OUT).
5. On requests of the operator, the monitoring interface displays immediately (without latency) a preview by means of 3D simulation engine of the video "captured" by the virtual camera; in addition, the system gives information its capability to compute the requested virtual video in real-time and/or in a photorealistic way.
6. The operator requests for the virtual video to be stored on the server or repeats step 3.
7. The server stores the virtual video that is available for playout or delivery purpose.
8. The operator may save the custom virtual viewpoint, so that it is available in the predefined virtual viewpoint list.

B. Predefined virtual viewpoint selection

1. The operator selects a particular timecode IN (touch screen "ruler" or progressive bar and/or console jog?)
2. The monitoring interface displays a preview of the image ingested by a real camera by means of the 3D simulation engine.
3. The operator selects a predefined virtual viewpoint.
4. The monitoring interface displays a preview of the image ingested by a real camera by means of the 3D simulation engine.
5. Optionally, the operator modifies the predefined virtual viewpoint.
6. The monitoring interface displays a preview of the image ingested by a real camera by means of the 3D simulation engine.
7. The operator defines a duration (or a timecode OUT).
8. On requests of the operator, the monitoring interface displays immediately (without latency) a preview by means of 3D simulation engine of the video "captured" by the virtual camera; in addition, the system gives information about its capability to compute the requested virtual video in real-time and/or in a photorealistic way.
9. The operator requests for the virtual video to be stored on the server or repeats step 3.
10. The server stores the virtual video that is available for playout or delivery purpose.

3.3.3. Free Viewpoint Video - Dynamic Virtual Camera

In these user scenarios, the virtual viewpoint is not fixed between the enclosing time codes of the virtual clip. The dynamic virtual camera video can be produced following distinct methods:

- **Virtual viewpath**: A virtual camera viewpath is a succession of virtual viewpoints. When this method is chosen by the operator, the UI allows him to add, update and delete those definitions. When he has completed the viewpath, the UI allows him to save it. A question arising here is how the system will perform the "continuous" video of the virtual camera between the "discrete" virtual viewpoints. This could be achieved with two methods. Firstly, the system creates automatically the transitions between virtual viewpoints: either by a "rectilinear" transition, or by means of "3D curve" transitions. Secondly, the

operator selects virtual transitions[3], such as "rapid-fly", "top-view", "matrix effect", and so on, transitions between virtual viewpoints.

- **Target tracking**: In this user scenario, the virtual viewpoint follows a target.
- **Subjective camera** (POV = Point of view): In this user scenario, the virtual viewpoint is assigned to any subject in the scene. This subject may be a player, a referee, or any other interesting subject.
- **Top view**: In this user scenario, the virtual viewpoint is assigned to a "top" point in the space that surrounds the whole scene.

When the operator wants to produce a virtual camera video, he will have to choose one of these methods. We describe in the following sections the user scenario related to these methods.

A. Custom Virtual Viewpath

1. The operator selects the dynamic virtual camera video method in the touch screen; in this case he chooses the "Viewpath" method (button, radio button ,...)
2. The operator clicks on a "Create" button in a "Viewpath" section of the touch screen.
3. On the touch screen, the operator selects a particular timecode and defines a virtual viewpoint and a duration.
4. The monitoring interface produces immediately (without latency) a 3D-simulation preview.
5. The operator adds the virtual viewpoint to the viewpath definition.
6. He repeats steps 3 to 5 as many times as needed.
7. The operator selects a transition method between virtual viewpoints: automatic (defined by the system) or custom (defined by the operator).
8. At any time, the operator can get an immediate 3D-simulation preview on the monitor screen.
9. The operator requests for the virtual video as well as the viewpath definition to be stored on the server or repeats step 3.
10. The server stores the virtual video and/or the viewpath definition that is available for playout or delivery purposes.

B. Predefined Virtual Viewpath

1. The operator selects the dynamic virtual camera video method in the touch screen; in this case he chooses the "Viewpath" method (button, radio button ,...)
2. The operator clicks on a "Predefined" button in a "Viewpath" section of the touch screen.
3. The UI displays a list of predefined viewpaths.
4. The operator selects one of the predefined viewpaths.
5. The operator may launch immediately (without latency) a 3D-simulation preview of the video based on the viewpath definition.
6. The operator selects any virtual viewpoint.

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[3] Classical video transitions will are not managed within fine system. A classical NLE system is required to compose sequences with such transitions.

7. The UI allows the operator to modify or delete the virtual viewpoint and to get an immediate 3D-simulation preview on the monitoring screen of the resulting video[4].

8. The operator can also add, or insert a new virtual viewpoint between two existing ones in the selected virtual viewpath.

9. At any time, the monitoring interface can produce immediately (without latency) a 3D-simulation preview on request of the operator.

10. The operator can select a transition method between new and previously defined virtual viewpoints or update the previously defined virtual transitions.

11. At any time, the operator can get an immediate 3D-simulation preview on the monitor screen.

12. The operator requests the virtual video and the viewpath definition to be stored on the server, or repeats step 3.

13. The server stores the virtual video and/or viewpath definition that is available for playout or delivery purposes.

C. Subjective Camera

1. The operator selects the dynamic virtual camera video method in the touch screen; in this case he chooses the "Subjective Virtual Camera" method (button, radio button ,...)

2. The operator selects a particular timecode and immediately (without latency) previews the scene in 3D-simulation on the monitoring screen

3. The operator chooses the subject in the scene that will define the virtual camera.

4. The monitoring interface produces immediately (without latency) a 3D-simulation preview.

5. The operation sets a duration or timecode out.

6. The operator gets an immediate 3D-simulation preview of the virtual video on the monitor screen.

7. The operator requests the virtual video to be stored on the server.

8. The server stores the virtual video that is available for playout or delivery purposes.

D. Top View

1. The operator selects the dynamic virtual camera video method in the touch screen; in this case he chooses the "Top view Virtual Camera" method (button, radio button,...)

2. The operator selects a particular timecode and immediately (without latency) previews the scene in 3D-simulation on the monitoring screen

3. The monitoring interface produces a 3D-simulation preview.

4. The operation sets a duration or timecode out.

5. The operator gets an immediate 3D-simulation preview on the monitor screen of the virtual video.

6. The operator requests for the virtual video to be stored on the server.

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[4] The system has to take care of timecode shifts when updating or deleting virtual viewpoints in a viewpath.

7. The server stores the virtual video that is available for playout or delivery purposes.

E. Target Tracking

1. The operator selects the dynamic virtual camera video method in the touch screen; in this case he chooses the "Target tracking Virtual Camera" method (button, radio button ,...)
2. The operator selects a particular timecode and immediately (without latency) previews the scene in 3D-simulation on the monitoring screen
3. The operator chooses the target to be tracked.
4. The monitoring interface produces immediately (without latency) a 3D-simulation preview.
5. The operation sets a duration or timecode out.
6. The operator gets an immediate 3D-simulation preview on the monitor screen of the virtual video.
7. The operator requests for the virtual video to be stored on the server.
8. The server stores the virtual video that is available for playout or delivery purposes.

4. Non-professional users scenarios

4.1. Overview

The Non-professional User Scenarios are designed to satisfy the non-professional user requirements (derived in D2.1) as best as possible whilst adhering to the technical constraints of a practical non-professional-usage scenario.

4.2. Free viewpoint usage scenarios

Non-professional users will be able to quickly and easily change between pre-defined real and virtual camera angles, allowing them to direct their own camera selection interactively throughout the game. Pre-defined viewing angles can for example include, following a particular player, following the ball, and a "player's eye view" (player point of view). User's will be able to access footage in real-time during a match, and afterwards.

In addition non-professional users will be able to create, save and share their own directed footage. The primary non-professional use is expected to be simply viewing the output of the Fine system. However, non-professional users are strongly in favor of the possibility to share directed footage with friends and others both directly and via online social networks, and blogs, as well as being able to access footage from popular directors. There was also a strong interest among non-professional users to be able to access footage focused on a particular team or player. Such footage can be made available either from a professional user, or another non-professional user, and accessed across the non-professional user network.

4.2.1. CG animations

The following screenshots shots (see Figure 4-1 to Figure 4-5) show the refined user interface and first implementations of it using computer graphics representations of players.
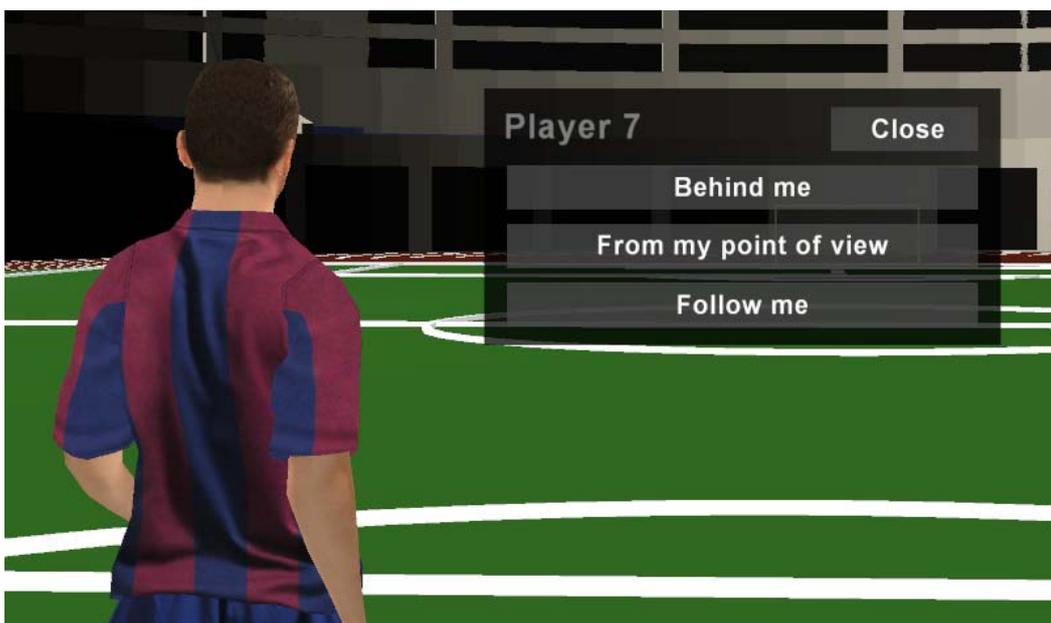
Figure 4-1 : The user can select three possible views associated with the player.
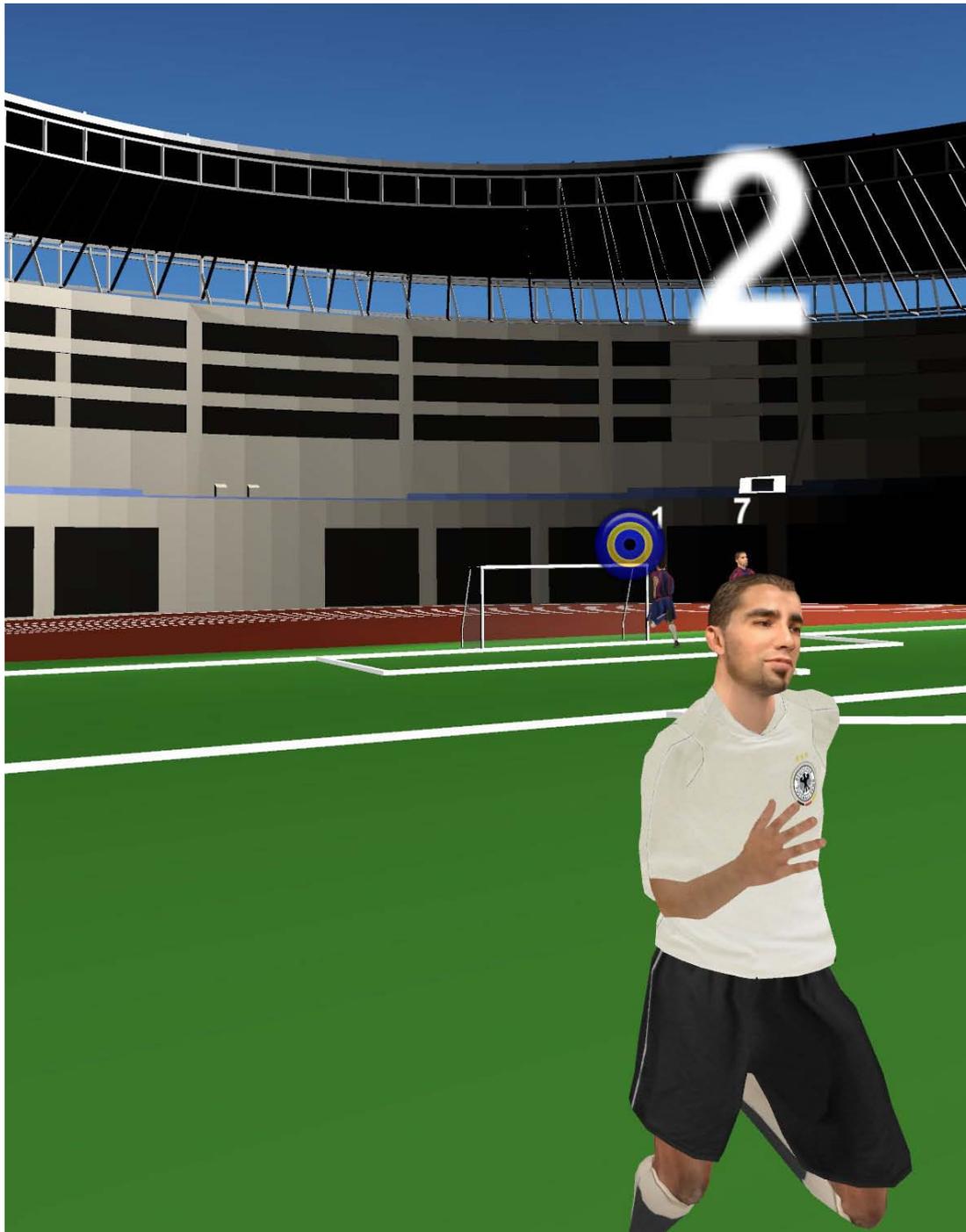

Figure 4-2 : User sees the scene from the viewpoint of the player

Figure 4-3 : User sees the scene from the viewpoint of the goal keeper

Figure 4-4 : User sees the scene from behind player number 3.

Figure 4-5 : User follows the player in the scene.

4.2.2. Photorealistic rendering

For photorealistic rendering the user can select the camera position for a free viewpoint view. The data of the scene is prepared from that camera position and delivered to the user for composition and rendering (see Figure 4-6).

Figure 4-6 : Photorealistic 3D soccer player (blue shirt) virtually positioned in real-time on the pitch alongside CG avatars.

4.2.3. Real-time effect

The system is aimed to provide a near real-time response time, if possible.

4.3. Usage scenarios based on the point of access

We can divide non-professional users into two groups, those attending the live event, whom we refer to as Arena Users, and those not at the event. The key differences are:

1. From a behavioral point of view the Arena User has significantly different needs than the user at home or at any other mobile location. This is due to the fact that the Arena User actually sees, or has the possibility to see, the full arena and all action simultaneously. This means that this user category is likely to have a wider spectrum of requirements on the FINE delivery when it comes to view points. Furthermore, it is quite likely that this user would generally have a need that is more post action than truly live. It is also a quite different packaging challenge in what ways the FINE content could enrich the real live experience compared to any offline experience.

2. The other main reason that differentiates the Arena User from other non-professional user scenarios is the networking possibilities with the core FINE content generation. Being on site at the arena, there are much better

possibilities to provide this user with extended bandwidth to access the FINE content and thereby increase the opportunity for interaction. In this sense the Arena User, in fact, comes much closer to the professional user than any of the other non-professional user categories.

Non-professional users who are not at the live event will access the system over the internet. In the case of the mobile user we envisage supporting a variety of Apple iOS and Google Android devices (see Figure 4-7).

In case the home user is at home, access will be via their TV, PC, netbook/iPad or Android tablet.

Most connection devices will have the possibility to connect to a large TV display or projector, allowing the user to enhance the viewing experience, and enjoy it with friends.

Figure 4-7 : Users will be able to view a dedicated CG scene on a variety of Apple iOS and Google Android devices.

Figure 4-8 : Augmented Reality with camera view from seating position in the stadium in real time.

Figure 4-8 shows a possible user scenario for the arena user. The focus of the services for the arena user should be post action, near real-time, selected viewpoints and actions. The potential for high bandwidth within the arena opens the possibilities for local sharing with a similar type of output as the Professional User. The arena user is a non-professional user, so it is essential that workflow be extremely quick and easy. There should be a community like approach that ties together all the people present at the arena enabling them to share the common outputs of the whole arena crowd. The hardware platform should preferably be surf pads and the network platform is most likely to be some form of Wi-Fi.

5. Conclusions

This report demonstrates the work that has been achieved to better understand and formalize the ways by which FINE users (both professional and non professional ones) will operate the system.

Following the results obtained during the first user interview, a new kind of non-professional user has been added (the arena user).

The user-scenarios described in this document are aimed to serve as a basis for the design of the UI. They clearly highlight the kind of interaction that any user would have with the FINE system in order to get free (virtual) viewpoints of the scene