D4.12.3

CARVIREN Experiment Results and Evaluation

2014-09-30

Manuel Vera López, Victor Andrés Andrés, Miguel Ángel Vicente, Carlos Padilla Sorbas (RealTrack Systems SL)

This deliverable reports on the implementation, execution and evaluation of the EXPERIMEDIA CARVIREN experiment that took place in the CAR Venue. This document provides EXPERIMEDIA software components developers with feedback on the usage of their components, and the venue partner with an overview of experimental results.

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<tr>
<td><strong>Authors</strong></td>
<td>Manuel Vera López, Victor Andrés Andrés, Miguel Ángel Vicente, Carlos Padilla Sorbas (RTS)</td>
</tr>
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# Table of Contents

1. Executive Summary ........................................................................................................... 5
2. Introduction ......................................................................................................................... 6
   2.1. General Description of CARVIREN Experiment ......................................................... 7
       2.1.1. Trampoline Widget ............................................................................................... 9
       2.1.2. Other Sport Widgets ......................................................................................... 10
       2.1.3. Mobile Transmission Unit .................................................................................. 11
2.2. Areas of Experimentation ............................................................................................... 11
2.3. Objectives ....................................................................................................................... 11
2.4. Overview of the Experiment Design ................................................................................ 12
2.5. Experiment Areas ........................................................................................................... 12
3. Experiment Preparation ..................................................................................................... 15
   3.1. Participants and Venue ............................................................................................... 15
   3.2. First Run ....................................................................................................................... 15
   3.3. Second Run .................................................................................................................. 17
4. Experiment Execution ......................................................................................................... 22
   4.1. First Experiment Run .................................................................................................. 22
   4.2. Second Experiment Run ............................................................................................. 22
5. Experiment Architecture ................................................................................................... 24
   5.1. RealTrack Components ............................................................................................. 24
       5.1.1. Sensors ............................................................................................................... 24
       5.1.2. DAPS ................................................................................................................ 25
       5.1.3. Sport Widgets ...................................................................................................... 26
       5.1.4. CARVIREN Website ......................................................................................... 26
       5.1.5. RealTrack Systems Component Architecture ................................................... 26
   5.2. EXPERIMEDIA Baseline Components ..................................................................... 26
       5.2.1. Experiment Content Component (ECC) .......................................................... 26
       5.2.2. Audio Visual Content Component (AVCC) ..................................................... 27
       5.2.3. Social Annotation Service ............................................................................... 28
   5.3. RealTrack Components and EXPERIMEDIA Components ................................... 30
   5.4. Functionality of the System ...................................................................................... 30
6. Quality of Experience Survey ........................................................................................... 32
   6.1. Results of the Survey ................................................................................................. 35
7. Analysis of Experiment Results
   7.1. QoS Analysis
       7.1.1. Number of Videos Recorded
       7.1.2. Facebook Event Metrics (Number of Posts, Likes and Comments) (AVCC-SCC)
       7.1.3. Recorded Sessions (RTS)
       7.1.4. Maximum number of users simultaneously (RTS)
       7.1.5. Average time in the Website (average usage)
       7.1.6. QoS on the Lime Survey
   7.2. QoE analysis
       7.2.1. Questionnaire and Questionnaire results
       7.2.2. Conclusions of QoE
   7.3. QoS and QoE Conclusions
8. Ethics and Privacy
9. Conclusions
   9.1. General
   9.2. Feedback on EXPERIMEDIA Baseline Components
       9.2.1. ECC Feedback
       9.2.2. AVCC Feedback
       9.2.3. Social Annotation Service Feedback
   9.3. Dissemination and Exploitation
   9.4. Exploitation and follow-up
1. Executive Summary

This deliverable reports on the implementation, execution and evaluation of the EXPERIMEDIA experiment for CAR VIRtualENvironment (CARVIREN), which focuses on a network for the CAR of Sant Cugat Venue; where information about the workouts of Biathlon and Trampoline are available to the “users” using a website.

Workout data is collected by a special hub, developed by RealTrack Systems. This hub, called WIMU is a portable hub of external sensors. It has also more than 20 sensors inside and it can be used in conjunction with other sensors. Thanks to its process capacity and reduced size, WIMU can be part of the fixed installation of the CAR Venue or become a Mobile Transmission Unit; able to collect, process and send data outside the Venue (with or without Internet access).

Training records are saved at CAR in a database. The raw data get processed by a data processor server, converting it into elaborated information. This information is displayed using sports widgets. These widgets (also called Sportwis) offer relevant information to help coaches and athletes in their path for performance improvement.

The Sportwis are being designed to process raw data and display it in a simple and relevant way. For this experiment, we have developed several widgets (description of all of them can be found later in this document).

In addition to the website and widgets services, CARVIREN integrates Baseline Components from EXPERIMEDIA: Audiovisual Content Component (AVCC), Experiment Content Component (ECC) and the integration of AVCC and the Social Content Component.

Thanks to this integration of Baseline Components, external sensors, sport widgets and WIMU, the user can access a whole new experience in trainings methodology. CARVIREN allows to record training with video, synchronizes data with the videos and boost social network relations between participants.

During this experiment, we have developed the website and its webserver, the data acquisition and process server (DAPS), mobile transmission units, integration with baseline components, sport widgets and a sport widgets server.

Two complete runs have been conducted, testing functionality and remote connection. All these experiments have been carried out in collaboration with the CAR of Sant Cugat Venue.
2. Introduction

The present report documents the preparation, experimental setup and analysis of the CARVIREN experiment, conducted at the CAR of Sant Cugat.

The deliverable is split in two parts. The first part (Sections 2-4) gives the description of the experiment, components used, runs, baseline components and the architecture. The second part is about the integration and results analysis of the experiment.

CAR Virtual Environment (CARVIREN) is an experiment conducted by RealTrack Systems in the context of the FP7 EXPERIMEDIA project. The Experiment consists of the development of a Virtual Community for the CAR Venue accessible using a browser where cinematic and physiological parameters with high definition recordings (from every training session) will be available in real time and/or remotely (if needed), and with the aim to provide rapid feedback to improve the athlete's performance.

In High Performance Centers, elaborated information is highly important. Information can come from multiple devices: wearables, machines, cam-recorders or information stored in the database. There is therefore a lot of raw data that has to be processed in order to be useful. This is one of the big problems: due to the different communication protocols and because each one uses its own system.

![Figure 1: CARVIREN – Biathlon discipline (SmO2 analysis).](image)

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1 SmO2: oxygen saturation (%)
The current state of the art brings us an opportunity to deal with the previous problems. First, because today technologies give us the chance to synchronize and deal with different devices in real time, and secondly, it gives the coach remote solutions, such as access to training sessions from his phone, no matter where he is, and in real time.

All that provides rapid feedback: elaborated and relevant information in real time and remotely if needed.

### 2.1. General Description of CARVIREN Experiment

The CARVIREN experiment focuses on high quality content production for the gymnastic training sessions. This content is what we call **relevant information**. Relevant information comes from elaborated raw data, including 3D motion capture based on inertial sensors and biomechanical analysis.

For example: raw data from an accelerometer contains metrics from each axis. These metrics can be displayed in a datasheet. Elaborated information takes that data and creates a graphical representation of the movement. Relevant information is the analysis of that elaborated information, such as number of impacts:

![Figure 2: Raw data from a 3D accelerometer.](image)

![Figure 3: Elaborated information (left) and relevant information (right). Impacts (using a 3D accelerometer)](image)

The main tool for the CARVIREN experiment is WIMU, a device developed by RealTrack Systems. WIMU is a light (88x52x29mm and 120g) smart device with microprocessor, RAM memory, 3D accelerometers, 1000 Hz gyroscope, magnetometer, barometer, microUSB and SD memory. WIMU has integrated Bluetooth, Ant+ and Wi-Fi radios. WIMU develops the concept of virtual sensors. Virtual sensors allow WIMU to deal with data generated by other devices like self-generated data.
These features make WIMU optimal to work as a hub, by connecting multiple devices together and synchronizing them in the same network. WIMU is plug-and-play and it connects easily with the CAR Wi-Fi infrastructure. It takes only seconds to setup for the very first time. Microprocessor and internal memory allow an installation of CARVIREN inside the WIMU. This possibility is a key point for Mobile Transmissions Units.

WIMU is not only a hub, it can be more. It can be a whole Mobile Transmission Unit (MTU). WIMU’s microprocessor can process data without being connected to the server. Internal memory and external memory (up to 32GB) can save the information collected and processed.

CARVIREN carried out research on synchronization of motion capture data gathered from the inertial sensors, video obtained from the cameras available at the CAR Venue and metadata. The experiment focused on the use of all those elements in the training process and on the improvement of the athlete's technique.

The experiment took place in the CAR Venue, with the interaction of athletes, trainers and other professionals involved in preparation and performance analysis.

So far, we knew the type of information we wanted to show (relevant) and the tool we were going to use to collect raw data. What we needed was to develop a way to display this relevant information in a simple way.
The answer to this requirement was to create the Sport Widgets (Sportwis). Sportwis are small utilities that show relevant information in a simple and easy way. Sportwis run in a web browser allowing any authorized person to access information from his tablet, laptop or a Smartphone (regardless of the model or operating system).

Sportwis were available in two modes: **real time** and **delayed mode**. In real time mode, information was displayed a few seconds after it was generated, while in History mode any information could be displayed by the system according to previously established access criteria (coaches, athletes, federations, etc.).

### 2.1.1. Trampoline Widget

Trampoline widget is a special widget developed for this experiment. This widget measures the flight time and can identify a jump. Why is this parameter so important?

Time-of-flight machines measure how long trampolinists spend in the air, and that calculation is factored into the scoring. The flight time machines cost more than 20,000€. This widget uses inertial sensors from WIMU (3D accelerometers, Magnetometer and gyroscope). Using a selection of each sensor’s channels, and applying a logarithm; an accurate flight time can be calculated.

It also measures maximum jump acceleration in Gs and angular speeds for the three axes.
Figure 6: Analysis of the 4th Jump of an athlete during a session (video and trampoline widget)

2.1.2. Other Sport Widgets

We developed other widgets according to the different needs of the experiment and the information we wanted to display for each discipline:

![Image](image_url)

**Figure 7: Available Sportwis**
2.1.3. Mobile Transmission Unit

Access to the dashboard is not restricted to be in the range of CAR’s Wi-Fi network. It is possible to upload a training session from outside the Venue. WIMU has been used as a Mobile Transmission Unit. The device stored all data collected from internal and external sensors onto a microSD card.

We had two scenarios:

Scenario 1: there was a network (with internet) and the hub is connected to it.

WIMU sent all the data to the acquisition and process server of CARVIREN. The training was displayed in real-time in the CARVIREN’s website.

Scenario 2: no network and no internet.

In this case, a “log file” was created and stored into the SD card. In this case, to record the session, the user had to push the record button of the WIMU manually (by pushing once at the beginning and twice at the end). When the user gets a computer with internet, he just had to take off the SD card, insert it into the computer and load the log using the “MTU Upload Loggers Application” from the CARVIREN website:

![Table of WIMU log entries]

This remote functionality was tested during the second run and for the final demonstration.

2.2. Areas of Experimentation

For this Experiment, there will be three disciplines involved:

- Trampoline: kinematic (flight time) and physiologic (Heart Rate and Muscle Oxygen consumption) data will be collected to check performance. Also videos from the AVCC repository and the Social Content Component (SCC)
- Biathlon: measuring the oxygen consumed in the muscle in real-time, cadence, speed and heart rate
- Gymnastics: measuring the oxygen consumed in the muscle in real-time

2.3. Objectives

Regarding the different parts involved in the experiment, there are specific learning objectives we wanted to achieve with the CARVIREN:

1) For EXPERIMEDIA:
a) Incorporate AVCC repository to our Virtual Environment.
b) Use new technologies to improve performance in the CAR
c) Apply new FMI tools in order to create a Virtual Network for the CAR

2) CAR Venue:

a) Improve the training process, implementing remote training when needed, classes and formative material no matters where, no matters when. That is what it is called Rapid Feedback, and it's vital, for a High Performance Centre
b) Develop a virtual environment that connects all actors.
c) Have a wider vision of the workout and accomplish a smarter training.
d) Combining data and video from the AV Repository with data collected by WIMU and offer these information together at the same time

3) Coaches and Athletics:

a) Combine the know-how with scientific analysis and improve the workouts
b) Remove physical and temporal barriers between coach and athletes.
c) Establish multidisciplinary contacts

4) Success of the Experiment

a) Measure Quality of Service and Quality of Experience
b) Connected QoS and QoE

2.4. Overview of the Experiment Design

The implementation of the CARVIREN experiment requires the integration of the WIMU’s hub system (developed by RTS) with the Experiment Content Component (ECC), the Audio Visual Content Component (AVCC) and the integration of the AVCC with the Social Content Component (SCC).

CARVIREN has also a website with a role system where all information (elaborated information) will be available in real-time and in delay mode for the different actors. This information was displayed using sport widgets.

2.5. Experiment Areas

For the experiments, four areas have been discussed with the CAR venue:

**Trampoline area;** where athletes had been training and recording the sessions with ATOS Camera:
Figure 9: Trampoline

**Biathlon:** with the study of oxygen saturation in the muscle (%), cadence, speed and heart rate parameters during cycling.

Figure 10: Moxy studio

**Gymnast:** occasional tests in different areas, such as pommel horse with Moxy (the device that measures oxygen saturation in the muscle $\text{SmO}_2$).

$\text{SmO}_2$ tells you how much oxygen is left after the tissues have taken the oxygen they need.
Remote Training: when an athlete is outside the CAR, we can still record sessions with WIMU and external sensors. They are saved inside the SD card of the device and loaded to the CARVIREN website:

Figure 11: Pommel Horse test

Figure 12: Remote uploaded workout in bicycle.
3. Experiment Preparation

This section outlines the preparation necessary to perform the experiments.

3.1. Participants and Venue

The experiment has taken place in the CAR venue. Over a period of 2 months, we have performed two experiment rounds and two free use weeks.

The first run took place the last week of July (starting the 21st of July).

The experiments involved the following participants:

- Coaches from trampoline who used CARVIREN during the first run (2 people).
- Athletes (5 people); three from Trampoline, one from Triathlon and one from Gymnastic. CAR technical Staff and Scientifics (7 people).
- RealTrack Systems Staff: experimenters have overviewed the execution and analysis of the experiments.

The second run took place the first and the second week of August (from 4th to 14th):

- One coach from pommel horse discipline.
- One athlete from pommel horse too.
- CAR technical Staff and Scientifics (7 people).
- RealTrack Systems Staff: experimenters have overviewed the execution and analysis remotely from Almeria.

3.2. First Run

We were testing functionality for trampoline and oxygen in muscle saturation. We used the ECC to collect QoS data from the baseline components and CARVIREN data of interest. For the experiment, CARVIREN data of interest were time spent in the website; number of users connected and number of training recorded.

System set-up involved various tasks:

1. Connection of WIMU to the Network
   Configuration of the right setup with the correct amount of signal and fluency (not too much, but not too low). The reason is simple, if the signal is too strong, WIMU won’t connect to a different AP when changing areas, and it could cause a delay (Figure 13). It should be clarified here that when a device is connected to a network, if the signal is under certain parameters (of quality, reception, etc.) it won’t disconnect from that access point. At the CAR Venue, WIMU connected (the first time) perfectly to the closest Access Point. Signal was still good when we moved from the laboratory to the trampoline area, so WIMU didn’t disconnect for the first AP and connect to the (new) closer AP. This was a roaming problem and helped us to deal with signal delay and solved it for the second run by adjusting the signal reception of the WIMU for a shorter range.

2. Set up all the components for the workout (HR Belt/Moxy; fabric belt, instructions, etc).
3. Creation of a new training in the CARVIREN system (Figure 14)
4. Start the workout
5. Run the workout (Figure 15)
6. Stop the training
7. Review of the training in delay mode (Figure 16)
8. Verbal feedback from athletes and technical staff.

Figure 13: Searching for a medium quality of the signal.

Figure 14: New training form
3.3. Second Run

The second run was conducted during the second week of August. It helped us to solve some problems with the ANT+ connection. We solved them by updating the firmware of the WIMU. For this run, there were two tests scheduled: a pommel horse session and the remote functions test.

We started with the pommel horse session. For this test we measured oxygen saturation in the muscle and recorded a workout.
This time, and thanks to the first run, we didn’t need previous steps 1 and 2 from the first run.

The rest of steps were the same:

1) Set Moxy for the workout
2) Creation of a new training in the CARVIREN system
3) Start the training
4) Run the workout
5) Stop the training
6) Review of the training in delay mode
7) Verbal feedback

After the pommel horse session, we continued with the second part of this run: the remote functionality of CARVIREN. In this part of the experiment, WIMU acts as a Mobile Transmission Unit.

We tested the two scenarios mentioned in section 2.1.3. For both tests, we used the help of Victor Andrés (worker of RTS and member of the Sport Association Mastrinkais).

**First Scenario: WIMU outside the CAR, connected to a wifi network with internet access. Podcasting in real-time from Almería:**

The steps were:

1) Simulate that the RTS’s office was a sport venue
2) Connect WIMU to our wifi network
3) Add the external sensors (heart rate, cadence, GPS, speed and oxygen saturation %)
4) Log into the CARVIREN’s website
5) Select the remote WIMU (Almería)
6) Start a workout (for triathlon)
7) Go around the block with the WIMU
8) Stop the workout 
9) Review

Disciplina

Triatlón

Atleta

Víctor Andrés

Wimu

Second Scenario: WIMU outside the CAR with no network or internet connection.

We used two Moxys, cadence, speed sensor, heart rate belt and gps.

The steps were the following:

1) Fully charge the sensors and the WIMU
2) Check SD card inside the WIMU
3) Preparation of the sensors on the bike
4) Set the Moxys
5) Go to an outdoor location (Sierra Alhamilla, Almería)
6) Start the session manually (pushing once on WIMU’s record button)
7) Ride and carry on with the workout
8) Stop the session manually (pushing twice on WIMU’s record button)
9) Save the log file from the SD card into the laptop
10) Log into the CARVIREN website (with admin role)
11) Go to the “upload logs tool”, and load the workout
12) Review of the workout

Figure 19: Preparation for the remote test
**Figure 20: Review of Victor’s workout**

The results and analysis of the two runs can be found in the next section.
4. Experiment Execution

Each experiment run was accompanied by its own steps guide (seen in the previous section), which aided the experimenters to ensure an efficient and correct execution of the experiments. Relevant details of the execution for both experiments are reported in the following paragraphs.

4.1. First Experiment Run

We had a problem connecting the web-service to the ECC, so we could not take any data about average usage of the website. We did take data for the rest of components.

We also experienced some issues regarding to the roaming and the hubs. RTS had to update some parameters from the WIMU and update the firmware. Once we solved this problem, we proceeded with the first part of the run.

The coaches and the athletes in trampoline conducted a series of workouts, in particular series of 10 jumps. We recorded all these sessions, trying to have a sample for each different jump (for later adjustments). Data was not fully synchronized with the video recorded by ATOS camera.

Two future improvements would come from this first part of the run (the timestamp from the video and an accurate flight time thanks to the sample).

The second part of the run included a Moxy in each leg, during the cycling workout of a triathlon test. Several CAR doctors and an athlete took part in this test. We recorded a session with two Moxys, the heart rate and the cadence sensor. The session was replayed after being recorded.

Feedback from the doctor at the test was good. Sm02 was definitely a very interesting parameter for them. So far, there are no other devices that measure this oxygen saturation in the muscle. This oxygen consumption is a key-parameter for improvement. Two Moxys allow a differential analysis for two opposite parts of the body (right and left leg; right and left arm, etc). The measures of Moxy (smaller than a Smartphone), the results in real-time and the export tool to xls were the perfect widgets for this session.

Figure 21: Moxy 1: left leg; Moxy 2: right leg

4.2. Second Experiment Run

In this run the ECC connection was available and we could monitor in real-time data about average use. The run has two parts.
For the first part (the pommel horse test), we recorded a training with a duration of 20 minutes. The workout consisted in the repetition of a pommel horse routine. For this test, we add a new feature, the activity marks.

This new feature allowed the coach to make marks between routines repetition:

![Activity marks during pommel horse test of run 2](image)

Figure 22: Activity marks during pommel horse test of run 2

No problems were detected during the test. Coaches keep analyzing the session after the athlete finished for at least 60 minutes. Once again, the oxygen saturation measurement in the muscle widget was one of the most appreciated features.

The second part of the Run (the MTU scenarios) was conducted without issues. We uploaded four sessions with different sizes: 5mb; 15mb; 50mb and 100mb. A 100mb session contains almost 70 minutes of training with a frequency of 40Hz.
5. Experiment Architecture

For this experiment, we have used three Baseline Components plus experiment-specific components developed by RTS. We are going to explain briefly each one of them (a more detailed description can be found in Deliverable 4.12.1) and we are going to review the architecture of the experiment and the components.

The diagram in Figure 23 gives a general idea of all the components involved and its relations:

![Diagram of Experiment Architecture](image)

**Figure 23: Architecture for the CARVIREN experiment within EXPERIMEDIA.**

5.1. **RealTrack Components**

In order to create this virtual environment, the following components have been developed:

5.1.1. **Sensors**

The first step was to establish which devices we are going to use and which ones needed a specific implementation study of their API/SDK. For example, we integrated Moxy, the oxygen saturation in the muscle monitor, speed and cadence sensors. These three sensors, they all used ANT+ communication protocol.

The new sensors required modification of the firmware of WIMU. WIMU could support 2 external profiles (two heart rate belts). With the new firmware, it was updated up to 8 external sensors, which is the maximum supported for ANT+ protocols (cadence, speed, heart rate, Moxy and remote control).
5.1.2. DAPS

The Data Acquisition and Process Server (DAPS) is the system in charge of reception and processing of data in order to generate elaborated information. This information will be stored in the database and it is available to the CARVIREN Sportwis.

DAPS has been installed in the CAR data centre. We have a space already configured with 100Gbs, 5Gbs RAM, Quad core and the Ubuntu 14.04 LTS I.O. installed.

DAPS manages the database with the sessions. Information arrived to DAPS by the information collected by the sensors linked to WIMU (internal and external). DAPS creates a session and saves it in the database, so it’s able to provide “sessions on demand” to the CARVIREN users. Users connect to the website. The website connects to DAPS using web sockets.

This is the UML Class Diagram:

![UML Class Diagram of the DAPS](image)

**Figure 24:** UML Class Diagram of the DAPS
5.1.3. Sport Widgets

Sportwis are developed in Dart. Dart is an open-source web programming language. Dart compiles the source code into JavaScript code, which allows it to be compatible with all modern browsers.

Communication between the CARVIREN website and the Sportwis is done by web sockets, allowing a bidirectional low latency communication. Once this phase of the experiment was completed, we integrated the Sportwis with the rest of the system.

5.1.4. CARVIREN Website

The CARVIREN website was developed using a JSF, a framework in Java language focused on web development. The reason was simple, this language allows a better access to our DAPS and also reuses components based on HTML5. JSF provides compatibility with smartphones, tablets and computers.

5.1.5. RealTrack Systems Component Architecture

Following, there is a diagram of the architecture of the CARVIREN experiment. This diagram shows how the RealTrack components were installed at the CAR Venue and how they communicate:

![Diagram of the RealTrack Systems Component Architecture](image-url)

Figure 25: Low-level system architecture for the CARVIREN experiments within EXPERIMEDIA.

5.2. EXPERIMEDIA Baseline Components

CARVIREN experiment used three modules developed within the EXPERIMEDIA facility:

5.2.1. Experiment Content Component (ECC)

CARVIREN has integrated the ECC component in order to measure data that helps us analyze the CARVIREN usage and the success of the experiment. The ECC is provided with APIs that can be used by ECC clients in order to communicate about experiments and measurements while the data is exchanged via a RabbitMQ message bus. These client APIs are available for
Java, Android, C# and C++ clients. We have used the Java client to connect Baseline Components plus our Hubs.

The first task to integrate the ECC was installing it a local server at RTS installations. First tests were done locally, in a controlled environment. After installing all ECC packages in a local Maven repository, we began the integration of the module with the

Figure 26: Diagram of the ECC and the relationship with the rest of components.

ECC was in the background, helping us to collect metrics from the Baseline Components, the website and the hubs. These hubs were not directly connected to the ECC, but to the DAPS. ECC gave us data of interest like connections, average time in the website; number of users created and connected, number of hubs connections, load workouts, created videos (and bitrate) and social metrics.

After the experiments concluded, the measurement data collected by the ECC can be accessed all at once via two CSV files (one with the metadata and the other containing the actual measurement data).

5.2.2. Audio Visual Content Component (AVCC)
CARVIREN accessed recorded content stored in the venue and live streaming using AVCC module provided by EXPERIMEDIA. Video can be recorded and stored at the “AV repository” of the AVCC.

The AVCC component is accessible as a webserver and offers the following interface:
Table 1: AVCC table of parameters

<table>
<thead>
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<th>Parameter</th>
<th>Description</th>
<th>Occurrence</th>
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<td>Title</td>
<td>A string representing the title of the video file to share on Facebook.</td>
<td>M</td>
</tr>
<tr>
<td>description</td>
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<tr>
<td>Category</td>
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<td>multiQuality</td>
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<td>C</td>
</tr>
<tr>
<td>html5Mp4U</td>
<td>A Boolean representing whether the video file has transcoding profile 'html5-mp4'</td>
<td>C</td>
</tr>
<tr>
<td>html5WebM</td>
<td>A Boolean representing whether the video file has transcoding profile 'html5-webm'</td>
<td>C</td>
</tr>
<tr>
<td>html5OggM</td>
<td>A Boolean representing whether the video file has transcoding profile 'html5-ogg'</td>
<td>C</td>
</tr>
<tr>
<td>html5Mp3audio</td>
<td>A Boolean representing whether the video file has transcoding profile 'Mp3 audio'</td>
<td>C</td>
</tr>
<tr>
<td>userName</td>
<td>A string representing the title of the video file to share on Facebook.</td>
<td>M</td>
</tr>
<tr>
<td>Path</td>
<td>A string representing the url of the video file to share on Facebook.</td>
<td>O</td>
</tr>
</tbody>
</table>

"M" (mandatory parameter) "O" (optional parameter) "C" (conditional parameter)

For the CARVIREN experiment, we have used the mandatory parameters, the transcoding profile 'html5Mp4U' (for computers) and the html5WebM (smartphones).

In order to sync data from the workout with the videos we had to request a timestamp from the video. We measured duration of the video and the workout. Because the order to start and stop both of them was given at the same time, durations of video and workout were the same. We just applied an offset to both timestamps.

5.2.3. Social Annotation Service

CARVIREN could also be defining a professional-social network in a small scale. The aim of using this component is to test if it's possible, for a High Performance Centre, the promotion through the social networks; or at least, the use of this environment as a social network inside the venue.

Because of the nature of the installation, the confidentiality of the training sessions can be crucial. However, coaches and technical staff could identify and share non critical content (with authorization of the athletes). In addition, we have the opportunity to test interactions between all actors involved in the experiment (athletics, coaches, staff, etc.) and see how it works in a small scale.

---

3 In computer science, an offset within an array or other data structure object is an integer indicating the distance (displacement) from the beginning of the object up until a given element or point, presumably within the same object. The concept of a distance is valid only if all elements of the object are the same size.
Here is where the integration of the SCC and AVCC modules comes in. This is how it works: a video is recorded inside the CARVIREN website (a training session or just a video); AVCC processes the video, and takes a highlight picture representative of the video. Then, a link is sent to the Facebook event page, and posted to the people invited to the event. The link cannot be shared, it doesn’t appear in the user’s biography, and the video still remains inside the CAR Database.

This is a diagram of the process:

![Integration of AVCC/SCC with CARVIREN](image)

Every time a new video is available for sharing on Facebook, a process running in the CARVIREN webserver sends an instruction to the AVCC webserver endpoint with both of the above mentioned parameters. Upon receipt of instruction, the AVCC webserver responds with a message regarding the status of the request.
5.3. RealTrack Components and EXPERIMEDIA Components

Following, there is a diagram of the relationship between RealTrack components and EXPERIMEDIA Baseline Components:

![Diagram of relationships between RTS and EXPERIMEDIA components]

Figure 29: Relationships between RTS and EXPERIMEDIA components.

5.4. Functionality of the System

The integration of RTS and EXPERIMEDIA components gave us the following functionalities of the CARVIREN:

1) Live and delayed recording of trainings
2) Users role manager
3) Sportwis: Moxy, heart rate (max, min and average), trampoline flight time, maximum jump acceleration in Gs and angular speeds for the three axis, cadence, speed and track in Google Maps.
4) Video recording with AVCC camera
5) Notifications on Facebook Event Page of each recorded AVCC video.
6) Remote training loading
7) Result exportation (in xls)
6. Quality of Experience Survey

In order to obtain user feedback in a more direct way, RTS has used the LimeSurvey service hosted at Infonova.

This service gives us the possibility to have an online recorded feedback, in real-time and personalized for each kind of user. Only the users that have used the CARVIREN have been given the link to the survey.

Using questionnaires to assess the users’ impressions of the CARVIREN experiment will directly contribute towards a successful evaluation of the Experiment’s impact on the users involved.

To be effective, a questionnaire should manage to get the desired information without taking too much of the participant’s time. The survey had to be flexible and changing. So different users with different roles could access the same survey, but it will change according to the role.

Figure 30: Screenshot of LimeSurvey

Most of the questions and answers have been formulated in the form of multiple choices. Questions have been divided into the following categories:

- **Identification**: there are 2 questions that will tell us the role, so the survey will change for each one of them. (Figure 31)
- **Quality of Service**: this is to determine quality of services metrics. (The metrics are defined in detail in Deliverable 4.12.2). (Figure 32)
Here is an example of conditional answer: when asking if the video was properly displayed, answering “yes” would mean a successful display of the video to the user and would result in new related questions appearing; in the case of a “no” answer, no new questions are asked.
Quality of service had two conditional questions that give rise to two extra questions, one for video, the other when you confirm you were able to record training sessions (it will ask you if you can replay that recorded session).

- **Quality of Experience**: to measure the subjective experience of each user about the video and the Facebook Event. In the following picture, you can see how questions about the Event are not asked. That’s because at the beginning of that particular survey, the chosen role was Technical Staff.

Here are the questions if the chosen role would be athlete:
There are 13 questions, with 3 extra questions depending on the role.

6.1. Results of the Survey
The analysis of the results of the survey is done in section 7.2, under the QoE analysis.
7. Analysis of Experiment Results

As discussed in EXPERIMEDIA deliverable D4.1, our aim for the CARVIREN experiments was to provide a useful private network for the CAR, where they can load trainings, watch them (in real-time or in deferred) in order to achieve improvement by rapid-feedback (just in time relevant information to change mistakes in the performance).

CARVIREN is a Private Social Network. And two of the most relevant metrics to measure the success of a social network are: number of users and average time of usage.

Because of the size of sample, no larger than 10-15 users from three different disciplines (including technical staff, doctors and sport’s scientists); number of users was not the most relevant metric to measure the success. The value we used was average usage.

Average usage is a QoS component, but related to QoE. The better content a website offers, the higher time the users will remain on it. Users won’t be in a website for long if the content in it isn’t good.

Using this reasoning, we related the usage time (QoS) to the QoE.

This metric is an important metric in the context of social networks popularity or success, because it tells the usage. It’s also used to establish a ranking (it does not take into account the number of total users, but the usage).

7.1. QoS Analysis

For the Quality of Service, we monitored the following metrics:

1. Number of Videos recorded (AVCC)
2. Facebook event metrics (number of post, likes and comments) (AVCC-SCC)
3. Recorded Sessions (RTS)
4. Maximum number of users simultaneously (RTS)
5. Average time in the website (Metric to connect with QoE)

7.1.1. Number of Videos Recorded

Here, we are measuring two values, number of videos positively recorded and average bitrate.

This metric is very important for us to understand QoE surveys about the video.

In digital multimedia, bit rate often refers to the number of bits used per unit of playback time to represent a continuous medium such as audio or video after source coding (data compression). The encoding bit rate of a multimedia file is the size of a multimedia file in bytes divided by the playback time of the recording (in seconds), multiplied by eight. For real-time streaming multimedia, the encoding bit rate is the output that is required to avoid interrupt: Encoding bit rate = Required output. The term average bitrate is used in case of variable bitrate multimedia source coding schemes. In this context, the peak bit rate is the maximum number of bits required for any short-term block of compressed data.
Following there is the average bitrate of all videos recorded within the 28\textsuperscript{th} of July and the 14\textsuperscript{th} of August:

![Average Bitrate graph]

The average gets very stable at 7,889.344 Kbit/s. This rate is actually the rate of HD videos. QoS shows videos recorded by ATOS (and processed) are by formal definition, high quality.

Regarding the number of videos recorded during the 2 runs, here are the stats:

![Video count graph]

Figure 36: Average bitrate during run 1 and 2

Figure 37: recorded videos during run 1 and 2
7.1.2. Facebook Event Metrics (Number of Posts, Likes and Comments) (AVCC-SCC)

For the sample, we have divided it in two groups: Developers (ICCS/NTUA, ATOS and RTS) and CAR Venue:

<table>
<thead>
<tr>
<th>Role</th>
<th>Number of Participants per Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTUA (Creator of the Event)</td>
<td>1</td>
</tr>
<tr>
<td>ATOS</td>
<td>2</td>
</tr>
<tr>
<td>RTS</td>
<td>2</td>
</tr>
<tr>
<td>CAR Technical Staff</td>
<td>3</td>
</tr>
<tr>
<td>Coaches (trampoline and pommel horse)</td>
<td>2</td>
</tr>
<tr>
<td>Athletes</td>
<td>3</td>
</tr>
</tbody>
</table>

The survey was conducted with participants related to the CAR. The results for both experiments:

![Figure 38: Facebook event metrics during run 1 and 2](image)

In the first run, RTS was actually in the Venue, so we showed the participants of the Facebook event, how it worked. It could have resulted in a higher use of this Component than for the second run when we were not present.

In order to compare them, we have created the graph averaged over all the videos in a run:
It’s clear the first run get more people involved, but Run 2 was without RTS participation.

### 7.1.3. Recorded Sessions (RTS)

This data will give us relation between real training sessions and the duration.

We have done a lot of tests and probes, with less than a minute duration. So we have to focus on real sessions.

In total of the two runs, we have recorded 5 workout sessions:

<table>
<thead>
<tr>
<th>Run</th>
<th>Duration (minutes)</th>
<th>Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Run</td>
<td>16</td>
<td>Triathlon</td>
</tr>
<tr>
<td>First Run</td>
<td>18</td>
<td>Trampoline</td>
</tr>
<tr>
<td>Second Run</td>
<td>15</td>
<td>Trampoline</td>
</tr>
<tr>
<td>Second Run</td>
<td>19</td>
<td>Pommel Horse</td>
</tr>
<tr>
<td>Second Run</td>
<td>21</td>
<td>Remote biathlon</td>
</tr>
</tbody>
</table>

As we can see, average duration of a workout is 17.8 minutes. Almost the same time as the average time spent in the website.

### 7.1.4. Maximum number of users simultaneously (RTS)

We have registered the following users at the Website:
Table 4: Different roles and number of them

<table>
<thead>
<tr>
<th>Role</th>
<th>Number of them</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrators</td>
<td>7</td>
</tr>
<tr>
<td>Coach</td>
<td>2</td>
</tr>
<tr>
<td>Athlete</td>
<td>4+2 (anonymous profiles)</td>
</tr>
</tbody>
</table>

The day with more access to the CARVIREN was the 12th of August, when we run a workout in pommel horse. These were the metrics:

![Figure 40: Simultaneous users connected during run 2](image)

The peak corresponds to the moment when the workout ended.

For the first experiment, we had problems with just 2 users connected simultaneously. It helped us to change and improve the performance of the webservice, so it can now go until 10-15 people without problems (tested in RTS).

In a real scenario, we get 6 of 13 users connected. Now, for these tests, there were no other users from other disciplines (7 users), that means, we were able to let all users involved (somehow) in that test (pommel horse, plus coaches and technical staff) connected to the website, checking the training.

7.1.5. Average time in the Website (average usage)

During 9 days, RTS was monitoring the website. There were a total of 534 CARVIREN’s logs. We know for sure, the top average usages of these sessions (seven logs) were due to our monitoring. The average time was 7.28 hours. So we are taking away these sessions.
That gives us a total amount of real logs from athletes, technical staff, scientists and doctors of 16 minutes and 38 seconds of average stay on the website.

Unfortunately, we cannot compare these results with average time in the first run, because of problems with the ECC and the webservice implementation.

Next graphic shows the evolution of average time in the website (starting the 5th of August and ending the 14th):

Figure 41: Average time in the website (run 1 and 2)

Average time increased quickly, and then became stable around 15-17 minutes.

7.1.6. QoS on the LimeSurvey

We used the LimeSurvey to get QoS data too. The questions were:

Table 5: Questions and answers for QoS (LimeSurvey)

<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of them worked (SQ001)</td>
<td>3</td>
<td>37.50%</td>
</tr>
<tr>
<td>All of them except the 3D model of the WIMU (chart widgets) (SQ002)</td>
<td>2</td>
<td>25.00%</td>
</tr>
<tr>
<td>Only the 3D model of the WIMU (SQ003)</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Only to a few of the chart type Sportwis. (SQ006)</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>None of them (SQ004)</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Was the video displayed?</td>
<td>Answer</td>
<td>Count</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>Yes (Y)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>No (N)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>No answer</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>8^4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Were you able to record training sessions?</th>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (Y)</td>
<td>7</td>
<td></td>
<td>87.50%</td>
</tr>
<tr>
<td>No (N)</td>
<td>1</td>
<td></td>
<td>12.50%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8^4</td>
<td></td>
<td>100.00%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Could you record a video session?</th>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (Y)</td>
<td>5</td>
<td></td>
<td>100.00%</td>
</tr>
<tr>
<td>No (N)</td>
<td>0</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Total</td>
<td>5^5</td>
<td></td>
<td>100.00%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Could you load the video sessions?</th>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (Y)</td>
<td>4</td>
<td></td>
<td>80.00%</td>
</tr>
</tbody>
</table>

^4 The athletes didn’t access the CARVIREN system directly; they saw the videos on the website and the training session with their coach and other members of the CAR staff.

^5 Only trampoline discipline had video recording option. The 5 surveys correspond to the people involved in trampoline discipline with admin/coach role.
<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, and it displayed always all the widget and the video (if available)</td>
<td>4</td>
<td>57.14%</td>
</tr>
<tr>
<td>Yes, but not all the time it displayed all the widget and the video (if available)</td>
<td>2</td>
<td>28.57%</td>
</tr>
<tr>
<td>Not always, still almost all the time</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Just a few times</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>28.57%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

There were 14 people invited to the Facebook Event. Only 11 confirmed. From these 11 people, 6 belonged to RTS, ATOS and NTUA. So, from the CAR, we had 5 confirmed people and 3 unconfirmed (corresponding to the 3 No answer). For these 5 confirmed users the following question was done too:

**About the Sport Widgets**: with the second question we wanted to test the role system. Only 8 of the 11 respondents had access to the sport widgets. From these 8, only 5 had access to all widgets.

Sport widgets were different depending on the role (the athletes only had access to the video, while the coaches and the technical staff had full access to all sport widgets.)
7.2. QoE analysis

7.2.1. Questionnaire and Questionnaire results
The number of recorded surveys was 11. For the surveys, the LimeSurvey tool was used. The questions about QoE were the following:

Table 6: Questions and answers for QoE (LimeSurvey)

<table>
<thead>
<tr>
<th>Role</th>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athlete</td>
<td>3</td>
<td></td>
<td>25.00%</td>
</tr>
<tr>
<td>Coaches</td>
<td>1</td>
<td></td>
<td>8.33%</td>
</tr>
<tr>
<td>CAR Staff</td>
<td>7</td>
<td></td>
<td>58.33%</td>
</tr>
</tbody>
</table>

Was the access to CARVIREN

<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very slow (1)</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Slow (2)</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Medium (3)</td>
<td>1</td>
<td>12.50%</td>
</tr>
<tr>
<td>Fast (4)</td>
<td>4</td>
<td>50.00%</td>
</tr>
<tr>
<td>Very fast (5)</td>
<td>3</td>
<td>37.50%</td>
</tr>
</tbody>
</table>

Number of answers: 8

Did you receive the alerts when a new session was recorded soon enough?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (Y)</td>
<td>5</td>
<td>100.00%</td>
</tr>
<tr>
<td>No (N)</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

*The athletes didn’t access the CARVIREN system directly; they saw the videos on the website and the training session with their coach and other members of the CAR staff.*
Those were the answers of the users that could record session with video and the athletes that watched it. To complete the questions about the video, we asked these users about video speed:

### Table 7: Questions and answers for QoE – deferred used (LimeSurvey)

<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video was running properly all the times</td>
<td>5</td>
<td>71.43%</td>
</tr>
<tr>
<td>Video was running too fast</td>
<td>2</td>
<td>28.57%</td>
</tr>
<tr>
<td>Video was running too slow</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

7.2.2. Conclusions of QoE

Overall, the main activities and functions of the CARVIREN worked.

We experienced some issues. A close review of each component follows:
• **CARVIREN website:** the access to the website was good. There were no problems with speed. All but one of the users responded fast or very fast (87.50%). One of the biggest problems of websites is the access time. Being fast doesn’t guarantee success, but a slow access is unforgettable.

• **AVCC Component.** More than the 80% of users qualified it as good/very good (7 or more in a scale of 1-10). The visualization was good too (71.4%). Thanks to the survey, we realized it was a good practice to reboot the server (it takes less than 2 minutes) before starting recording sessions (once a week top) to ensure it functions properly.

• **Experience on the** Social Annotation Service is also a 100% positive. The sample in Facebook included the 3 athletes that participated in the survey plus 2 of the other 5 users. All of them thought the service was good and fast enough. Again, with this kind of technologies, we are dealing with access time (or in this case, display time), which needs to be fast so as not to diminish the QoE.

• **User friendliness of the CARVIREN.** Thanks to informal feedback and after using the website, we realized there were some issues with user friendliness. We did some changes to improve the usability.

• **There were two kind of access to the CARVIREN.** For technical one (for developers) it was very tricky to make changes and, because we were dealing with functions such as restarting the server, connecting to the DAPS, or monitoring in real-time the web environment of each Hub.

On the other hand, we did change constantly the access to coaches, athletes and rest of CAR users. Our aim was to offer better features in a friendly user way.

### 7.3. QoS and QoE Conclusions
In order to measure the success of the experiment, we chose average time session in the website. CARVIREN is a private social network and the time users spend on it has to be correlated with the quality of the content.

We had an average time during the 2 runs of 16.97 minutes.

We realize that CARVIREN is not directly comparable to public social networks, e.g. Facebook or Twitter. We need to remember CARVIREN is a trial of a new environment so people would be bound to be curious about it and thus raise the time spent on it. However, the time spent, together with the feedback received by the athletes, coaches are certainly encouraging indications that this is something of definite interest to the people involved.

Following, we have a report from last January (2014) published by the Wall Street Journal. In this report we can find the minutes per visitor. As we said before, we cannot compare CARVIREN to these social networks, but the following graphic gives us an idea of the current situation:
This time is an average, and it's not the session time, but we can do an extrapolation for different number of visits:

<table>
<thead>
<tr>
<th>Visits</th>
<th>Monthly time (minutes)</th>
<th>1</th>
<th>15</th>
<th>30</th>
<th>60</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facebook</td>
<td>405</td>
<td>405</td>
<td>27,00</td>
<td>13,50</td>
<td>6,75</td>
<td>4,50</td>
</tr>
<tr>
<td>Twitter</td>
<td>21</td>
<td>21</td>
<td>1,40</td>
<td>0,70</td>
<td>0,35</td>
<td>0,23</td>
</tr>
<tr>
<td>LinkedIn</td>
<td>17</td>
<td>17</td>
<td>1,13</td>
<td>0,57</td>
<td>0,28</td>
<td>0,19</td>
</tr>
<tr>
<td>MySpace</td>
<td>8</td>
<td>8</td>
<td>0,53</td>
<td>0,27</td>
<td>0,13</td>
<td>0,09</td>
</tr>
<tr>
<td>Tumblr</td>
<td>89</td>
<td>89</td>
<td>6,00</td>
<td>3,00</td>
<td>1,50</td>
<td>1,00</td>
</tr>
<tr>
<td>Pinterest</td>
<td>89</td>
<td>89</td>
<td>6,00</td>
<td>3,00</td>
<td>1,50</td>
<td>1,00</td>
</tr>
<tr>
<td>CARVIREN</td>
<td>Fixed Value: 17 minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The monthly time spent on social networks is not telling us the number of visits. We can see that engagement on CARVIREN appears good. It would be interesting to know what could happen if CARVIREN continues in the future.
8. Ethics and Privacy

According to detailed ethical guidelines in EXPERIMEDIA deliverable D5.1.2, all EXPERIMEDIA experiments need to be conducted in accordance with certain ethical oversight procedures. Those principles were integrated in an adequate way into the design of the CARVIREN experiment.

The only update from the last deliverable (4.12.2) was under the formal requirements.

CARVIREN experiment intends to record actual motion and sensible data from real athletes in the CAR Venue. This situation was discussed during the EXPERIMEDIA General Assembly held in Madrid in October 2013 and in Leuven in December 2013. It was agreed that we will sign a Controller-Processor Agreement under the current Data Protection Act (DPA) used at CAR.

This document was finalized and signed during the General Assembly in Barcelona, in May, between RTS and CAR.

Before that, no real data was collected.
9. Conclusions

9.1. General

Overall the experiment has been successful in many aspects. First of all, the fact that CARVIREN, the social private network for CAR, had a high average time spent in the website. Combined with the positive feedback received by the athletes and their entire environment, it makes us optimistic about a possible commercial acceptance of a future version of this network as a product.

As a future commercial product, almost all parts of the work done will remain.

RTS has been working in high performance for almost 7 years. We are used to developing new monitors (the Sportwis in this experiment). A project like this one, gave us the opportunity to test new areas we haven’t tested before (trampoline and oxygen saturation).

Furthermore, we had the possibility to integrate interesting new FMI technologies like the ones of the EXPERIMEDIA Facility, namely AVCC and SCC.

Regarding the Experiment, the most important part was being able to record videos and training sessions, which according to the QoS and the QoE was a moderate-high result. This part was accomplished.

Another important achievement was the synchronization of data with video. This has a great impact on sport training, as when reviewing workout sessions the simultaneous production of data and video can be of great value only if appropriately synchronized.

The sport widgets are also an important achievement. Trampoline air time was not easy at the beginning to calculate, because of the great number of parameters. It required a lot of time and simulations. Final result is a widget with an error no higher than other professional machines.

About CARVIREN’s website, there were weaknesses, mostly due to the lack of user friendliness. But as any other platform, improvements came with use and suggestions. Changes have been implemented leading to a better platform.

There were also other areas to achieve improvements. More widgets and more cameras on different rooms could be integrated into a commercial version.

We cannot forget that it will never be as big as a public social network, so potential users are not going to be a large sample, maybe 30-40 users.

EXPERIMEDIA Components have turned out to be great assets. They were reliable and worked as expected and the support for each component was really quick and efficient. As commercial services, the components could be a very competitive solution.

9.2. Feedback on EXPERIMEDIA Baseline Components

With the CARVIREN experiment, we have focused on using the ECC as a metric logging system, the AVCC for video recording and the Social Annotation Service (SCC-AVCC integration) for the social integration.
The experience has been very good, not only because those are very good tools, but also because we had very good support.

9.2.1. ECC Feedback

ECC has proved to be a very powerful tool. The amount of data and detail is a clear key advantage.

Although it might appear complicated, it is as easy to use as any other monitor tool. In version 2.1, we found an incredible stability and fluency. Also, a very useful feature is the possibility to collect and view live metrics.

Furthermore, the possibility to add one’s own metrics (in our case, our hubs and average usage time) is important. So, you combine metrics from Baseline Components with any other data you need. The fact that it is available for C#, C++, Android and Java is very useful as it allows compatibility with many different systems.

You can export all data in CSV which is much better (when you want to keep control and do your own stats) than XLS (because of the huge amount of data, datasheet cannot responded).

Bottom-line, it’s a very powerful tool, very flexible and with many possible applications.

9.2.2. AVCC Feedback

It’s a very easy to integrated component, which an incredible support Company behind. Every single time we experimented problems with the video (too slow, fast) we get rapid-response, and we were able to solve all the problems. We haven’t used all functionalities, but the few we have implemented on CARVIREN work perfect.

9.2.3. Social Annotation Service Feedback

This was the easiest Component to integrate. It surprises all of us, how simple and easy it was to integrate. Obviously, there is a significant amount of work behind, but the performance during the Experiment was smooth without any problems at all and the service was very user-friendly.

From a commercial point of view, the event on Facebook (combined with the video) is something that can save a lot of time and it’s an application customers could look to integrate with their systems.

9.3. Dissemination and Exploitation

Intermediate and final results of the CARVIREN experiment have been disseminated via several channels, mostly social networks:

- Three articles in our blog:
  - [http://blog.realtracksystems.com/2014/06/02/EXPERIMEDIA-2014-CARVIREN-demonstration/](http://blog.realtracksystems.com/2014/06/02/EXPERIMEDIA-2014-CARVIREN-demonstration/) (more than 2,500 visitor)
  - [http://blog.realtracksystems.com/2014/08/01/first-run-of-CARVIREN/](http://blog.realtracksystems.com/2014/08/01/first-run-of-CARVIREN/) (in two weeks, it had 1,893 unique visitors)
• Wikipage (to be realized when the experiment ends with the approbations of the Consortium Members)

• Case study (Spanish and English): This eBook will be available in Amazon and other platforms when the Experiment ends and with the approbation of the Consortium Members

• Social Hashtag: #CARVIREN and a twitter campaign.

• Also, another social networks has been used, such us LinkedIn and Google Plus

9.4. Exploitation and follow-up

The exploitation of CARVIREN technology aims to provide services to 3rd parties. Sport monitor services in real-time and deferred mode.

RTS has been in the high performance sector for a few years, and it’s very well-known that every piece of data counts in high performance. Coaches and technical staff are very reserved when analyzing data comes. They want to keep control of every single collected data, which means, CARVIREN could be a good tool to help them having relevant information plus the whole logs recorded inside the hubs.

A collaboration agreement with CAR for further exploitation is going to be signed. It will bring forward the following exploitation possibilities:

• The possibility of integrating new external sensors gives to the system new updates and further widgets.

• Access to specialized staff in High Performance

• Marketing promotion thanks to CAR showroom activities (with other high performances centers and federations)

• Improvements in our products thanks to the continue development and feedback

Also, we are going to integrate the sport widgets we have created in EXPERIMEDIA in our current commercial products (Sm02 into Seego\(^7\) and Trampoline Widget into our future software Wisee). Both products monitor real-time activity using a Tablet in a visual way and use ANT+ protocol. Therefore, the work carried out in the context of EXPERIMEDIA provides many possibilities for exploitation which we will definitely pursue in the next months.

\(^7\)http://seego.realtracksystems.com/