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List of Participants (Core Institutions)

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2	Dublin City University	DCU	IR
3	Groupe des Ecoles des Télécommunications	Institut Telecom	F
4	Fraunhofer Institute for Telecommunications Heinrich Hertz Institute	HHI	D
5	University of Geneva	UNIGE	CH
6	Informatics and Telematics Institute	ITI	GR
7	Korea University	KU	KR

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Executive Summary

3DLife aims at stimulating joint research and integrating leading European research groups to create a long-term integration of critical mass for innovation of currently fragmented research addressing media Internet. It fosters the creation of sustainable and long-term relationships between existing national research groups and lays the foundations for a Virtual Centre of Excellence (VCE) in media Internet.

This deliverable reports all types of activities that have been carried out jointly among 3DLife participants during month 25 - 30 of the project, i.e. January to June 2011. The works reported in previously are not repeated in this document. These activities can be mainly categorised into four types: management, integration, research and development, and dissemination. The joint work to be presented in this deliverable is mainly reported on per activity basis, highlighting the main contributions from each involved partner. This deliverable also presents a status report on pending deliverables and milestones, and provides a conclusion about the reported joint activities in months 25 - 30 and an overview of future work in the next period.

In WP1 (Management and Auditing), coordination and management activities which are conducted during the reporting period have been presented. Specifically, efforts have been contributed on meeting organisation, reporting, communication with EU commission, and concertation during the reporting period. WP2 (Integration of People and Organizations) is focused on facilitating integration of personnel and resources within the network. During this reporting period, one senior research visits have been conducted and around 2 PhD exchanges 3 industrial placement have been conducted, ongoing or planned. Moreover, the list of performance indicators have been updated for monitoring integration activities. One key achievement in WP2 is the resubmission of improved Erasmus Mundus proposal in April. For WP3 (Pan-European Integration), significant progresses have been achieved for EMC^2, including the completion of company registration, finalised business plan, establishment of external advisory board, and organising an industry panel session in WIAMIS 2012. The HUAWEI/3DLife grand challenge 2012 was organised and sponsored by Huawei Company second year in the raw. In WP4 (Media Internet Research) progresses have been made in different research areas centred at ACM MM Grand Challenge and 3D media internet in general. These research activities result in several successful joint publications. Details of joint activities are described following sections. WP5 (3DLife Framework for Integration) targets the design and installation of necessary technical infrastructure to enable and facilitate human and technical integration activities. During the reporting period, the main efforts reported include the maintenance and upgrade of 3DLife technical repository, collection of potential contributions to 3DLife research, teaching resources and equipments. The aim of WP6 (Spreading of Excellence and Outreach) is to spread the Network's excellence in all types of efforts and activities. The main progress includes the maintenance and upgrade of the 3DLife website, promotion of 3DLife groups in several social networks. Both WIAMIS 2012 and MediaSense summer school were organised successfully during this reporting period.

This deliverable also presents a status report on pending deliverables and milestones, and provides a conclusion about the reported joint activities in months 25 - 30.

1 Joint Activities and Major Achievements during the Reporting Period

1.1 WP1: Management and Auditing

Within this work package the management team of 3DLife runs the management procedures on daily bases to ensure the project operates smoothly. Specifically, this WP takes care of meeting organization, moderating discussions, monitoring progresses in activities, reporting, communication with the EU, handling legal and financial matters. As the coordinating partner, QMUL has been maintaining and upgrading the project management scheme.

The following deliverable and SMART indicators were due during the reporting period:
- Deliverables
  - D1.1.9 (M27) The 9th quarterly management report (QMUL) - ***Submitted***
  - D1.1.10 (M30) The 10th quarterly management report (QMUL) - ***Submitted***
  - D1.2.5 (M30) The 5th report on joint activities of the network (QMUL) - ***Submitted***
- Milestones
  No millstones were due during the report period.
- SMART Indicators:
  No SMART indicators were due during the report period.

A1.1: Project administration and reporting

QMUL, as the coordinating partner, has been monitoring the preparation and submission of all deliverables, making sure that they are delivered timely according to the description of work. Deliverables and their status during the reporting period are listed in Section 4 - Deliverables and milestones in month 25 - 30.

During the reporting period, there were two project review meetings organised. For both meetings, rehearsals have taken place to enable final preparations for the review. Details of these meetings are as below:

- 4th review meeting
  Date: 16 February 2012, 9:00~16:45
  Place: Room BU25 0/S5, EU Commission premises, Brussels
  Attendants: The project officer, project reviewers, and all 3DLife NSB members.
  In this meeting the achievements by 3DLife in months 19~24 of the project life were presented to the project reviewers and the European Commission. Presentation sessions and a technical demonstration session were organised. Questions from the reviewers have been answered and valuable feedbacks were received.

- 5th review meeting
  Date: 18 April 2012, 14:15~17:45
  Place: Room BU25 0/S1, EU Commission premises, Brussels
  Attendants: The project officer, project reviewers, and all 3DLife NSB members.
  This meeting focused on the feedbacks to the comments received from 4th review, and on the outcomes of actions implemented by consortium to achieve all project objectives. In

addition, the 3Dlife financial report for Year 2 (expenditure and resources) was presented and elaborated to the review team.

In addition to the above mentioned meetings, several NSB and technical tele-conference have been organised for detailed management or technical discussions. Following topics have been addressed in these meetings:
- EMC^2 and technical discussions.
- Actions to achieve all project objectives
- Additional work and actions in cooperation with the SA-EMC^2.
- Preparation and the submission of a new Erasmus Mundus Proposal
- Business plan of EMC^2
- Collaboration with 3DLife/EMC^2/REVERIE

More details and meeting minutes of these group meetings are available on 3DLife management wiki.

A1.2: Communication with the EU Commission

The project coordinator, Prof. E. Izquierdo, has been constantly updating the EU project officer about the project progress, issues and visions. Thus the European Commission has been well informed of the latest project developments.

A1.3: Concertation, consensus and clusters

On 23rd March 2012 in Brussels, 3DLife represented by Professor Ebroul Izquierdo participated in EC the transversal cluster meeting aimed at setting up a new EC Entrepreneurship and innovation cluster focusing on technology entrepreneurship. EMC^2 represented by Dr George Whales also participated and contributed in this meeting in order to play a key role in the early stages of entrepreneurship initiatives in the EC. The main objectives of this cluster meeting included: (a) To allow the projects supported by the European Commission in the area of entrepreneurs and innovation to get to know one another and look for synergies; (b) To agree on the main tasks for the cluster; and (c) To define the governance structure of the cluster.

On 29th March 2012, a meeting was held to discuss the interaction and clustering between 3DLife, EMC^2 and REVERIE projects. During this meeting Professor Ebroul Izquierdo and Dr George Whale presented the progress and achievements of 3DLife and EMC^2 respectively. Valuable feedback on the EMC2 business plan was obtained from REVERIE industrial partners .

A1.4: Handling of IPR, legal matters and gender issues

There has not been IPR, legal or gender issues during the reporting period in the project.

A1.5: Financial planning, accounting and financial audits

D1.3.2 (M24) (the second annual financial plan and audits) has been approved during this reporting period.

1.2 WP2: Integration of People and Organizations

This work package focused on integration of people and organisations within 3DLife and facilitating the exchange of personnel within the network. It considers researchers at all levels from experienced senior researchers, through post-doctoral level, to PhD level. Specifically, it targets substantial exchange of academic research personnel and short scientific missions. The work package is broken down into the following five specific activities.

The following deliverables, milestones and SMART indicators were due during the reporting period:
- Deliverables
  No Deliverables were due during the report period.
- Milestones
  - MS2.1.2 (M30) – 12 research exchanges within the network (including at least 4 senior research visits and 2 industrial placements) (TPT) - *Achieved*
- SMART Indicators:
  - SI2.1.2 (M30) – Completed research exchanges (TPT) - *Fulfilled*
  - SI2.6 (M30) – Update of qualitative and quantitative performance indicators (QMUL) - *Fulfilled*

A2.1: Exchange of Senior Research Personnel

During the reporting period, Gael Richard from TPT visited HHI and Technical University (TU) of Berlin (which is an external partner but also part of the submitted Erasmus Mundus proposal.) on April, 26th 2012. This visit was the occasion to give a seminar talk on audio signal processing to a wide audience of researchers and students (between 25 and 30 people have attended the talk). The talk also included a presentation of the Huawei/3Dlife ACM Grand Challenge 2012 to attract participants and spread the 3Dlife databases recorded for this challenge. Part of the visit was also dedicated to further discuss the Erasmus Mundus programme proposed within 3Dlife with two of the partners of the submitted proposal (including a new partner who is not involved in 3Dlife: TUB represented by Prof. T. Sikora). Finally, Prof. G. Richard participated as opponent in the jury of the PhD defence of F. Kaiser. This visit has then not only served to spread 3Dlife excellence but it has also prepared future collaborations on both research and teaching at PhD level.

All research (senior, PhD and industrial placement) exchanges are reported with more details on the 3Dlife Wiki (http://3dlife.qmul.net/wiki/doku.php?id=3dlife:wp2). More recently, new integration measures were defined and each visitor has to complete a questionnaire on the quality of integration (see activity A2.5).

A2.2: Exchange of PhD Students

During the reporting period, 2 PhD student exchanges were finalized, both after a rather long duration (6 months). More precisely, these exchanges involved 2 students from the University of Zilina (Slovakia), respectively hosted by TPT and QMUL. Both internships were financially supported by EMC^2 fellowships. Their topics addressed the problem of emotion recognition using kernel learning approach. The internship of Martin Hric was more specifically dedicated to the implementation in the global system for 2D/3D recognition of emotional states of humans, while Bruno Gardlo investigated the notion of quality of experience (QoE) in 3D applications using social network environment. Both exchanges were successful and should lead to joint publications. As an example, one of these visits is further described below (extract from the visit report):

Visit of Bruno Gardlo (Zilina) at QMUL (Nov. 2011- April 2012)
Provisioning digital video services is a difficult task as it is hard to estimate optimal settings of video parameters, given transmission constraints, while maximizing the overall end-user quality. With Internet streaming services becoming part of our everyday life, end-to-end optimization of such systems is important. On one hand, huge effort is given into subjective or objective evaluation of the end-user perception. High quality audiovisual perception with respect to the minimized costs of the provided service is one of the main interests for the network providers. On the other hand, subjective evaluations to determine best video and audio configurations are often evaluated in controlled test laboratory environments, which have little to do with the real environments in which consumers enjoy such content. Unfortunately, no serious attempts have been made to take into account interactions between quality of the content and its perception at the end-user side when provisioning end-to-end video transmission systems.

In contrary to the traditional laboratory assessments, new methodologies for conducting subjective assessments in the end-user's natural environment are being developed. In this context, crowdsourcing emerges as an interesting concept for conducting subjective user tests in a real world environment. The crowdsourcing users conduct the tests remotely at their own computers in a familiar environment. In particular, they launch a web-based application in their browser and click through the subjective test. The basic idea of crowdsourcing is to utilize a huge number of Internet users, such that tasks are completed within short time and at low costs.

This 3DLife Fellowship Program was focused on application development suitable for use in a new methodology for Quality of Experience (QoE) evaluation at the end-user side by exploiting crowdsourcing possibilities. For this purpose, the new web-browser-based application implemented into Facebook.com GRAPH API has been developed. Furthermore, initial testing was performed and subjective QoE results from different crowdsourcing platforms, but also comparison to subjective testing conducted in the QMUL Performance LAB were obtained.

A2.3: Industrial Placement of Research Personnel

The 2 joint PhDs between the French SMEs and TPT previously declared in the Report on Joint activities D1.2.4 are ongoing with satisfying progress. For both of them, frequent discussions occur between the respective companies and TPT. Note that for one of the students, a joint publication between TPT and the SME Arkamys on audio signals dereverberation was submitted to the IWAENC conference (*N. Lopez, Y. Grenier, G. Richard, Y. Bourmeyster, "Low Variance Blind Estimation of the Reverberation Time", submitted to IWAENC2012*). Future collaboration between TPT and Arkamys was further discussed in a brainstorming session in May 2012 at Arkamys. This may result in additional joint works or technology transfer opportunities in the medium term.

Virginia Fernandez Arguedas (QMUL) visited to company ISDEFE for two weeks starting on 16April. This research activity promote the internal integration of Queen Mary University and ISDEFE by understanding the different approaches in order to find shared areas of collaboration in privacy issues of video surveillance within the public sector. During the industrial placement, the final user needs were analysed for the definition of a set of use cases, such as "cash and carry" and traffic accidents event detection. The compendium of the different use cases were proposed for the development of a forensic search tool, which enables the efficient semantic labelling, storage and retrieval of relevant information by

exploiting the behavioural information implicit within the moving objects. Moreover, due to the mandatory compliance of the surveillance video analysis techniques with privacy protection and ethical laws, an in-depth analysis of the privacy, ethical and user constraints and requirements for the abovementioned forensic search tool was carried out. The future plan for collaboration between ISDEFE and QMUL will focus on the development of the proposed forensic search tool considering not only the final user requirements but also its compliance with the privacy and ethical constraints.

A2.4: Jointly Post-Graduate Courses

A new Erasmus Mundus proposal was submitted last April (deadline was set to April 30th). This new proposal was largely inspired by the previous one submitted last year, but strengthened several aspects, including:

- An extensive survey of existing Erasmus Mundus joint programmes. Consequently, the budget model and fee handling were completely rethought. On the other hand, the survey confirmed the necessity to simplify the consortium structure of our proposal.
- A simplified consortium structure consisting of 5 High Education Institutions (HEI), namely QMUL, TPT, DCU, KU and a new external partner, Technical University of Berlin, complemented with associate partners which can provide additional services including links with industry and internships (HHI, ITI).
- A central and simplified scheme for the grant management and a detailed description of the implementation costs. More precisely, implementation costs have been calculated using the following main principles:
  o A single and centralised office supported by a part-time secretary at the coordinator site.
  o An efficient and consensual fee scheme: to cope with the significant discrepancies between HEIs in terms of fee policy, it was agreed first to waive any fee above 2.8 k€ and then to charge the participating student only for the average fee between institutions. Thanks to the balance in terms of number of PhD students in each partner, this allows to reach an average yearly fee of 1200 €.
  o Some budget is reserved for programme meetings (management and scientific meetings, PhD jamboree).
  o A central budget is secured for future dedicated actions (special events organisation, PhD prize).
- A better integrated learning programme with a stronger emphasis on learning entreneurial skills in comparison with more classical technical skills.

A2.5: Monitoring and Evaluation of Integration Activities

This activity aims at monitoring and evaluating the integration activities. The work in this activity has mainly focused on two aspects:

1) Identification of 19 evaluation indicators for integration activities, and constantly monitoring the progress of these activities based on the indicators.
2) Definition and update of a set of questionnaires for subjective evaluation of integration activities, as well as utilising a professional tool, WarpPLS, for evaluation model construction and analysis.

During this reporting period, based on previous monitoring results and experiences, qualitative and quantitative performance indicators for M42 have been revised. Types of updates include:

- Add exact quantities for quantitative indicators that were not specified previously (e.g. number of tool/demo generated for future junior research exchange)

- Adjust the criteria for quantitative indicators
- Add quantitative objective for qualitative indicators

Preliminary version of updated indicators has been proposed and available in 3DLife Wiki. It will be deliberated in the 3Dlife plenary meeting on 5th July. The final version will be reported in D1.2.6 (6th Six-monthly report on Joint Activities of the Network) and D2.3 (Third report on integration of people and organisation).

The questionnaires for research personal exchange have been collected continually and will be fed into the WarpPLS to produce the evaluation model for third year in D2.3 (Third report on integration of people and organisation).

1.3 WP3: Pan-European Integration

The main objectives of this Work Package (WP) are to establish initiatives for stimulating the integration of research resources and effort beyond the 3DLife consortium through a Virtual Centre of Excellence (VCE). This WP targets the sustainability of these initiatives beyond the lifetime of the project. The work package is broken down into the following four specific activities detailed below.

The following deliverables, milestones and SMART indicators were due during the reporting period:

- Deliverables
  No Deliverables were due during the report period.
- Milestones
  No millstones were due during the report period.
- SMART Indicators:
  - SI3.2.2 (M30) – At least 12 VCE fellowships completed (ITI) – ***Partially Fulfilled***: To date there have been several VCE fellowship applications received and so far 5 have been accepted and approved and have started.

A3.1: Towards a Virtual Centre of Excellence

During this reporting period there has been a significant amount of activity within EMC^2.

The company Registration:
The registration process was finalised in May/ June 2012: a not-for-profit company limited by guarantee was incorporated under the name "European Centre of Excellence in Media Computing and Communication", with G. Whale as Director and L. Gymnopoulos as Secretary.

EMC^2 Business Plan:
Following substantial revision the business plan was finalised with a more detailed and comprehensive breakdown of service provision, projected income and expenditure. Partner institutions are currently procuring the information needed for EMC2 to begin marketing research results and expertise to industry, which are two of the main planks of the business strategy.

EMC^2 external advisory board:
The EMC^2 external advisory board members have been selected and appointed. The following individuals were appointed as members of the EMC^2 external advisory board:

- Eric Seulliet, Fabrique du Futur
- Theodore Zahariadis, Synelixis
- Qing, Huawei
- Jan Bouwen, Alcatel-Lucent
- Paulo Villegas, Telefonica

The first meeting (teleconference) of the EMC2 External Advisory Board (EAB) took place on Tuesday, May 08, 2012 with the participation of: Dr. George Whale (EMC^2 Director , Chair), Mr. Lazaros Gymnopoulos (EMC^2 Secretary) , Mr. Jan Bouwen (Alcatel-Lucent), Mr. Eric Seulliet (La Fabrique du Futur), and Mr. Qing Zhang (Huawei). Mr.Theodore Zahariadis, Mr. Paulo Villegas, and Prof. Ebroul Izquierdo (QMUL, Coordinator of SA EMC^2) were also invited but could not attend; however they were officially informed about the outcomes of the teleconference through the meeting minutes that were disseminated to them. As the first meeting of the EMC^2 EAB, this was an introductory meeting. Its most concrete outcome was the decision to organize a physical meeting of the EMC^2 EAB in London on the 26th of June 2012 with an extended agenda that will cover all major issues of the centre. An internal EMC^2 coordination meeting was held the day before (25th June 2012).

EC concertation group on entrepreneurship
EMC^2 is an active participant in the new EC concertration group focusing on technology entrepreneurship. This allows EMC^2 a key role in the early stages of entrepreneurship initiatives in the EC. In a related development, on 29 June 2012 EMC^2 will be hosting the European Accelerator Leader Meeting to discuss support for European technology start-ups.

Erasmus Mundus proposal
EMC^2 is an Associated Partner in the Erasmus Mundus Joint PhD application submitted last month by 3DLife project partners in collaboration with TU Berlin. EMC^2 input was in entrepreneurship aspects, including the securing of an Associated Partner from industry (MentorWell, London) specialising in entrepreneurship mentoring.#

Imagina 2012
EMC^2 staff attended the Imagina 2012 technology conference in Monaco in February, giving presentation and talking about EMC^2 to around 20 companies specializing in areas of 3D technology (urban visualization, stereoscopy, GIS). Several of those companies followed up with an interest in being involved in EMC^2.

EMC^2 Newsletter
The first EMC^2 Newsletter (June 2012) distributed to over 600 companies and researchers in 3D related fields included invitations to join the EMC^2 network and to complete an online questionnaire in entrepreneurship.

Website development
The EMC^2 website was substantially revised to incorporate an integrated database/ membership/ payment system, and to facilitate user interaction and member engagement.

WIAMIS 2012 participation and sponsorship
As WIAMIS co-sponsor, EMC^2 ran a special panel session in which four industry experts addressed the question, "What does 3D industry need from research?" The panellists, with expertise encompassing 3D imaging and animation, stereoscopy, 3D film post-production,

computer gaming and user experience research, each delivered a 10-minute presentation, and in a lively Q&A session fielded questions from the audience.

Figure 1 First page of the first EMC^2 newsletter

Figure 2 EMC^2 organized industrial panel discussion at WIAMIS 2012 in DCU

A3.2: Open Calls for VCE Fellowships

In the third year of the 3DLife project the VCE fellowship programme is now on track. After the latest revision of the terms, conditions and policies of the fellowship programme towards

a more realistic approach, new fellowship applications were received and new fellows were welcomed to the consortium. Since December 2011, HHI have been hosting a Post Doctoral researcher, Dr. Ismail El Sayad, who is being supervised by Professor Peter Eisert. Dr. Sayad is to be hosted for a period of 1 year. He is currently being funded by the EU ERCIM Alain Bensoussan Fellowship Programme and as 9th January 2012 Dr. Sayad application to be an (unfunded) VCE fellow has been accepted. Dr. Sayad's main area of interest and study during his fellowship is in the area of Augmented Reality. He is due to complete his fellowship by 30th November 2012.

As of 2nd Feburary 2012 the VCE fellowship application for Dr. Eleftherios Tiakas has been formally reviewed and accepted. Dr Tiakas is being supervised by Dr. Petros Daras at CERTH/ITI in Greece. Dr Tiakas's fellowship started on April 2, 2012 and will conclude on December 9, 2012. The main objectives of this fellowship are: a) to study existing indexing methods for multimedia search and retrieval - 12 Weeks, b) to design and implement a new method for efficient search and accurate retrieval of multimedia content - 12 Weeks, and c) to evaluate the new method both with real and synthetic data - 12 Weeks.

In summary, to date there have been 5 successful applicants in the Open Calls for VCE fellowships. All 5 of these applicants have either finished their fellowship or are currently active in them.

A3.3: VCE Grand Challenge on media Internet

During this reporting period we very pleased to have once again, based on past interest and success, been included in the ACM Multimedia Grand Challenge. The Multimedia Grand Challenge is a set of problems and issues from industry leaders that are geared to engage the multimedia research community in solving relevant, interesting and challenging questions about the industry's 3-5 year horizon for multimedia. Since its creation in 2009 the ACM MM Grand Challenge has established itself as an extremely prestigious competition in the multimedia community and were are very privileged to have been once again included in the Challenge.

As in 2011 an industry partner, Huawei, has agreed to co-sponsor this year's challenge. We originally made contact with Huawei through 3DLife participation in a dissemination activity at the NEM Summit in Barcelona in October 2010 and this relationship has proved extremely fruitful.

A3.4 VCE long-term Pillars

This activity aims at establishing the following important pillars to cement the long-term presence of the EMC^2 in important sections of the media Internet sector:
- EMC^2 distinguished lecture series and virtual education centre;
- Post-graduate courses;
- EMC^2 Workshop/Conference Series;
- EMC^2 regular special issues or dedicated journal on media Internet.

More details on these activities during this reporting period can be found in previous section.

Figure 3 ACM MultiMedia Grand Challenge webpage showing the link to the 3DLife Grand Challenge

1.4 WP4:Media Internet Research

In this work package, the goal is to support the integration of technologies for generating 3D information from a variety of content sources. It targets extraction of 3D data from video, audio and complementary data sources, as well as computer graphics methods for generating 3D models. Special consideration is given to the analysis of tools needed for efficient transmission and sharing of 3D data over the Internet.

The following deliverables and SMART indicators were due during the reporting period:

- Deliverables
  No Deliverables were due during the report period.
- Milestones
  No millstones were due during the report period.
- SMART Indicators:
 No SMART indicators were due during the report period.

Since Month 18, The ACM Multimedia Grand Challenge has been the central platform for the research work towards common framework integration. The dataset captured for 3Dlife Grand Challenge at ACM Multimedia 2011 has been continually employed for the Grand Challenge of this year. The main progress in this reporting period has been the consolidation of this dataset. DCU has further analysed the WIMU data within the Grand Challenge dataset and has also been working on acquiring features for the Kinect/WIMU synchronization. QMUL has completed the video synchronisation for both the datasets from first capturing session in TPT and second capturing session in QMUL. Collaboration work (DCU, UNIGE and QMUL) on developing a system for 3D Human Visualisation using enhanced 3D joint positions of dancers based on Kinect/WIMU synchronization has been initialised and ongoing.

The collaboration between TPT and ITI resulted in a joint paper submitted to the ACM Multimedia GC 2012 [1]. In this work, a novel method for the analysis of dance movements has been developed. The approach focuses on the decomposition of the dance movements into elementary motions. Placing this problem into a probabilistic framework, the method relies on the use of Gaussian processes to accurately model the different components of the decomposition. Such a decomposition can be favourably exploited in many tasks of dance analysis, for example in the correction of tracking errors.

During this reporting period, several joint papers have been accepted or published. [2] was accepted in ICASSP 2012. This work describes a novel system that automatically evaluates dance performances against a standard performance exploiting Kinect depth-maps, audio and WIMU modalities and provides feedback to the performer. One journal paper [3] was accepted to Journal on Multimodal User Interfaces. This manuscript presents a new, freely available, multi-modal corpus for research into, amongst other areas, real-time realistic interaction between humans in on-line virtual environments. In particular, the document provided details about the set up and synchronization of the multi-modal equipment used for the capturing of the data. Additionally, technical information regarding the choreographies performed by the dancers is included. Three joint conferences papers [4] [5] [6] were also accepted to WIAMIS 2012. [4] addresses two important issues, regarding teleimmersive-environments. More specifically, it focuses on techniques for: (a) the real-time, 3D reconstruction of moving humans from multiple Kinect devices and (b) the off-line generation of real life 3D scenes from visual data, captured by non-professional users. [5] described a system for automatically synchronising multi-view video sequences of Salsa dancing recorded with multimodal capturing platform. In order to improve the synchronization accuracy, in [5], the proposed system employed state-of-art body detection and tracking algorithm to obtain Region of Interest, within which the appearance changes are analysed. With the dataset accurately synchronised, further processing such as 3D pose estimation and 3D modelling of dancer body can be applied.

The Virtual Cloth Advisor, jointly developed by HHI, ITI, and DCU within the Robust Virtual Mirror integrated project, is an augmented reality system that allows a user to virtually try on t-shirts with different colours and logo prints (Virtual Try-On scenario), and to query a database for similar clothes with respect to colour, texture, and shape (Virtual Cloth Advisory scenario). Background information on Virtual Mirror can be found in previous joint activity reports. HHI has been continuously working on synthesis of near regular textures, i.e. textures that consist of a regular global structure plus subtle yet very characteristic stochastic irregularities, as well as warp-based texture analysis for image-based retexturing. Although the method was developed for near-regular textures, it was observed that it produces also very good results for irregular textures. Furthermore, HHI has been working on image-bsaed retexturing methods. Retexturing means the augmentation of a surface or object in an image with a new synthetic texture. The method assumes an image of a deformed regular texture (a near-regular texture) and decomposes it into intrinsic part, such as the appearance of the undeformed texture, a deformation grid, representing texture distortion as well as a shading map. In other words, we estimate a regular reference image plus a geometric and photometric warp that registers the reference texture with the given image and such get information on texture deformation and shading. The decomposition is illustrated in Figure 4. The decomposed parts can then be applies to any user specified texture.
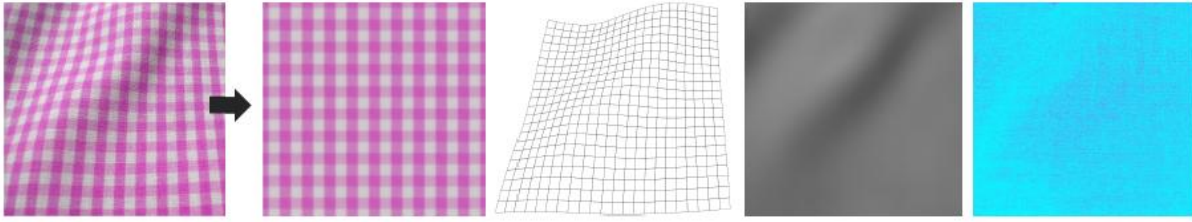
Figure 4 Decomposition of the original texture (left) into a regular texture, spatial deformation field represented by a deformed mesh, estimated shading map, estimated high frequency yarn structure (colors scaled).

HHI has also worked intensively on an image-based representation of clothes for augmented reality systems. The work targets at augmenting a user of an augmented reality system, e.g. the Virtual Mirror, with completely new clothes instead of retexturing parts of it. The idea is to capture a database of images showing pieces of clothes, each in different poses and from various viewing directions. During rendering, views of new poses (i.e. the user's poses) are synthesized by specifying the perspective of the viewer as well as the desired skeleton pose. Based on this information images from the database are warped and blended to the new pose. The offline created database consists of multiple high-quality/high-resolution views of clothes in multiple poses. During the offline processing phase, each pose is augmented with 3D depth information (rough shape model) as well as an articulated pose model (e.g. in form of joint angles). Additionally, deformation models, i.e. image warps, between neighbouring images are calculated in an image-based warp optimization approach. To allow modification of the clothes appearance, the images are decomposed into their intrinsinc parts, i.e. undeformed texture, as warp specifying texture distortion in the image and a shading mask according to the method described above. This allows retexturing the images with user defined textures. Figure 5 illustrates the concept of the multi-view multi-pose database.
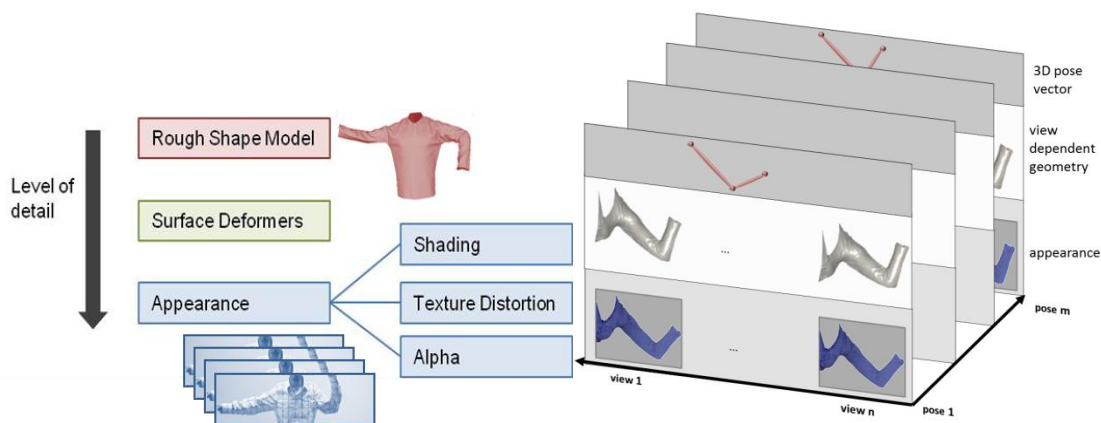

Figure 5 Base model representation consisting of a multi-view/multi-pose image set, silhouette information, view-dependent geometry and 3D pose information.

TPT has continued to develop and integrate several technical components in its framework for processing, editing and rendering complex 3D scenes. In particular, TPT has developed a new pipeline for performance capture data processing and editing, a new compressed indirect lighting representation for high quality rendering and a new interactive shape modelling method to edit the geometry of the captured data. The preliminary work on performance capture processing is currently pursued (journal paper, accepted pending minor modifications) and the work on indirect lighting is now developed in the direction of light specular transport simulation. Finally, two new real time rendering technique adapted to typical 3DLife

application needs – anti-aliasing for screen space rendering and fast point-based global illumination, are currently under investigation but already in a running state. These work lead to several publications [7] [8] [9].

During the reporting period ITI conducted research towards the generation of 3D user-worlds from non-expert user captured visual data. The research led to a paper entitled "Reconstruction for 3D immersive virtual environments" that was presented to the WIAMIS 2012 workshop that was organized by 3DLife. A summary of the research efforts and the foreseen future work follows.

Internet comprises a rich source of visual data, where a simple user can search and find multiple images for a specific locations or points on earth. At the same time, the evolution of digital photography has allowed non-expert users to capture high quality photos using low-cost camera equipment. Therefore, easiness in the capturing of digital photographs and the wide availability of visual data opens up new opportunities for the computer vision research field. The general framework considered so far for the 3D reconstruction from user data is presented in the diagram of Figure 6. The pipeline includes the estimation of the camera(s) motion parameters and multi-view reconstruction, by the generation and fusion of multiple high-resolution depth maps.
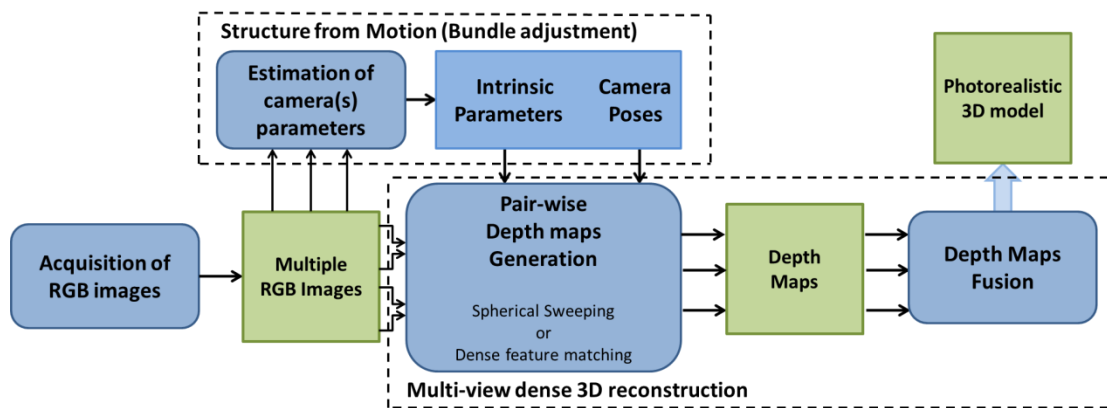
Figure 6 The proposed framework for photo-realistic 3D reconstruction of real scenes from user generated visual data.

An indispensable step towards dense multi-view 3D reconstruction is to recover the relative poses and the intrinsic parameters of the camera(s) employed to capture the scene. After an extensive research on available solutions, the implementation of the work presented in [10] is exploited to provide and efficient way for computing robustly the camera parameters and a sparse reconstruction of the scene from a set of user-generated images, which may be un-calibrated and unordered. The availability of robust cameras information provides a wide range of choices that could undertake the 3D reconstruction task. In order to handle the input visual dataset, the images are organized into stereo pairs, where pairs are comprised by images whose cameras positions have the minimum baseline distance. Two approaches that exhibit different reconstruction characteristics are taken into consideration so far for the generation of the depth maps from stereo pairs. The first one exploits and advances the spherical-sweeping methodology described in [11], while the second one is based on dense feature matching between images using the Daisy descriptor [12]. The depth maps generated by one of the above described methods are combined into a single 3D mesh using the implicit volumetric fusion method of [13]. The 3D reconstruction pipeline proposed so far relies on state of the art methods for the recovery of scene's camera(s) parameters and for the fusion of

depth maps. Current advances, consider mainly the extraction of the depth maps from the stereo image pairs. Future work will include:

- Application of methods for improving the quality of the generated depth maps
- Propose an efficient way of handling texture-less image areas
- Consideration of more efficient approaches for merging multiple depth maps
- Application of visibility constraints for refining the reconstruction accuracy of the final 3D model.

1.5 WP5: 3DLife Software Framework for Integration

This work package targets the design and installation of necessary technical infrastructure to enable and facilitate human and technical integration activities. It provides support to share and exchange research resources among partners, including equipment, teaching resources, tools, interfaces and test data. The objective is to stimulate the collaboration within and beyond the 3DLife consortium, by providing the necessary support for efficient collaboration. A detailed report about the design of the Integration Framework and its development within the first 18 months of 3DLife can be found in deliverable D 5.1.1.

The following deliverables and SMART indicators were due during the reporting period:
- Deliverables:
  - o D5.1.2 (M30) – Annual report on status of the 3DLife framework (HHI) - *Submitted*
- Milestones
  - o MS5.3.2 (M30) – Collection of tools and databases (HHI) - *Achieved*
- SMART Indicators:
  - o SI5.2.2 (M30) – At least 18 hours of testing data available (HHI) - *Fulfilled*

A5.1: Distributed Research Environment Design

The framework is designed around three main components: a wiki, a file repository server, and a project tracking system. The wiki aims to be the central place to collect, structure and share resources and expert knowledge available from 3DLife consortium members. Partners can describe and offer their shareable equipment, upload or hyperlink available teaching resources, and collaboratively work on documents within the wiki system. The file repository, in contrast, offers a central place to store and integrate data in a secure way, by providing a version history along with support for comparing, merging and reverting changes made to the stored data. This meets the special requirements of source code integration, and also allows tracking changes made to e.g. scientific data sets. The project tracking system aims primarily at, but is not limited to, software development. It provides a platform to document the project course, report bugs, and access the aforementioned file repository, using an easy to use web interface.

HHI has contributed to the research environment, by designing the framework infrastructure and providing a public server with high speed internet connection. Starting with the initial setup, HHI is providing regular maintenance of the server hardware and the software installation, and also has taken responsibility for the platform administration and end user support. The server has been equipped with a MediaWiki system, a Subversion file repository service, and a Trac project tracking system. The URL to access the services is https://3dlife.hhi.de. They share a common account management, so users may login to all

services using the same username and password. Access to all services is secure, by providing encrypted access over standard HTTPS connections. All data stored on the server and in the repositories is being backed up on a daily basis to ensure no data is lost, caused e.g. a server harddrive crash or a hacking attack.

By the end of this reporting period the wiki has been accessed 4600 times and edited 672 times.

A5.2: Sharing of Software and Database Resources

The objective of this activity is to review existing research resources like software tools or libraries available within the Network on an on-going basis and collect these into (distributed) repositories that can be accessed via the distributed environment designed in WP5.1. For software with source code being shared among the partners, a revision control system has been set up in order to simplify the collaborative editing for enhancements and adaptation of the software. Additionally, this activity is responsible for the collection and creation of joint databases that can be used among 3DLife partners. These datasets will be enhanced by further processing, labelling, and addition of metadata. They also serve as reference data used to optimize algorithms and to compare and evaluate different solutions developed by the partners.

By the end of this reporting period, the integration framework wiki lists 19 software tools from various areas of interest, as well as 14 datasets with more than 23 hours of recorded audio and video.

Full details about shared software and database resources can be found in deliverable D5.1.2

A5.3 Facilities and Equipment Sharing

The goal of this task is to simplify the exchange and joint usage of equipment and laboratories among the NoE partners. This effort is being complemented by access granted to external researchers to these resources via the VCE. A specific objective of this activity is to keep updating the inventory of existing resources within the Network and produce reports to help external partners to access possibilities and efficiently benefit from the NoE and the VCE offers to share facilities and specialized equipment.

The list of shareable equipment and facilities has continuously grown since the start of the 3DLife project. By the end of this reporting period, 45 different types of equipment and facilities have been made available by the partners, resulting in a total sharing time of 49.5 days (approx. 396 hours with 8 working hours per day) within the first 30 months of the project.
ITI contributed eight newly bought Microsoft Xbox Kinect Cameras to the common pool of shareable facilities and equipment. ITI uploaded the final, integrated version of the "Immersive Worlds IP application". This application integrates technologies from most of the 3DLife consortium partners (ITI, DCU, HHI, TPT, UNIGE, QMUL) demonstrating the final vision of the 3dlife project. It supports 3D visualisation for Autostereoscopic displays based on HHI's technology. A video preview of the application can be found in the 3DLife YouTube channel at: http://youtu.be/qhoKtuOWMI4.

Full details about facilities and equipment sharing can be found in deliverable D5.1.2

1.6 WP6: Spreading of Excellence and Outreach

This work package aims at spreading the Network's excellence in integrative efforts, technology transfer, scientific results, and training. The dissemination actions are focused mainly on the following three groups of people: academics, people from industry/business, and the non-specialist citizen. The work package is broken down into the following four specific activities.

The following deliverables, milestones and SMART indicators were due during the reporting period:

- Deliverables:
  - D6.2.5 "Six-monthly Electronic Newsletter" (M30) – *pending* (for technical reasons will be submitted during M31, right after the submission of D1.2.5, as agreed)
  - D6.3.2 "Report on jointly publications and 3DLife sponsored special sessions in conferences and workshops" (M30) – *submitted*
  - D6.5.2 "Annual report on talent boosting and technology transfer" (M30, UNIGE) – *submitted*
- Milestones
  - MS6.3.2 "Significant number of publications achieved" (M30) – *achieved*
  - MS6.4.2 "Successful organization of 3DLife summer schools" (M30) – *achieved*
- SMART Indicators:
  - SI6.1 "Relevant statistics on the website and Electronic Newsletters" (M30)
    - SI6.1.1 "Website hits, at least 250 hits per month" – *fulfilled* (an average of more than 300 hits per month)
    - SI6.1.2 "Number of users subscribing to the virtual community around the project through the web site. At least 4 new users every month. This virtual community will be based on well established social networking structures as Facebook or LinkedIn." – *fulfilled* (an average of more than 7 new users every month)
    - SI6.1.3 "At least 200 Electronic Newsletter downloads per year and at least 500 Newsletter paper issues distributed per year" – *fulfilled* (an average of more than 200 Electronic Newsletter downloads per year and 500 Newsletter paper issues distributed per year)

A6.1: Online dissemination

A series of changes were made to the 3DLife/EMC^2 websites and virtual *communities*. The current situation is as follows:

Additionally, extensive changes were made to the *EMC^2 website* in order to significantly enhance its function as a membership site as well as its aesthetics. Those changes range from updating the core development system (WordPress) to the latest version to acquiring (buying) a professional membership management system and will be reported in detail within the SA-EMC^2 project.

The *3DLife website* was visited at least 1,675 times during this semester (see image below) by at least 1,303 unique visitors. It must be noted that 56 of those visits were made through various mobile devices. Moreover, it must be stressed that the collection of statistics was

suppressed from February 3rd up to March 1st (one month) due to programmed maintenance (updating etc.).

Table 1: The 3DLife and EMC^2 virtual communities side by side

|	Website	Mailing List (MailChimp)	Virtual Community			Video streaming (YouTube)	RSS Feed
			LinkedIn	Twitter	facebook		
3DLife	www.3dlife-noe.eu	3DLife list (97 subscribers)	Common EMC^2 Group (46 members)	Common EMC^2 Timeline (56 followers, 74 tweets)	Common EMC^2 Page (13 likes, recently replaced the obsolete 3DLife Group)	3DLife channel (13 subscribers, 5,716 video views)	3DLife Feed
EMC^2	www.emc-square.org	EMC^2 list (635 subscribers, not all confirmed)				EMC^2 channel (3 subscribers, 194 video views)	EMC^2 Feed
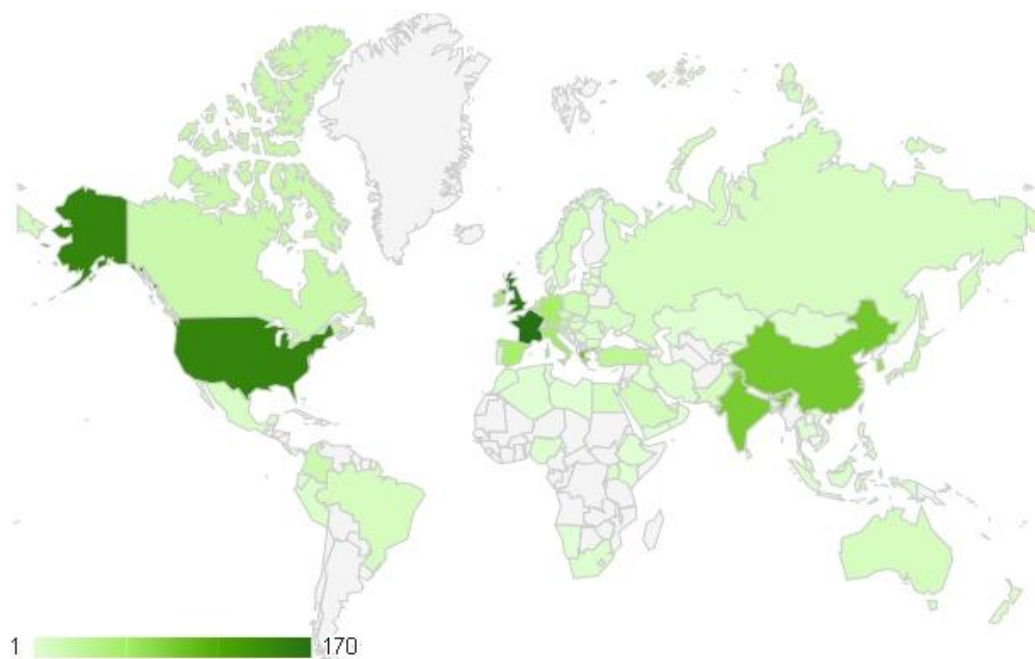
Figure 7: Geographic distribution of the website visits.

The 5th issue of the 3DLife *newsletter* will be prepared after the submission of the current deliverable in order to accurately reflect all 3DLife actions, issues, and events. It will be disseminated electronically to the respective mailing list which counts 97 subscribers; it will also be printed in 250 copies for further dissemination in future 3DLife related events. It is noted that all issues of the 3DLife newsletter can be downloaded from the 3DLife website (Resources → Dissemination Material).

A6.2: Joint Publications

The list of 3Dlife publications (in peer-reviewed journals, transactions and magazines, conferences, workshops and symposia, books and book Chapters) is reported in D6.3.2 (Second report on joint publications, 3DLife sponsored special sessions in conference and workshops, and exhibitions). An up to date list of is kept at 3Dlife website (Collaboration → Publication List).

KU has organized a ***one-day workshop*** on March 23rd, 2012 for smart media industry in Korea. The workshop was hosted by the Smart Media Association and sponsored by 3DLife, the National Research Foundation (NRF), and the Korea Creative Content Agency (KOCCA). Prof. G. Richard (TPT) has delivered a talk on Smart audio to the Korean audience from smart media industry of about 30 persons. He was also jointly interviewed with Prof. H. J. Kim by the journalist J. H. Shin of Korea IT TIMES. This interview resulted in a two pages article entitled "Excellence in Media Computing and Communication" in the April 10, 2012 (Vol. 93) issue.

The ***13th International Workshop on Image Analysis for Multimedia Interactive Services (WIAMIS 2012)*** (http://wiamis.dcu.ie) took place in DCU from 23rd-25th May 2012. WIAMIS is one of the main international events for the presentation and discussion of the latest technological advances in interactive multimedia services. The objective of the workshop was to bring together researchers, developers and end users from academia and industry working in the areas of image, video and audio applications, with a special focus on analysis. WIAMIS was sponsored by 3DLife and EMC^2, with support from CLARITY: Centre for Sensor Web Technologies, Science Foundation Ireland, Failte Ireland and Dublin City University. The event was technically co-sponsored by the IEEE Signal Processing Society. Of particular note was an ***industry panel session*** organized by EMC^2 on the theme, "What 3D Industry Needs from Research". The aim of the session was to consider and discuss some of the commercial needs and opportunities in the 3D media/ communication field, and the research challenges that must be overcome to enable new market opportunities to be exploited. A detailed report on the EMC^2 special panel session can be found in Appendix A. A detailed report on WIAMIS 2012 can be found in D6.5.2 - Annual report on talent boosting and technology transfer.

Figure 8: ITI's George Kordelas in front of his work at WIAMIS 2012.

Figure 9: EMC^2 organized a special panel session within WIAMIS 2012.

A6.3 Exhibitions

HHI's Virtual mirror was presented at RETAILTECH JAPAN 2012. RETAILTECH JAPAN is Japan's largest and most influential trade show specializing in retail information system. There is a vast collection of cutting-edge retail information technology ranging from store systems (e.g., Point-of-Sale registers) to head-office systems, in-store promotion devices, RFID / IC tags, backyard system and logistics. This show is classified into more specific categories based on their solutions, such as total retail information system, digital marketing, or warehouse and distribution to enhance the efficiency of business matching between visitors and exhibitors.

Figure 10: HHI Virtual Mirror at RETAILTECH JAPAN.

A6.4 Talent boosting and technology transfer

The two days prior to the WIAMIS 2012 workshop that was mentioned earlier were devoted to the running of the MediaSense EU PhD *Summer School* (http://mediasense.dcu.ie) where PhD students from across Europe working in multimedia analysis arrived in Ireland for an intensive series of lectures delivered by some of Europe's best researchers in this field. A detailed report on the MediaSense Summer School can be found in D6.5.2 - Annual report on talent boosting and technology transfer.

In addition, HHI is currently doing a knowledge transfer to Aesculap in a study on high accurate markeless model-based tracking of the human lower leg for the capturing of the leg position during a surgery of the knee.

2 Deviations

2.1 Administrative issues

There have been no administrational issues to report during the last period.

2.2 Change of personnel

During this reporting period, Dr. Philip Kelly has left DCU and David Monaghan is now in charge of managing DCU's involvement in 3DLife.

3 Deliverables and milestones in M25 - M30

Deliverables

Status of deliverables in the first project year				
Deliverable	Current status (completed/ underway)	On schedule (yes/no)	Original completion date (as in Annex I "Description of Work" + Calendar Date, e.g. "M6 = June 2010")	Actual/planned completion date (Calendar Date, e.g. "15 June 2010")
D1.1.9	completed	Yes	M27 = March 2012	30 March 2012
D1.1.10	completed	Yes	M30 = June 2012	29 June 2012
D1.2.5	completed	Yes	M30 = June 2012	29 June 2012
D5.1.2	completed	Yes	M30 = June 2012	29 June 2012
D6.2.5[1]	Underway	Yes	M30 = June 2012	6 July 2012
D6.3.2	completed	Yes	M30 = June 2012	29 June 2012
D6.5.2	completed	Yes	M30 = June 2012	29 June 2012

Milestones

Status of milestones in the first project year				
Milestone	Current status (completed/ underway)	On schedule (yes/no)	Original completion date (as in Annex I "Description of Work" + Calendar Date, e.g. "M6 = June 2010")	Actual/planned completion date (Calendar Date, e.g. "15 June 2010")
MS2.1.2	completed	Yes	M30 = June 2012	29 June 2012
MS5.3.2	completed	Yes	M30 = June 2012	29 June 2012
MS6.3.2	completed	Yes	M30 = June 2012	29 June 2012
MS6.4.2	completed	Yes	M30 = June 2012	29 June 2012

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[1] D6.2.5 (The 5th issue of the 3DLife biannual newsletter) will be submitted during the first week of M31, as agreed between the EC and the 3DLife consortium, in order to properly reflect all activities and deliverables of the current reporting period.

4 Conclusions

In this deliverable, all types of joint activities conducted during months 25 - 30 of the project have been reported. All the deliverables and milestones that are due during months 25 - 30 have been achieved successfully and on time.

5 References

[1] Antoine Liutkus, Angélique Drémeau, Dimitrios Alexiadis, Slim Essid, Petros Daras, Analysis of dance movements using Gaussian processes, submitted to ACM MM Grand Challenge. 2012

[2] Essid, S., Alexiadis, D., Tournemenne, R., Gowing, M., Kelly, Ph., Monhagan, D., Daras, P., Dremeau, A., and O'Connor, N. E., "An Advanced Virtual Dance Performance Evaluator", In Proc. of IEEE International Conference on Acoustics, Speech and Signal Processing, Kyoto, Japan, March 2012.

[3] S. Essid, X. Lin, M. Gowing, G. Kordelas, A. Aksay, P. Kelly, T. Fillon, Q. Zhang, A. Dielmann, V. Kitanovski, R. Tournemenne, A. Masurelle, E. Izquierdo, N. O'Connor, P. Daras, G. Richard, "A multi-modal dance corpus for research into interaction between humans in virtual environments", to appear in The Journal on Multimodal User Interfaces, 2012.

[4] D. S. Alexiadis, G. Kordelas , K. C Apostolakis, J. D. Agapito, J. M. Vegas, E. Izquierdo, P. Daras, "Reconstruction for 3D immersive virtual environments", WIAMIS, 2012.

[5] X. Lin, V. Kitanovski, Q. Zhang, E. Izquierdo, "Enhanced Multi-view dancing videos synchronization", WIAMIS, 2012.

[6] Philip Kelly and Noel E. O Connor, "Visualisation of Tennis Swings for Coaching", WIAMIS, 2012

[7] Bert Buchholz and Tamy Boubekeur, Quantized Point-Based Global Illumination EGSR 2012 - Computer Graphics Forum journal:

http://perso.telecom-paristech.fr/~boubek/papers/QPBGI/

[8] Leila Schemali, Jean-Marc Thiery and Tamy Boubekeur , Automatic Line Handles for Freeform Deformation, Eurographis, 2012

[9] Jean-Marc Thiery, Julien Tierny and Tamy Boubekeur , CageR: From 3D Performance Capture to Cage-based Representation, SIGGRAPH 2012 - Talk Program:

http://perso.telecom-paristech.fr/~boubek/papers/CageR-talk/

[10] N. Snavely, S. Seitz, and R. Szeliski, Modeling the world from internet photo collections, International Journal of Computer Vision, 2008.

[11] X. Zabulis, G. Kordelas, K. Mueller, and A. Smolic, Increasing the accuracy of the space-sweeping approach to stereo reconstruction, using spherical back-projection surfaces, In ICIP, 2006.

[12] Tola, E., Lepetit, V., and Fua, P., DAISY: An efficient dense descriptor applied to wide-baseline stereo. PAMI, 32(5):815-830, 2010.

[13] B. Curless and M. Levoy, A volumetric method for building complex models from range images, In SIGGRAPH, 1996.

6   Appendix A

EMC² Special Panel Session at WIAMIS 2012

As one of the sponsors of *WIAMIS 2012* (*13th International Workshop on Image Analysis for Multimedia Interactive Services,* 23rd-25th May 2012) at Dublin City University EMC² organised a special panel session on the theme, "What 3D Industry Needs from Research". The aim of the session was to consider and discuss some of the commercial needs and opportunities in the 3D media/ communication field, and the research challenges that must be overcome to enable new market opportunities to be exploited.

The expert panellists were (left-right order in photo): **Benoit Michel** from Belgium, Editor of *Stereoscopy News*; **Maryline Clare-Charrier** of 3DLIVE project, France Telecom R&D Orange Labs; **Gavin Duffy**, Director of RealSim Ltd., Galway, Ireland; and **François Pitié** of Sigmedia Group, Trinity College Dublin. The panel was chaired by George Whale of EMC² (far right).

Each panellist presented a thought-provoking 10-minute talk on research challenges in 3D, and the four presentations were followed by lively audience Q&A.

François Pitié – Research for 3D movie post-production

François Pitié of Trinity College's Sigmedia group gave a fascinating short talk on movie post-production, showing some of the many software techniques that can be applied to 2D and 3D film and video, e.g. to remove noise, flicker and camera shake, or to manage colour, focus and depth.

He described some of the visual effects tools he has been involved in developing for Green Parrot Pictures and for the Academy Award winning software suite Furnace from The Foundry. He also outlined his current work in 2D to 3D conversion for an Enterprise Ireland project of which he is principal investigator.

François identified some of the research challenges in this field, which include improving the speed and functionality of existing algorithms and the development of new diagnostic tools for post-production.

Maryline Clare-Charrier – Need of R&D for stereoscopic 3D

Maryline Clare-Charrier of Orange Labs R&D focused on quality aspects of stereoscopic 3D. At present, she said, quality falls short of market expectations, and the problems are both of equipment and of content production processes.

She stressed the importance of collaboration in research, and the need to work with partners spanning the whole chain from acquisition through processing, encoding, transmission and decoding to final adaptation for viewing. Such an integrated approach, she said, eliminates the need for simulation (which distances research from the real world) and makes research results more useful and relevant to industry than mere prototypes or demos.

Maryline described some of her R&D work at Orange Labs, especially in the context of 3DLIVE, a three-year French collaborative project which combined R&D with live 3D events.

She laid out the following principles for research in this area:

• combine R&D and the real world as often as possible;

• define a 3D perception model – stereoscopy is not just a matter of 'visual quality' but includes two new axes: visual comfort and depth perception;

• perform subjective tests to see how people react to these three axes, and what makes content fulfil quality criteria;

• create rules and tools to help stereographers and film directors make artistic decisions whilst respecting technical parameters and understanding how parameters interact;

• perform subjective screen tests.

She identified the following areas of research as of greatest potential value to industry:

• more work on fatigue, headaches and other discomforts;

• subjective testing of all new equipment, reporting to manufacturers and sharing results with the 3D community (via standardization, conferences, etc).

Gavin Duffy – What *one small part* of the 3D industry needs from the research community

Gavin Duffy began his presentation by reminding us just how broad the 3D industry is, covering such disparate areas as GIS (Geographic Information Systems), animation, 3D TV, engineering, medicine and architecture.

He noted that many of the technological advances have arisen from the film and games industries, as they continually strive to push the visual envelope for entertainment; consequently there is great potential for harnessing games technology and methodology to simulating and solving real world problems.

If academia is to exploit this opportunity, he argued, then traditional university departments where 3D is taught (film, media and gaming courses) must reach beyond their 'silos' to collaborate with other departments, especially in science and engineering.

Gavin described how his company, RealSim Ltd., has engaged with academia in R&D into 3D simulation of marine environments, use of game play analytics for resource management, and simulation and visualisation of interstellar forces in astronomy research.

Of special interest to RealSim is the creation of accurate and realistic 3D simulations of the world. Until recently, he said, GIS has been largely 2D, but the cumbersome architecture of GIS and CAD software does not allow for the manipulation of the massive, graphically rich datasets needed for a large, detailed, virtual world environment. The games industry, however, has developed smart algorithms and hardware (graphics card

technology) to perform just this type of task. A game engine, said Gavin, can not only visualise the world as it is but, through physics engines, can simulate the world *we want to* live in, helping planners and decision makers to decide how the future should look.

There are technical problems to overcome in integrating games technology and data formats into existing GIS architecture, and this is where academia can come in. Students and researchers can harness the large array of software and hardware developed by the games industry to develop solutions for the 3D mapping industry and many others besides.

Benoit Michel – 2012: 3D Hits The Wall

In the last of the four expert presentations, Benoit Michel of *Stereoscopy News* considered a range of research challenges in the field of stereoscopic 3D cinema and television. He compared the situation now with what it could be in ten years' time if concerted research effort is put into solving technical problems.

These include the set-up complexities of 3D camera rigs, incompatibilities among 3D file formats and display technologies, and the limitations of autostereoscopy for multiple viewer/ large screen situations.

Benoit argued that 3D movie creation/ distribution is currently too complex and expensive, that users are often frustrated and that the need for special glasses is a major obstacle to widespread uptake of 3D TV. He envisaged a simpler, less expensive state-of-the-art in 2022 with:

• triple-cam rigs able to acquire extreme resolution depth maps;
• automatic post-production correction of inter-ocular distance (IoD) and convergence;
• a universal 3D file format facilitating distribution and processing;
• good quality, inexpensive autostereoscopic displays up to two meters wide;
• TVs with interactive depth control.

Other difficult problems for researchers include 3D stereoscopic rendering of hair, smoke, clouds and semi-transparent edges, and the handling of mirrors, reflection and refraction.

Audience Q&A

In a short question and answer session following the presentations, several interesting issues were raised, among them the issue of how durable the present phase of 3D entertainment is likely to be, given its history of waxing and waning popularity. Panellists felt that the great advances in technology in recent years greatly encouraged uptake, especially in the home, which was seen as crucial for establishing 3D long-term.

Audience members cited negative factors such as the poor quality of some 3D content – for example, many automatic 2D to 3D movie conversions – as deterrents to public acceptance.

The problem of incompatible 3D technologies and data formats was discussed, and finally Gavin reiterated the need for academic researchers to engage in cross-disciplinary collaboration in order to address the range of difficult technical challenges facing different areas of 3D industry.

Panellist Biographies

François Pitié is a researcher at Trinity College Dublin. His research interests include digital cinema and digital film restoration. He has published over 30 papers on a variety of topics and has two patents. His work on colour transfer and deflicker are references in the field and have been implemented in a number of commercial applications including the Academy Award winning software suite *Furnace* from The Foundry. He has worked on many EU projects, including i3DPost, an FP7 project on multi-camera cinema production, and is currently principal investigator for an Enterprise Ireland project on 2D to 3D conversion. François has consulted for a number of companies, including Weta Digital, and recently founded PixelPuffin, a start-up specialising in the development of post-production tools.

Maryline Clare-Charrier graduated from INSA (Institut National des Sciences Appliquées) in 1989. She gained 10 years' image coding experience at Canon Research, where she led research work linked to fractals. She then became heavily involved in the JPEG2000 standardization effort, as Head of the French Delegation and co-chair of the Transform-Quantization-Entropy Coding group. She subsequently joined Orange Labs R&D to work on advanced video coding, and was responsible for the 3D side of the *Don Giovanni* operation – the first live 3D transmission of an opera, in June 2009. Maryline led 3DLIVE, a consortium of 8 French industrial and academic partners aiming to develop high-quality live stereoscopic technologies, and will coordinate 4EVER, a new French collaboration whose main targets are ultra-high-definition transmission for home and cinema, and HD for all in every situation.

Gavin Duffy is a trained geophysicist, but seven years ago discovered the potential of gaming technology and methodology for solving real world problems. Having used traditional GIS software for interrogating 2D maps, he was impressed by the real-time rendering power of game engines in handling graphically rich, large-scale, real-world environments. In 2007 he set up RealSim, initially offering a 3D city planning and development solutions. Since then the company has expanded its 3D simulation services to other areas, producing simulations for marine, industrial, medical and historical environment applications. Game player analytics is another area of interest for Gavin as he believes it can provide insights into social and economic behaviour not possible with mathematical analysis, because as he says, "people are unpredictable and cannot be easily defined by a set of algorithms".

Benoit Michel co-founded Neurones, one of the first 3D cartoon studios in Europe, in 1989. After that, he switched to R&D project management in telecommunications, human-machine interaction, digital cinema, and multimedia. He is currently at UCL (Université catholique de Louvain, Belgium), where he has managed the SIMILAR network of excellence on multimodal interfaces, the EDCINE project on enhanced digital cinema and the Belgian funded 3D Media research project focusing on stereoscopic and 3D imaging. He is now working on a medical imaging project called InVivo/ IGT improving the way 3D images are driving proton therapy machines for cancer treatment. Benoit is a member of the editorial board of *ERCIM News*, and is a consultant for the European Commission, the TWIST cluster of Walloon companies and various private companies. He is Editor of the free newsletter *Stereoscopy News* and co-founder of Eurospaceward, a European association promoting earth preservation through space activities.