EUREKA PROJECT E!2588 - EUROCARE SCANTED

1. General description

Project	E! 2588 - EUROCARE SCANTED	**Status**	Announced - 28-JUN-2002
Title	**Scanning, Texturing And Degradation Modules For Laser Range Scanning**		

Class	Sub-Umbrella	**Technological area**	Lasers
Start date	01-SEP-2001	**End date**	01-SEP-2004
Duration	36 months	**Total cost**	3.36 Meuro

Partner sought   Yes

Summary   Modular System For Accurate,Rapid Acquisition,Reconstruction Degradation Analysis Of Cultural Heritage Sites. The First 2 Include Freeform Surfaces/Multi-Resolution Representations. The Third Diagnoses And Classifies Degradation Shapes.

Budget and duration

Phase	Budget(Meuro)	Duration (Months)
Definition phase	1.12	12
Implementation phase	2.24	24
Total	**3.36**	**36**

Member contribution

Member	Contribution	Position	Since
Italy	**54.50%**	**Contact Member**	**09-JAN-2002**
Germany	40.40%	Participating Member	28-JUN-2002
Turkey	5.10%	Participating Member	28-JUN-2002

Participants

Company	Country	Type	Role
El.En. S.P.A.	**Italy**	**Large company**	**Main**
Istituto Centrale Per Il Restauro	Italy	Governm./Nat. Admin.	Partner
Ist. Di Ricerca Sulle Onde Elettromagnetiche Nello Carrera	Italy	Research Institute	Partner
C.N.R. - Istituto Di Elaborazione Della Informazione (Iei)	Italy	Research Institute	Partner
Selfin S.P.A.	Italy	Large company	Partner
Istituto Per Le Applicazione Del Calcolo M. Picone (Iac)	Italy	Research Institute	Partner
Univ. Di Genova/Dip.Di Inform.E Scienze Dell'Informaz.(Disi)	Italy	University	Partner
Zoller + Froehlich Gmbh	Germany	SME	Partner
Tu-Darmstadt/Graphische Datenverarbeitung	Germany	University	Partner
Wilhelm Schickard Inst.F.Informatik	Germany	University	Partner

Participants

Company	Country	Type	Role
Graphisch Interakt.Syst. Eberhard-Karls Universitaet Tuebingen			
Hacettepe University/Department Of Classical Archeology	Turkey	University	Partner
Soprintendenza Per I Beni Cult./Lab.Di Analisi Scient. Rava	Italy	Research Institute	Partner
Instituto Per Le Tecnologie Applicate Ai Beni Culturali	Italy	Research Institute	Partner
Computergraphik Universitaet Bonn	Germany	University	Partner
Sebit Education And Information Technologies Inc.	Turkey	SME	Partner

2. Project outline

Project description

A modular system for the accurate, rapid acquisition, reconstruction and degradation analysis of cultural heritage sites will be developed. The first two modules include freeform surfaces and multi-resolution representations. The third module diagnoses and classifies degradation shapes starting from both images acquired by echo laser and fluorescence images acquired by a fluorescence optical radar.

Technologies, methodologies and innovative software will be experimented on two study cases: Aosta (ITALY) Roman monuments and Goereme Valley (TURKEY) sites.

The project includes two subprojects. The first subproject is devoted to the scanning by means of an advanced echo laser radar system and 3D reconstruction of cultural heritage sites and architecture. In particular it concerns the development and the implementation of a reconstruction system which will be used for the reconstruction of acquired data. Firstly the already existing reconstruction software will be enhanced to support freeform surface meshes.

The second aim is to match photographs and fluorescence thematic images to the reconstructed geometry in order to get correctly coloured objects.

Thirdly, a multi-resolution representation for the freeform geometry will be designed and implemented. A 3D Web viewer supporting the progressive transmission of 3D models (primitives as well as triangle meshes) will be developed. This Web viewer will be the technical basis of the multimedia presentations of two selected study cases for which scanned data have been acquired.

The second subproject is aimed to analyse the material and its degradation dealing with both images acquired by echo lasar and fluorescence images acquired by a fluorescence optical radar. The extensive control of the status of historical buildings and their conservation can often be a very troublesome task. From this point of view, the use of remote sensing techniques for the monitoring of building surfaces is very attractive, since it can allow a fast, extensive monitoring of large surfaces without the use of scaffolding and, in addition, a thematic mapping easy to be read. Innovative software will be developed for diagnosing the state of conservation of materials exposed to both artificial and natural light. In particular, multi-spectral images will be processed for monitoring the biodeteriogen of different stone quality and origin.

Multimedia presentations for these sites will be designed and implemented in the project and used to promote both the used methodologies and technologies and virtual visits.

Keywords: cultural heritage, scanning techniques, computer graphics.

Technological development envisaged

- System for the accurate rapid reconstruction of 3D-architecture including freeform surfaces and multi-resolution representations.
- Viewer for the visualisation of highly complex 3D-architecture with textures and photographs on the WWW.

- Highly accurate digital reconstructions of the Aosta Roman monuments and Goereme sites.
- A 3D-virtual visit to the Aosta monuments and the Goereme sites will be offered over the WWW.
- Detection by high spectral resolution fluorescence lidar of thematic (presence of biodeteriogens, lithology, etc.) images of the investigated monuments and their matching to the 3D visualisation.
- Classification of degradation shapes of different materials.
Note under Relationship to other EU Programmes:
This project fits with the objectives of the Fifth Framework Programme of the E.U. 'The City of Tomorrow and Cultural Heritage', Energy, Environment and Sustainable Development.

Markets application and exploitation

The laser scanning and reconstruction system will make the
archiving of historical and architectural sites possible.
Once developed, the system can be exploited to provide 3D
databases of historical and other sites. Such databases are
of great interest to the film and advertising industries
and in archeological and historical research.
It can also be used for different other applications and
will be sold by the industrial partners.
Lidar (optical radar) systems will be able to monitor
architectural surfaces by remote and quite far away
workstations. In this way, it will be possible to acquire a
new layer of data and matching it with 3D databases. The
Lidar system will be useful in optimizing maintenance and
conservation strategy, and verify the conservative
operations throughout.
The Web applications to be developed in the project may be
sold by the partners. They might also be of interest to hee
foreign and tourist Ministries of the different countries.

Project codes

BSI

AK	research
ALI	computer-aided design
BCB.V	scanners
BCB/BCD	measuring instruments
MY	computer applications
MYG	computer graphics

NACE

3002	Manufacture of computers and other information processing equipment
3320	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except indus

3. Main participant

Company   **El.En. S.P.A.**
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Organisation type   Large company
Participant role   Main

Contribution to project

Fluorescence images having a high spectral resolution (512 spectral points/pixel) will be acquired by a fluorescence lidar (optical radars). These multi-spectral images will than be processed with an original software in order to achieve thematic images of the monument surface like biodeteriogens distribution, different stone quality and origin. The thematic images will be matched to the reconstructed geometry in order to improve the information content of the 3D reconstruction of the investigated monuments.

Expertise

Leading group (ten companies) in ITALY in manufacturing of laser sources, laser medical, industrial and scientific equipment and accessories. The company is certified according to ISO 9001 and EN 46002. One hundred full time employers, all highly qualified, and several specialised consultants run the group activities in four locations. Since 1984 EL.EN. has produced more than 800 industrial systems and more than 4000 medical equipment delivered in 40 countries. The total turnover for 1999 was around 30,000,000 US dollars.

4. Partner

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Organisation type	Governm./Nat. Admin.
Participant role	Partner

Contribution to project

During and after the realization of an industrial prototype of lidar fluorescence purposely planned for historical buildings, it will be applied on case studies of Roman and Italian Monuments under restoration. The purpose is to evaluate the data from the instrument, comparing this with measurements carried out using other methodologies (FTIR, GC-MS, UV-Fluorescence and SEM-EDS). For a better understanding of the measurements will be carried out and tested on laboratory samples simulating works of art treated with several substances that have normally been found on monuments.

Expertise

The organisation belongs to the ITALIAN MINISTRY OF CULTURAL HERITAGE, and its tasks are: * to carry out systematic investigations according to the influence of the various environmental factors, natural or accidental, that exercise a process of deterioration; * also on the means to prevent and inhibit the effects; * to carry out the necessary investigations to formulate rules and relative specific techniques of restoration of conservation interventions; * provide teaching on restoration techniques.

4. Partner

Company	**Ist. Di Ricerca Sulle Onde Elettromagnetiche Nello Carrera** Via Panciatichi, 64 50 127 Firenze Italy Tel +39 055 423 51 Fax +39 055 410 893
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Organisation type	Research Institute
Participant role	Partner

Contribution to project

Will contribute its know-how on the development of fluorescence lidars and their use for the detection of thematic images of historical buildings. Will cooperate with the EL EN. on the development of the fluorescence lidar devoted to the monitoring of buildings and will bring in the project its fluorescence lidar FLIDAR3 and its laboratory set-up for the detection of fluorescence spectral signatures.

Expertise

Has been active for more than 20 years in the development of fluorescence lidars and the analysis of its applications to the remote sensing of the environment. The FLIDAR fluorescence lidars of IROE-CNR have been and are the international reference for all the fluorescence lidars with high spectral resolution. In 1994 IROE-CNR was the first institute in the world which used the fluorescence lidar for the remote monitoring of historical buildings and is at present the only Institute active in this field together with the Atomic Physics Division of LUND TECHNICAL UNIVERSITY (SWEDEN).

4. Partner

Company	**C.N.R. - Istituto Di Elaborazione Della Informazione (Iei)**
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Organisation type	Research Institute
Participant role	Partner

Contribution to project

Development of techniques and image-based applications for the state of conservation assessment and monitoring of historical buildings. 2D and 3D surface degradation modelling and analysis faced by processing real images obtained using different acquisition modalities. Surface densitometric characterization and recognition of lapideous materials performed by combining feature extraction techniques with neural network models. Image categorization of different materials for study cases taken from the Aosta Roman monuments.

Expertise

This Institute conducts research in Computer Science, Information Technology and related application areas. In particular, R & D activities concern models for image description and understanding, referring also to the functionalities of integrated environments for both image analysis and synthesis, with applications in the field of Cultural Heritage. Moreover, image processing methodologies are under refinement in order to study the surface material structure of historical ashlars and stones, based also on the simulation of deformation processes applied on 2D and 3D images. Besides, innovative neural network models has been developed for recognizing and classifying digital images. Ovidio Salvetti is a Senior Researcher at the INSTITUTE FOR INFORMATION PROCESSING (IEI) of the Italian NATIONAL RESEARCH COUNCIL (CNR), in Pisa, working in the field of theoretical and applied computer vision. His fields of research are image processing,

pictorial information systems, spatial modelling and intelligent processes for image understanding. He is co-author of three books and monographs and more than two hundreds technical and scientific articles. He is the owner of ten patents, most of which relate to systems and tools for image management and processing. Dr. Salvetti has been the scientific co-ordinator of National and European projects in the field of diagnostic imaging and computer vision and a Fellow of the Study Group on Non-Destructive Testing within EU BRITE activities. He is currently the CNR Contact Person in ERCIM (European Research Consortium in Informatics and Mathematics) for the 'Health and Information Technologies' Working Group and a Member of IEEE and IEI's Scientific Council.

4. Partner

Company	**Selfin S.P.A.** Via Francesco Giordani, 7 80 122 Napoli Italy Tel +39 081 246 6310 Fax +39 081 660 236 www.selfin.it
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Organisation type	Large company
Participant role	Partner

Contribution to project

* Logical and physical design of the database. * Database management procedures. * Information Technology architecture design. * Communication protocols definition.

Expertise

The organisation, an IBM subsidiary, has created in 1989 a department, which has the aim to develop specific ITC projects in the field of Cultural Heritage and Tourism. Today SELFIN is one of the leading companies for the development of projects, IT solutions and products and is able to offer a wide variety of products and services as: - Acquisition, editing and archives of images. - Design and development of application software relating to: * Catalogue database management * Thematic cartography. - Multimedia products for learning and educational purposes. - Web and E-commerce sites and applications. - Multilingual translation of dictionaries as well as scientific and didactic texts. - Project management.

4. Partner

Company	**Istituto Per Le Applicazione Del Calcolo M. Picone (Iac)** Viale Del Policlinico, 137 00 161 Roma Italy

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Organisation type   Research Institute
Participant role   Partner

Contribution to project

Development of techniques to diagnose the conservation state of ancient buildings starting from images and oriented to the classification of degradation shapes in order to propose recognition methods.

Expertise

Largest Mathematical Institute of the Italian NATIONAL RESEARCH COUNCIL (CNR). Its history goes back to 1927 when it was founded by Mauro Picone. Since February 1997, its Director has been Prof. Michiel Bertsch. Their main research activities are synthetized in the following list of keywords, which reflects an equilibrium between the development of advanced mathematical methods, their applications often of interdisciplinary character, and computational aspects: partial differential equations, statistics, computer science, signal and image processing, fluid mechanics and material science, biomedical and industrial applications, cultural heritage, mathematical finance, data analysis, variational methods, control theory, computer graphics and scientific visualization, theory of computation, high performance computation, numerical, symbolic and statistical computing. Research activities are carried out in the framework of national and international projects and coordinated by the Scientific Committee of the Institute. The scientific staff consists of 23 researchers. Each year about 10 scientific experts have official appointments at IAC, and about 50 visitors come to the Institute to give seminars and to collaborate in research projects. The educational activities at IAC, strongly connected to research, involve about 20 students (PhD, etc.) every year. The Institute is equipped with an advanced distributed scientific computing environment and library. Dr. Laura Moltedo (Rome, 1946), graduated in physics from the UNIVERSITY OF ROME, is a Research Director at the ISTITUTO PER LE APPLICAZIONI DEL CALCOLO within C.N.R. Her main research interests include computer graphics, multidimensional data visualization , unified environments for image analysis and synthesis. Current research in the field of texture parameters extraction are oriented to Cultural Heritage applications. She is the author of 64 papers which have appeared in journals, 4 books, 52 communications in proceedings of workshops. She has been the coordinator of National Research Projects, acts as a member of ISO/TC97/SC5/WG2 and IFIP WG 5.10 and takes part in the editorial board of Computer Graphics Forum Journal. Contribution: Objectives: - Study the results obtained applying these techniques to images acquired under controlled (artificial and known) light sources (case study of Goereme churches). - Extension of these techniques to images of different materials coming from the Aosta Roman Theatre (as a study case for natural light source). Description of work: - The classification of degradation shapes includes the use of shape grammars in order to code and store the obtained information. Different shape grammars relative to various kinds of degradation will be produced. - A chromatic correction is required in advance in order to consider correct images. - Neural networks are used to recognize degradation shapes. Automatic recognition of degradation shapes using neural networks is useful in helping to design restoration actions.

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4. Partner

Company	**Univ. Di Genova/Dip.Di Inform.E Scienze Dell'Informaz.(Disi)**
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Organisation type	University
Participant role	Partner

Contribution to project

Their contribution will be mainly the development of data structures and algorithms that manage multi-resolution geometric models in the context of a client-server architecture.

Expertise

Expertise: DISI (Dipartimento di Informatica e Scienze dell'Informazione), the Department of Computer and Information Sciences of the UNIVERSITY OF GENOVA, was established in 1992, building up on a research group previously operating within the Department of Mathematics. It has grown rapidly and its teaching and research staff consists currently of 18 people, 8 of whom are full professors. Main research areas include Formal Methods, Geometric Modelling and Computer Graphics, Object-Oriented and Logic Programming, Performance Evaluation, Semantics and Logic, Databases and Information Systems and the Design and Implementation of Languages and Systems. The Geometric Modelling and Computer Graphics group of DISI is active in geometric modeling and computational geometry for specific applications in visualization, geographic information systems, and CAD. The group studies modelling and computational issues concerning the representation and manipulation of spatial objects, with special emphasis on multi-resolution geometric models, geometry compression and geometry reconstruction. This activity has led to several papers published in international journals and in the proceedings of international conferences in the fields of Computer Graphics, Geometric Modelling, Geographic Information Systems, and to several software products for terrain modeling and analysis, for object modelling and visualization in virtual environments. The group has been involved in several national and international research projects, among which three projects funded by the European Community: * Human Capital Mobility Project SPACENET: A Network for Qualitative Spatial Reasoning, 1995-97; * BRITE Basic Research Project VENICE: Virtual Environment Interface by Sensory Integration for Inspection and Manipulation Control in Multifunctional Underwater Vehicles, 1996-99; * the European Training Network MINGLE :Multiresolution in Geometric Modeling: (2000-2004). Leila De Floriani has been professor of Computer Graphics at DISI since 1990, where she heads the Geometric Modelling and Computer Graphics group and she coordinates research projects funded by CNR, MURST and by the European Community. She graduated in Mathematics in 1977 from the UNIVERSITY OF GENOVA. From 1982 to 1990 she was a research scientist at the Institute of Applied Mathematics of the Italian NATIONAL RESEARCH COUNCIL (CNR). She has been several times a visiting professor at foreign universities such as the RENSSELAER POLYTECHNIC INSTITUTE (Albany, New York, USA), the UNIVERSITY OF MARYLAND (College Park, Maryland, USA), and the UNIVERSITY OF NEBRASKA (Lincoln, Nebraska, USA). Leila De Floriani is the author of over one hundred publications. She serves a member of the Program Committee of many international conferences and is member the editorial board of

the International Journal of image analysis and of GeoInformatica. In 1998 she received an award as a IAPR Fellow for her research activity in geometric modelling. Contribution: These will allow the user to query the model by setting arbitrary, possibly view-dependent, resolution parameters and perform interactive selective refinement, while minimizing the amount of information exchanged between a server managing the model and a web browser visualizing it. This mechanism will provide the multiresolution engine underlying a web browser, which will make it possible to balance time response and rendering quality (either automatically, depending on architecture bandwidth, or manually, depending on user needs). The multi-resolution data structure, as well as algorithms working on it, will be modular with respect to the simplification technique used to build the multi-resolution model. They will also study, as alternatives to be used in simpler applications, efficient methods for compressed encoding of meshes, both static and progressive. These can be used to further minimize the amount of transmitted data in cases where user requirements do not require continuous, multi- resolution (e.g., for virtual environments made of many small separate objects).

4. Partner

Company	**Zoller + Froehlich Gmbh** Simoniusstrasse, 22 88239 Wangen I.A. Germany Tel +49 7522 930 80 Fax +49 7532 930 852 www.zofre.de
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Organisation type	SME
Participant role	Partner

Contribution to project

They will provide different visual laser radar systems to scan the architecture and content of the Aosta Roman monuments in ITALY and the Goereme sites in TURKEY which are heavily threatened by decay. They will perform this scanning in ITALY and TURKEY. and provide accurate and precise 3D range points (?3 mm) and intensity values of the objects. The point clouds result in remarkably high resolution images of the physical surroundings in short periods of time.

Expertise

The organisation was founded in 1963 in Wangen in the south of Germany. The development and production of laser radar systems including CAD software packages for 3D environmental modelling started in 1994. This area is very innovative and the 3D visual laser radar won an innovation prize in GERMANY in December 1998. Some projects have been executed together with well known German and international industrial partners as well as Universities worldwide.

4. Partner

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Organisation type	University
Participant role	Partner

Contribution to project

Will concentrate on the development of intelligent and efficient mesh simplification algorithms that can guarantee certain geometric approximation errors while minimising the number of necessary triangles for the approximation.

Expertise

Expertise: Reinhard Klein studied Mathematics and Physics at the UNIVERSITY OF TUEBINGEN, GERMANY, from where he received his MS in Mathematics (Dipl.-Math.) in 1989 and his Ph.D. in computer science in 1995. In 1999 he finished his Habilitation and became Professor of Computer Science at the TECHNICAL UNIVERSITY DARMSTADT and Head of the department A3 'Image communication and Animation' at the FRAUNHOFER INSTITUTE FOR COMPUTER GRAPHICS (IGD) in Darmstadt. He is currently engaged in teaching and various research projects on Computer Graphics, Geometric Modelling, Agent systems and Web-based Computer Graphics at the TU DARMSTADT and the FRAUNHOFER IGD. His current subjects of research includes Geometric Modelling, Mesh Simplification and Multiresolution Modelling, Mesh Generation, Computer Applications in Surgery and WEB-based computer Graphics. His Web-based Computer Graphics Course 'Computer graphics - A Playful approach' received several rewards. He has published numerous papers in scientific journals and conferences in the areas of Geometric Modelling, Object- Oriented Graphics Systems, Mesh Generation, Mesh Simplification, Multiresolution Modelling, and Computer Graphics Education and he is co-author with Encarnacao and Strasser of two German books on Computer Graphics: * Graphische Datenverarbeitung I, * Graphische Datenverarbeitung II, Oldenbourg Verlag, Muenchen, 1995, 1997. Contribution: Although several such algorithms have already been implemented by commercial software companies, more effort is needed in order to find optimal algorithms with respect to the geometric approximation as well as to the algorithmic complexity. The simplification algorithm will automatically build up a multi-resolution hierarchy of meshes. A stand-alone application will be generated that allows the testing of the simplification algorithm on example data reconstructed so far. Their second part will be the development of an X3D-viewer component for progressive mesh representations including material and texture properties. Here they strive for viewer-technology that not only supports standard progressive representations but also selective refinement of the models, e.g. in combination with view frustum culling. The realization of the viewer as a X3D viewer component will allow to use is in common XML Web pages which will be generated by the partners.

4. Partner

Company	**Wilhelm Schickard Inst.F.Informatik Graphisch**
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Organisation type	University
Participant role	Partner

Contribution to project

- Automatic integration of colour photographs into reconstructed scenes (automatic registration of photographs and calculation of camera parameters, texture generation and interpolation, parameterization). - Radiosity-Shading of models (pre-calculation of realistic global shading) - Integration of image based rendering into viewer (integration of light field rendering into viewer, compression of light fields).

Expertise

WSI/GRIS is the Graphics Laboratory of the UNIVERSITY OF TUEBINGEN, directed by Prof. Wolfgang StraSSer. In the past 12 years the Laboratory has established a high reputation in computer graphics hardware, geometric modeling, multi-resolution models, Web applications and Web standardization, etc. At GRIS, Dr. Reinhard Klein was especially responsible for the field of multiresolution modelling and Web applications. The work of Tuebingen has been presented at all major conferences like Siggraph, Eurographics, Visualization and others. The important journals in the field published papers from Tuebingen. The Lab has well developed links to industry and a long record of European ESPRIT projects. The experience gained in SPIRIT, SPECTRE, MONOGRAPH, and OMI-VIEW can directly be used in FAMULA. Tuebingen has many years of experience in multiresolution representations, be it in the field of medicine, engineering or geographical visualization systems of scientific computing. In all these areas Tuebingen has developed and realized novel ways of data visualization. The aim of Tuebingen in the project is to transfer the research knowledge to industry and also to advance the state-of-the art in Progressive Representations of architectural 3D data as well as in the 3D Web Viewer technology. Wolfgang Strasser studied Electrical Engineering and Communications, and Computer Science at the TECHNICAL UNIVERSITY OF BERLIN, where he received his Dipl.-Ing. (MasterS Degree in Engineering) degree in 1968. For three years following, he worked as a computer engineer for Nixdorf Computers. In 1971 he returned to TU BERLIN as a research assistant in Computer Science. In 1974 he finished his Ph.D. work with his thesis work in the area of computer graphics hardware. In the same year he was appointed director of the Department for Information Processing of HEINRICH-HERRTZ-INSTITUT Berlin. There he worked in cooperation with GRUNDIG, SIEMENS and NIXDORF on advanced end user terminals for future telecommunication services such as interactive cable TV and viewdata. In 1978 he was appointed Professor of Computer Science at the TECHNICAL UNIVERSITY DARMSTADT. In 1986 he moved to UNIVERSITY OF TUEBINGEN and founded the graphics research group. At present, StraSSer is Professor of Computer Science and adjunct Professor of Mathematics at Tuebingen. In 1986, StraÃŸer started the successful series of EG graphics hardware workshops. He has published numerous papers in scientific journals and conferences and is the co-author

with Encarnacao and Klein of the standard graphics book used in most German universities. He has given tutorials at EG conferences, was an invited keynote speaker, has chaired many conferences and workshops and is a fellow of the EG ASSOCIATION.

4. Partner

Company	**Hacettepe University/Department Of Classical Archeology** Beytepe Campus, 065 32 Ankara Turkey Tel +90 312 266 7662 Fax +90 312 266 4139 www.bilkent.edu.tr
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Organisation type **Participant role**	University Partner

Contribution to project

Archeological support and web application in TURKEY. In the scope of this project the scanned and reconstructed 3D-data on Goreme will be augmented with explaining texts and data. The content will be provided by the three cultural heritage partners. The result will be publicly accessible WEB-servers supporting virtual visits to the sites. After the scanning the Goreme sites a researcher from HACETTEPE UNIVERSITY will be visiting WSI/GRIS in Tubingen and Graphische Datenverarbeitung department in Darmstadt for studying in the reconstruction phase of Goreme sites and implementation phase a WEB-viewer allowing 3D-virtual visits. This researcher also will improve and organise the WEB applications on Goreme in TURKEY.

Expertise

Expertise: The Department of Archaeology is one of the well established departments of HACETTEPE UNIVERSITY in Ankara with undergraduate end graduate programs. The faculty consisting of 12 academicians is also in charge of 4 major archaeological excavations and several surveys in Turkey. Their annual reports appear in German, English and Turkish in referred scholarly journals such as Ystanbuler Mitteilungen, Anatolia Antiqua, Anatolica, etc. Engin Ozgen: Born in Ankara, Turkey, Engin Ozgen graduated from the Department of Prehistory at ISTANBUL UNIVERSITY in 1973. He received his Ph.D. in classical archaeology in 1979 from the UNIVERSITY OF PENNSYLVANIA, where he studied under a Fulbright grant. From 1992 to 1996, he served as the director general of Monuments and Museums in the MINISTRY OF CULTURE of the REPUBLIC OF TURKEY. He is currently a full professor of Archaeology at HACETTEPE UNIVERSITY in Ankara, where he chairs the Department of Classical Archaeology. Since 1990, he has been excavating at the site of Oylum Hoyuk, near Kilis in south Eastern TURKEY.

4. Partner

Company	**Soprintendenza Per I Beni Cult./Lab.Di Analisi Scient. Rava**
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Organisation type	Research Institute
Participant role	Partner

Contribution to project

Their role will be to define the parameters of use of the Scanner laser in the field of the Cultural Heritage. The possibility, supplied from the Scanner laser, to obtain a reflection of a light radiation on the surface, will be studied and estimated in order to verify if, through systems with suitable detectors, the analysis of the superficial composition and, therefore, of the type of degradation present on the monument can be carried out.

Expertise

These National Institutions look after the Conservation of the Cultural Patrimony. During such activities they need to carry out surveys for architectonic and archaeological study of the monuments. The Laboratory of Scientific Analysis, in particular, takes care of conservation diagnostic and participates to research projects with some Institutes of the NATIONAL RESEARCH COUNCIL of ITALY.

4. Partner

Company	**Instituto Per Le Tecnologie Applicate Ai Beni Culturali**
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Contact	**Arch. Paolo Salonia**
	Researcher
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Organisation type	Research Institute
Participant role	Partner

Contribution to project

The aim is to shape tools as aid for the analysis of the situations of decay and the evaluation of the state of conservation regarding the building heritage. It will be necessary to collaborate in all the surveys for the data acquisition phases. To this aim, it will be experimented the software ARKIS for the topological integration of heterogeneous data, collected from different surveys on the study cases. The objective is to collaborate to the definition of methodologies for the automation of naked eyes analysis through the techniques of image elaboration.

Expertise

This Institute, founded in the second half of the 1970s, represents the first institute of the Italian NATIONAL RESEARCH COUNCIL (CNR) that, historically, has had Cultural Heritage as its main aim. It characterizes for the multidisciplinary competences present within its departments and services: geophysics, architecture and town planning, chemical analysis, GIS, topographical surveys and photogrammetry. To the traditional lines of search of the institute, extraordinary activities are added: the National Project Parnaso, the Contracts with the REGIONE AUTONOMA VALLE D'AOSTA (RAVA), the Project ARAMIS (Project RAPHAEL) and, above all, the P. F. Cultural Heritage of the CNR. Paolo Salonia (Roma, 1948), graduated in Architecture from the UNIVERSITA 'LA SAPIENZA' in Rome, is senior scientist at the 'ISTITUTO PER LE TECNOLOGIE APPLICATE AI BENI CULTURALI' of the Italian NATIONAL RESEARCH COUNCIL (ITABC - CNR) since 1981. His research interests include documentation methodologies for architectural heritage, photogrammetric surveys and information systems for the knowledge and cataloguing of historical buildings in the recovery processes. He was the principal investigator of several research teams within the CNR Finalized Project 'EDILIZIA' and coordinator of a O.U. within the CNR Strategic Project 'Knowledge through images: an application to Cultural Heritage'. He develops his activity of search conjugating the principal aspects of the discipline of the restauration and conservation of historical building with those typical of the Information Technologies He is at present leading a project to design an information system in an ArcView environment (GIS by ESRI) for the organisation, representation and use of the knowledge of architectural heritage: the software ARKIS (Architecture Recovery Knowledge Information System). Programmed in the AVENUE language (by ESRI), it is finalized to the topological integration of heterogeneous data, geometric and descriptive. He collaborates with numerous inter-disciplinary groups of search, constituted from researchers of different Universities and other Institutes CNR, directed on thematic relative to the knowledge and the safeguard of Cultural Heritage, to the organization and the transfer of information in multimedial distributed environments (i.e.: MURST 5%, PARNASO). He is co-author of two books and he has published several scientific papers and presented contributions to National and International workshops.

4. Partner

Company	**Computergraphik Universitaet Bonn**
	Regina-Pacis-Weg, 3
	53115 Bonn
	Germany
	Tel +49 228 73-0
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	www.informatik.uni-bonn.de/II/
Contact	**Prof. Reinhard Klein**
	Head Of Department
	Tel
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Organisation type	University
Participant role	Partner

Contribution to project

- Registration of different scans of the same object - Triangulation of point clouds - Mesh simplification - Multi-resolution data structures. - Shading and texture dependent refinement and rendering - Viewer for progressive mesh representations including material and texture properties - Improved user interface and intuitive navigation.

Expertise

Reinhard Klein studied Mathematics and Physics, in 1989 Dipl.Math., in 1995 Ph.D. in Computer Science, in 1999 Habilitation, Professor of Computer Science at the Technical University Darmstadt and Head of the Department A3 'Image communication and Animation' at the FRAUNHOFER INSTITUTE FOR COMPUTER GRAPHICS (IGD) in Darmstadt, in 2000 Head of Graphics Department UNIVERSITY OF BONN. Numerous publications in the areas of Geometric ModelLing, Object Oriented Graphics Systems, Mesh Generation, Mesh Simplification and Multi-resolution Modelling. Co-author with Encarnacao and Strasser of two books on Computer Graphics.

4. Partner

Company	**Sebit Education And Information Technologies Inc.**
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Contact	**Mr. Ahmet Eti**
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Organisation type	SME
Participant role	Partner

Contribution to project

- Shading, texturing and rendering of scanned 3D models to be used in the CD-ROM environment; - Real-time walk through and other necessary high resolution animations (i.e. particle, character, etc.) in the 3D models. - Design and implementation of the CD-ROM, including software, interface, interaction design, sounds and music - Design and building of the website with the contents mentioned - Production of CD-ROM

including packaging, manuals, etc.

Expertise

This subsidiary of DOGUS HOLDING, TURKEY, was founded as THE MULTIMEDIA RESEARCH AND DEVELOPMENT GROUP OF BILTEN (Information Technology and Electronics Research Institute), under TUBITAK (The Scientific and Technical Research Council) in 1988. SEBIT, being the largest establishment in the multimedia sector in TURKEY, produces interactive multimedia titles to be marketed worldwide in the concepts of computer aided education (CAE) and educational entertainment like the following: - 'Vitamin' and 'Akademedia' are educational interactive multimedia sets to improve and support the education aiming the high school level. - 'The Ephesus Simulation' project which can be described as a reconstruction of the ancient site of Ephesus in 3D using SGI's. - 'Housing in Anatolia' CD-ROM was produced for Habitat '96 which covers the history of houses and habitation of Anatolia over a period of twelve thousand years. - 'Piri the Explorer Ship', another educational entertainment product of SEBIT, is a 3D point-and-click adventure game to explore multinational and multicultural entities of the 16th century.