7th

INTERNATIONAL

WORKSHOP

ON HIGHER

EDUCATION

Mechatronics meets Heritage Conservation Science

27 June 2017

University of Vic - Central University of Catalonia

UVIC
UNIVERSITAT DE VIC
UNIVERSITAT CENTRAL
DE CATALUNYA

**Escola
de Doctorat**

**Unitat de
Divulgació Científica**

Presentation

Science and technology applied to Cultural Heritage experienced a progressive advance during the last decades with a subsequent growing of the interest in analytical devices employed for the characterization of a wide range of materials, decay processes or conservation treatments. Nonetheless, such a kind of approach largely depends on the availability of funding to acquire high-tech devices. Usually, most of the latter are not intended for artworks diagnostic and or monitoring, thus implying additional costs for calibration and training purposes. Software copyright and hardware restrictions typical of industrial-oriented devices, concur in affecting an economically sustainable approach to technology.

On the other hand, the recent proliferation of open-source, user-friendly and low-cost hardware and software, as well as the enhancing of digital accessibility to knowledge and expertise, has increased the flexibility and capabilities in design and production of analytical devices. An innovative bottom-up approach to technology is facilitating the worldwide diffusion of the "maker culture", with proliferation of hacker-spaces and fab-labs also within the academic environment. The recent advances in user-friendly, open and low-cost software and hardware are increasing the number of technologies based on the 'knowledge sharing' concept, allowing users to develop their own apparatus devoted to a multiple of purposes.

The aim of this workshop is twofold: getting the interest of Cultural Heritage professionals, operators and administrators on the opportunities that sustainable technology could offer to overcome economic obstacles, and promote alternative technological solutions whose reliability is often underestimated, or simply unknown; expose to mechatronics professors, researchers, students and professionals, the field of science and technology applied to Cultural Heritage as a potentially receptive context, so to propose them to design and prototyping innovative solutions.

Program 27th June 2017

9.00-9.10h	Welcome
9.10-10.00h	**Technological Innovation for the Knowledge construction yard in restoration process: Let us re-find our "sense of measure"**, Paolo Salonia, CNR-Institute for Technologies Applied to Cultural Heritage, Italia.
10.00-10.20h	**Affordable mechatronics for the empowerment of scientists,** Pau Català, Juli Ordeix, Josep Ayats, Montserrat Corbera, Miquel Caballeria, MECAMAT Research Group, UVIC-UCC.
10.20-10.40h	**Demonstration of mechatronics solutions for lab-based challenges**: **Universal machine for tensile tests,** Marcel Pla, Pau Català, MECAMAT Research Group, UVIC-UCC.
10.45h	Coffee Break and Poster Session
11.30-12.20h	**The lab of the future: enabling collaboration between Engineering and Heritage**, Josep Grau-Bové, UCL-SEAHA. EPSRC Centre for doctoral training in science and Engineering in Arts, Heritage and Archaeology (SEAHA) London, UK.
12.20-12.40h	**Sustainable technology for cultural heritage: the smarts project advances**, Mainardo Gaudenzi Asinelli, Judit Molera, Juli Ordeix, Moisès Serra MECAMAT Research Group, UVIC-UCC.
12.40 a 13.00h	**Demonstration of mechatronics solutions for on site and lab-based challenges**, Pau Català, Mainardo Gaudenzi, Sergi Martínez, Albert Muñoz, Josep Pomés, Albert Rovira, MECAMAT Research Group, UVIC-UCC.
13.00-13.20h	**Share or die! The role of makers and diy culture in research**, Marc Genevat, Make & Learn.
13.20-14.00h	**Final Discussion and Conclusions**

Tuesday, 27th June from 9:10 to 10:00h

TECHNOLOGICAL INNOVATION FOR THE KNOWLEDGE CONSTRUCTION YARD IN RESTORATION PROCESS: LET US RE-FIND OUR 'SENSE OF MEASURE'

Paolo Salonia, CNR-Institute for Technologies Applied to Cultural Heritage, Italia. Executive Board ICOMOS Italia

It has by now become common place and **consolidated** practice to decline terms like heritage, knowledge, conservation together with others like technologies, digitalisation, 3D, modelling, and to acknowledge such utterances in actions and operational procedures that give substance to the process of protection and enhancement of Cultural Heritage. Numerous are the examples that bear witness to how the evolution in the field of technologies applied to cultural heritage in the last decades had extraordinary accelerations in terms of accuracy and reliability of measurements and reproduction and management of the data acquired, albeit not always accompanied by simplification of procedures and cost cutting. The extremely vast production of data, that has even given rise to the new definition of Digital Heritage, opens up the debate on the use of such databases and poses questions on the opportunity and appropriateness of making them accessible to scientific communities, but without restriction for others, in the form of open data. Concerning public funding, in the last Framework Programs of the European Union and currently in HORIZON 2020, the actions scheduled are strongly orientated towards the use of technologies, and in a totalising way, towards digitalisation. There are numerous initiatives fostered by States throughout the world and among those that should be recalled, there are the UROPEANA project for standardisation of Digital Heritage. Or the Arches Project, an international collaboration including the Getty Conservation Institute and the World Monuments Fund, besides Universities and research centres from different countries, with the objective of developing an informative geo-spatial open source system that may represent a digital archive for the online management of material cultural heritage. New opportunities are thus emerging for the standardisation of vast quantities of information, for the digitalisation of heritage and the utilisation of social media to support the control, planning, organisation, management, interpretation and monitoring of the actions of conservation, but also for the identification of new forms of enhancement and fruition. However, the specificity of the current situation shows the consolidation of a more

open gap between the technological development, which follows its own exponential growth according to other external rules and factors, and the delay of a disciplinary debate for affirming different ways of using these technologies, based on a critical awareness that knows how to question the real and necessary validity of those same technologies. But, to what extent are heritage and digital currently orientated towards the creation of a new cultural approach capable of developing real integration between the two key factors of the problem? The theme of technology must necessarily and without delay, be repositioned at the core of our reflection, so that it may actually give a valuable contribution to the achievement of full equality, inclusiveness, sustainability of growth, which may ultimately strengthen the centrality of Cultural Heritage.

Dr. Paolo Salonia is an Architect and former Director of the ITABC CNR, with more than 35 years of research experience in the field of knowledge for the preservation of architectural, archaeological, historical and artistic assets. Director of Research Associate of ITABC-CNR, he is currently Research director Associate at the ITABC-CNR and member of the executive board of ICOMOS. He has a huge experience of management and participation in several EU projects (e.g., FP7-600890 – ROVINA - Robots for Exploration, Visualization and Digital Preservation of Archaeological Sites), and was and still is National Coordinator and Scientific Director of Operational Units within several Italian publicly funded projects (for example PRIN, SIINDA, etc), as well as contracts with various Superintendences. His activity has been oriented to the knowledge, analysis and preservation of the architectural, archaeological, historical and artistic heritage, with a "multiscale approach", for the preservation, recovery, development and use of these assets.

Tuesday, 27th June from 10:00 to 10:20h

AFFORDABLE MECHATRONICS FOR THE EMPOWERMENT OF SCIENTIFICS

Pau Català, Juli Ordeix, Josep Ayats, Montserrat Corbera, Miquel Caballeria

MECAMAT Research Group, UVIC-UCC, Catalonia

Nowadays the majority of machines, mechanisms, devices or research equipment to accomplish their function requires the combination of mechanical, electronic, control and programming modules. Considering this fact, mechatronics engineers are extremely well prepared professionals to face the current scenario. In parallel, in the recent years many affordable technologies that are in the scope of mechatronics such as 3D printing or open electronics have come up, allowing free and fast knowledge sharing among citizens, organizations but also researchers. This conference presents the vision and experiences of UVIC-MECAMAT research group in the scope of providing affordable mechatronic devices for researches to empower their research areas.

Dr. Pau Català is Assistant Professor in Industrial Engineering at UVIC since 2016. He is PhD by the Universitat Politècnica de Catalunya (UPC) in Mechanical Engineering and Degree in Industrial Engineering by the UPC. His research interests are related with cam mechanisms, linkage mechanisms, kinematics, dynamic analysis, Machine Design, Advanced Manufacturing Processes.

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Tuesday, 27th June from 10.20 to 10.40h

DEMOSTRATION OF MECHATRONICS SOLUTIONS FOR LAB-BASED CHALLENGES: UNIVERSAL MACHINE FOR TENSILE TEST

Marcel Pla, Pau Català

MECAMAT Research Group, UVIC-UCC, Catalonia

This Final Degree Project (TFG) represents the design, construct and the validation of a low cost universal mechatronic machine (less than 1000) for a tensile or compression test. The universal machine needs to be adaptable for biologic materials and at the same time plastic materials with the strength enough for achieving the strain-deformation data of them. Also will be use it as an educational for some subjects at the materials from Technology and Science that are taught at engineering degrees and the research groups from UVic, TR2Lab (biomedical area) and MECAMAT(mechatronics area).
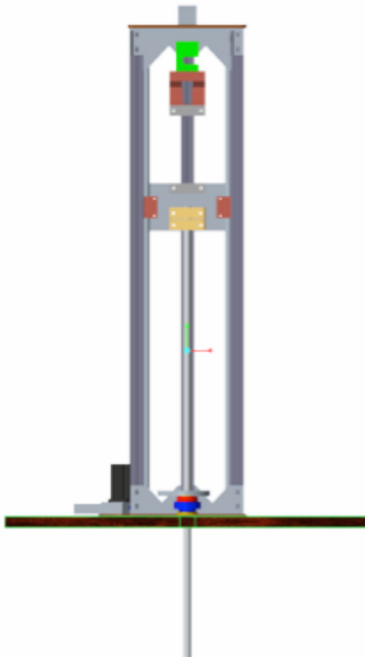
Marcel Pla is a recent graduated Mechatronic Engineer by UVIC-UCC.

Tuesday, 27th June from 11:30 to 12:20h

THE LAB OF THE FUTURE: ENABLING COLLABORATION BETWEEN ENGINEERING AND HERITAGE

Josep Grau-Bové

Centre for doctoral training in science and engineering in Arts, Heritage and Archaeology (SEAHA), EPSRC, University College of London, UK

Science and engineering are useful to heritage preservation when two conditions are fulfilled: technology must be accessible and research must be interdisciplinary. This talk will illustrate this principle with three stories from the centre for doctoral training in Science and Engineering in Arts, Heritage and Archaeology (SEAHA). The development of low-cost strategies for environmental monitoring and control in collaboration with diverse heritage institutions demonstrates the importance of interdisciplinary research. The Mobile Heritage Lab demonstrates how we can tackle the inequality of access to scientific resources. Experiments in citizen science offer new opportunities to support preventive conservation and, simultaneously, increase visitor engagement.

Dr. Josep Grau-Bové lectures in Heritage Science in the Institute for Sustainable Heritage, University College London, and manages the Mobile Heritage Lab, a mobile facility for research and public engagement. His research focuses on the interface where technology meets preventive conservation. He studies transport phenomena processes such as particulate matter and pollutant dispersion, plasticizer migration in historic plastics and moisture transport in porous media. He is also interested in exploring how computational methods, such as system dynamics, computational fluid dynamics and building information modelling, can support preventive conservation management.

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Tuesday, 27th June from 12:20 to 10:40h

SUSTAINABLE TECHNOLOGY FOR CULTURAL HERITAGE: THE smARTS PROJECT ADVANCES

Mainardo Gaudenzi Asinelli, Judit Molera, Juli Ordeix, Moisès Serra

MECAMAT Research Group, UVIC-UCC, Catalonia

The current convergence of open source and low cost technology, technological acceleration and hyper-connectivity, open and free access data, and active citizenship culture can represent a key factor for sustainable development actions on a 'glocal' base. Such a sustainable approach can enhance local communities abilities to preserve and promote their Cultural Heritage. The smARTS project is based on this approach, by promoting open and free access to knowledge and technology, interacting with the global makers movement, and sustaining the Citizen Science principles. This speech shows the more recent advances within the smARTS project on prototyping low cost, free and open source hardware and software, easy to assemble and easy to use, and fully customizable devices for mapping, monitoring and analysing cultural heritage artefacts and environments.

Dr. Mainardo Gaudenzi research focuses on technology applied to cultural heritage conservation science, with special emphasis on low-cost and open source technology. From summer 2016, he joined UVIC-UCC as an experienced researcher and post-doc Marie Curie Sklodowska fellow to run the smARTS project funded under the EU Horizon2020 programme. Main goals are to prototype smart and low cost devices to monitoring, mapping and analyse art's materials, as well as decay and conservation treatments processes. He is currently working on an environment monitoring system for museums.

Tuesday, 27th June from 12:40 to 13:00h

DEMOSTRATION OF MECHATRONICS SOLUTIONS FOR ON SITE AND LAB-BASED CHALLENGES

Pau Català, Mainardo Gaudenzi, Sergi Martínez, Albert Muñoz, Josep Pomés, Albert Rovira

MECAMAT Research Group, UVIC-UCC, Catalonia
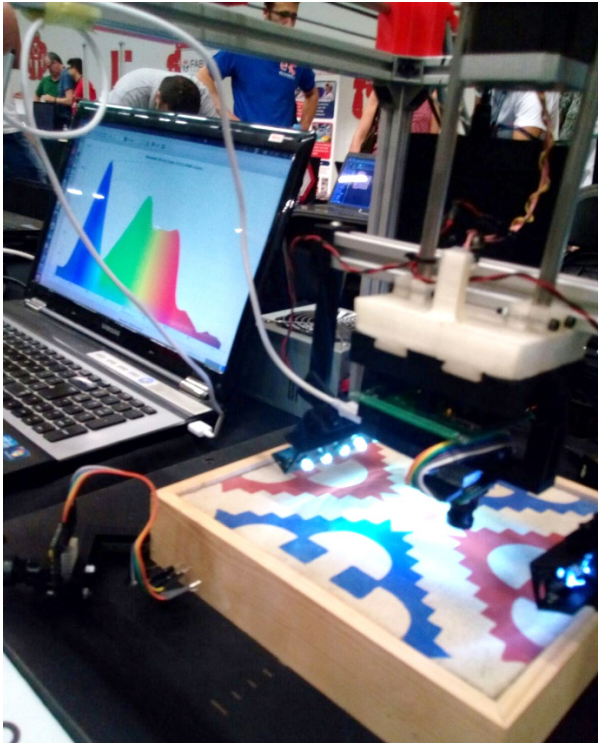
Sergi Martínez, **Albert Muñoz**, **Josep Pomés**, and **Albert Rovira** are students of Mechatronics Engineering at UVIC-UCC.

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Tuesday, 27th June from 13:00 to 13:20h

SHARE OR DIE!
THE ROLE OF MAKERS AND DIY CULTURE IN RESEARCH

Marc Genevat

Make&Learn, Catalonia

Since the emergence of open hardware and software, the spreading of knowledge sharing culture, as well as the appearance of prototyping technologies as the 3D printing, the maker and do-it-yourself philosophy has been a game changer for many research fields. It contributes to and accelerates research projects; and, at the same time, it lows costs and opens up enormous possibilities in many fields. In this conference the convergence between mechatronics discipline and cultural heritage science is discussed from the point of view of such a novel approach. The rover "Canyonero" is an example of how the maker culture and open resources can contribute to a wide variety of research applications, being a low-cost functional and modular prototype able to monitor remote areas autonomously collecting several types of data suitable for monitoring and mapping actions.

Marc Genevat is a Mechatronic Engineer by UVIC-UCC and Master in Robotics (UVIC-UCC and Eurecat). CEO and co-founder of Make&Learn. He is currently exploring how the maker education can impact the next generation of STEAM professionals. Associate professor at UVIC-UCC.

http://mon.uvic.cat/international-workshop/

 #IWHEUVic

Dates and Place:

Tuesday 27 June 2017
Aula Segimon Serrallonga, Masia Torre dels Frares
Universitat de Vic – Universitat Central de Catalunya
c/ Perot Rocaguinarda, 17, Vic

Information:

IWHE 2017
http://mon.uvic.cat/international-workshop/

Blog Mechatronics meets Heritage Conservation Science
http://mon.uvic.cat/international-workshop/mechatronics-robotics-
materials-and-signal-processing/

MECAMAT Research Group (SGR-1585)
Mechantronics and Modelling applied to Technology of Materials
http://mon.uvic.cat/mecamat

Contact:

Judit Molera, coordinator MECAMAT Research Group
Judit.molera@uvic.cat

Registration:

**Don't forget to register! (write down the detail of the symposia you
want to attend in the registration form)**
Free Workshop registration
http://mon.uvic.cat/international-workshop/registration/