Co-funded by the
Erasmus+ Programme
of the European Union

Applied Curricula in Technology for East Africa

Belgium - Germany - Greece
Ethiopia - Uganda - Tanzania
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Antwerp - Kortrijk - Dortmund - Chania
Mekelle - Jimma - Kampala - Mbarara - Arua
Dar Es Salaam - Morogoro

Training Dates

20th –26th January 2022

Place

Mbarara University of Science and Technology – Mbarara - Uganda

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About ACTEA

Problem Statement

STEM-education is very relevant for East-African countries, as producing added value is a way of improving life standard in these developing countries. Moreover there is a high demand for technicians from investors, NGOs and the emerging mid-class in Ethiopia, Uganda and Tanzania, supported by legislative attempts to increase local employment. To cope with this demand, there is a need for skilled people, trained in relevant engineering trades, but they are hard to find, due to the strong theoretical approach in universities instead of practice-oriented competence-based teaching. This is directly related to the lack of modern curricula in engineering and industry-grade equipment.

Goal of the project

The ACTEA project aims to fulfil the specific needs in engineering, provide better skills matching, deliver course material in 2 specializations, Computer Aided Manufacturing Technology and Electrical Engineering & Automation and, establish technologic laboratories, with virtual and remote accessibility, establish learning tools, give academic staff additional training on technology and in developing technologic course material according to EU standards.

Computer Aided Design & Development training

CAD/CAM refers to the integration of Computer-aided design (CAD) and Computer-aided manufacturing (CAM). Both of these require powerful computers. CAD software helps designers and draftsmen; CAM "reduces manpower costs" in the manufacturing process.

One goal of CAD is to allow quicker iterations in the design process; another is to enable smoothly transitioning to the CAM stage. Although manually created drawings historically facilitated a designer's goal of displaying an idea, it did not result in a machine-readable result that could be modified and subsequently be used to directly build a prototype. It can also be used to "ensure that all the separate parts of a product will fit together as intended.

CAD, when linked with simulation, can also enable bypassing building a less than satisfactory test version, resulting in having dispensed with the costly, time-consuming task of building a prototype.

In Computer-aided manufacturing (CAM), using computerized specifications, a computer directs machines such as lathes and milling machines to perform work that otherwise would be controlled by a lathe or milling machine operator. This process, which is called Numerical Control (NC OR CNC), is what came to be known as 20th century Computer-aided manufacturing (CAM), and it originated in the 1960s. Early 21st century CAM introduced the use of 3D printers.

CAM, although it requires initial expenditures for equipment, covers this outlay with reduced labor cost and speedy transition from CAD to finished product, especially when the result is both timely and ensuring one-time machining success rate.

Master Class Product & Process Design and Development by Muni University

Content

Input Muni

In this course:

- Input Muni

Prerequisites

- Input Muni
- …

Master Class Solid Edge by Mesay Alemu Tolcha (JU)

Content

Input Mesay

In this course:

Input Mesay

Prerequisites

- Input Mesay
- …

Automation training

Automation describes a wide range of technologies which reduce human intervention in processes. Human intervention is reduced by predetermining decision criteria, subprocess relationships, and related actions — and embodying those predeterminations in machines.

Automation, or automatic control, includes the use of various control systems for operating equipment such as machinery, processes in factories, boilers, and heat-treating ovens, switching on telephone networks, steering, and stabilization of ships, aircraft, and other applications and vehicles with reduced human intervention.

Automation covers applications ranging from a household thermostat controlling a boiler, to a large industrial control system with tens of thousands of input measurements and output control signals. In control complexity, it can range from simple on-off control to multi-variable high-level algorithms.

Master Class Embedded Measurement & Control

Content

Most common form of computer in use today is by far the embedded controller. This controller, combined with embedded software, is referred to as an embedded system. These systems are built into a product for control, monitoring and communication without human intervention. There are some 30 embedded microprocessors per person in developed countries with an average of 250 million lines of code. In a new premium car 20 to 70 electronic control units can be found. Embedded systems are used in more critical domains of human life, such as medicine, automotive and aerospace applications. And we all know very well our private embedded system, the smart phone, which has many advanced features and computing power, including a variety of sensors and wireless communication capabilities.

Billions of embedded processors are sold every year and annual market share is around 160 billion Euros with growth rates of around 9% depending on the domain.

With the rise of Industrial Internet of Things (IIoT), microcontrollers are finding rapid implementation in traditional industrial automation processes. With the growing market and opportunities, investing in education and research effort in innovative embedded control systems is very interesting for African universities as it does not need big investments, because controllers and tools are cheap compared to other machinery, while at the same time many useful application can be found.

In this course:

Will learn how to control high current loads basing on sensor values by building a simple Arduino based embedded system to control household appliances such as a light bulb or a fan depending on environmental or physical conditions like temperature, light and distance monitored by respective sensors

Prerequisites

- Participated in basic programing/Arduino programming course
- Embedded Kit: kit with microcontrollers, electronic components, sensors and actuators.
- A 5V Arduino relay module
- An AC bulb holder and a bulb
- Arduino IDE installed: https://www.arduino.cc/en/Main/Software

Master Class Process Simulation and Control

Content

The Master Class will provide the basic concepts and ideas on how to effectively and efficiently teach students in the concepts of Process Simulation and Control. The MC will cover the following major thematic areas:

- Modeling of dynamic systems
- Analysis of dynamic systems in the time and the frequency domain
- PID control design
- The pole-placement control system design

Expected audience

Teachers, lecturers, trainers in the field of Automation with interest in Control System Design.

Prerequisites

- Projector and projection area
- Wi-fi
- Whiteboard and markers

Master Class Automation

Content

Input MUST

A programmable logic controller (PLC) is an industrial digital computer that has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, robotic devices, or any activity that requires high reliability, ease of programming, and process fault diagnosis.

PLCs can range from small modular devices with tens of inputs and outputs (I/O), in a housing integral with the processor, to large rack-mounted modular devices with thousands of I/O, and which are often networked to other PLC and HMI / SCADA systems.

In this course, we will build-up practical and applied experiences with Siemens, one of the leading manufacturers in the world of industrial automation in combination with the ©Real Games Factory IO 3D virtual factory.

Expected audience

Input MUST

Teachers, lecturers, trainers in the field of Industrial Automation with interest in programmable logic controllers (PLC).

Prerequisites

- Input MUST
- Windows 10 computer with Siemens TIA Portal V16 installed (installation disk is delivered with the AST PLC Training panels in an installation box)
- Siemens TIA Portal V16 (can be found on a USB-stick inside the installation box)
- ASTI PLC Training panel with power cord and banana cords
- Ethernet download cable (green download cable delivered with ASTI PLC Training panels)
- Online course material
    - https://actea-erasmus.github.io/m2c3-plc
    - https://actea-erasmus.github.io/m2c4-aplc

Master Class Network & Cloud Technology in Education

Content

Overview of the network & cloud technologies used and applied in the curricula of the IT department of AP University College. We explain how we work together with external partners (Cisco, VMWare, Microsoft, Amazon, Google) and how we embed their technologies. We explain the reason why and methodology used for building our own private cloud infrastructure (using VMWARE) that is used for different courses and research projects and can work together with public cloud infrastructure.

Expected audience

Teachers, lecturers, trainers in the field of Network & Cloud technologies with interest in Virtualisation.

Prerequisites

- Projector and projection area
- Wi-fi

Labor market skills training

Labor market skills are identified as being valuable skills for engineers in addition to the specific engineering skills and knowledge.

In ACTEA we developed a courses on

- Project Management & Strategy
- Economics
- Soft Skills for Engineers
- Quality Control

Generic skills, soft skills, 21st century skills are often interchanged and they comprise skills, abilities, and learning dispositions that have been identified as being required for success in 21st century society and workplaces by educators, business leaders, academics, and governmental agencies. This is part of a growing international movement focusing on the skills required for students to master in preparation for success in a rapidly changing, digital society. Many of these skills are also associated with deeper learning, which is based on mastering skills such as analytic reasoning, complex problem solving, and teamwork. These skills differ from traditional academic skills in that they are not primarily content knowledge-based.

Master Class Project Methodology in Education

Content – Kelly Casal Mosteiro

Overview of projects in the IT program at AP university College. How do we work with external partners?
Overview of different project methodologies used and applied in the professional field.
Waterfall, Iterative/ Agile, SCRUM, KANBAN.
Advantages and disadvantages, when to use which methodology.

How to embed project methodologies in student projects. Advantage of this teaching method is that students learn all about working with a specific methodology, that they have practical experience before working as a professional. The additional advantage is that teachers have a methodology so they can follow up their students on different skills (technical, functional, soft skills) and have an insight on their projects and maintain regular contact through demonstrations and reviews.

SCRUM game: Let's build a tropical island.

Expected audience

Teachers of project courses, who want to get professionals involved in student projects, teachers who want students to learn practical methodologies while working on their projects. Teachers struggling with how to follow up on students during their projects. It doesn't matter if your student projects are IoT, security or software projects. This embedded methodology can be applied on several type of projects.

Prerequisites

- Input Kelly Casal Mosteiro
- Link to course presentation
- Scrum game material

Master Class Soft Skills for Engineers

Content

In this session an overview of selected soft skills essential for the collaboration among Engineers will be presented. The soft skills will be discussed with the participants will be:

1. Oral Presentation Skills.
2. Active Listening Skills.
3. Time Management Skills.
4. Cultural Intelligence Skills.

Expected audience

Undergraduate, postgraduate students, Scholars and Administrators.

Prerequisites

- Knowledge of English (with a Greek accent)
- Internet connection.
- Access to the internet either with mobile phones or PCs (I am using Mentimeter a lot during my lectures)
- Curiosity!!

Round table sustained cooperation – operation

The round table serves as a Master Class for the Development of Research & Internationalization Policy and Strategy, while at the same time it is the opportunity to investigate the cooperation possibilities and draft a 5-year follow plan after the ACTEA project.

The round table members also discuss the setting up meaningful cooperation with the local labor market, through the Business Integration Bureau, through shared experience in this matter.

The round table discussion gives the hosting university the opportunity to present itself to the EU partners, to highlight their departments and to investigate the

cooperation possibilities, both locally as internationally. The visiting EU universities in turn can present themselves and showcase their internationalization policy and strategy.

The final goal is to find synergies between the partners and mutual ambitions for student and staff exchange, internships and mutual beneficial project work.

Agenda

Thursday 20/01/2022 **09h00-12h00**	Master Class: Product & Process Design and Development by Muni University
Thursday 20/01/2022 **13h00-16h00**	Master Class: Product & Process Design and Development by Muni University
Friday 21/01/2022 **09h00-12h00**	Master Class: Embedded Measurement & Control by Kevin Njuu – Ardhi University
Friday 21/01/2022 **12h00-13h00**	Master Class Network & Cloud Technology in Education by Yves Masset-Belgium
Friday 21/01/2022 **15h00-17h00**	Opening ceremony MUST Technology Labs
Saturday 22/01/2022 **09h00-13h00**	Master Class Process Simulation & Control by George Fouskitakis (HMU-Belgium)
Saturday 22/01/2022 **09h00-12h00**	Master Class project methodology by Kelly Casal Mosteiro (AP-Belgium)
Saturday 22/01/2022 **13h00-15h00**	Master Class Process Simulation & Control by George Fouskitakis (HMU - Belgium)

Monday 24/01/2022 **09h00-13h00**	Master Class: Automation by MUST and Geert Van Grieken (AP), Belgium
Monday 24/01/2022 **13h00-18h00**	Visit MUST / visit external stakeholders
Tuesday 25/01/2022 **09h00-12h00**	Meeting sustained cooperation - operation
Tuesday 25/01/2022 **13h30-16h30**	Master Class Soft Skills for Engineers by Kostas Petridis - online (HMU)
Wednesday 26/01/2022 **09h00-12h00**	Master Class Solid Edge by Mesay Alemu Tolcha (JU)
Wednesday 26/01/2022 **13h00-16h00**	Master Class Solid Edge by Mesay Alemu Tolcha (JU)

Trainers

Kevin Njuu

Kevin Njuu holds a Master degree in Information and Communication science and engineering since 2016. He has been working with Ardhi University since 2011 as tutorial assistant and later assistant lecturer in the department of Computer Systems and Mathematics. In the department, Kevin has served as Information Systems Management degree programme coordinator, Curriculum development coordinator and Industrial training coordinator at different periods of time. Before joining Ardhi University, he worked as a Systems Administrator cum Trainer at University of Dar es Salaam Computing Centre.

His areas of expertise are Networking and Information Technology Systems development while his areas of research interest are Internet of Things, ICT for development, Machine Learning and Data Science.

Mesay Alemu Tolcha

Input

Georgios Fouskitakis

Dr. George Fouskitakis holds a PhD degree in Mechanical Engineering since 2001. After his studies, he worked as a post-doctoral researcher at the Stochastic Mechanical Systems Laboratory at the University of Patras/Greece. In 2008 he was hired as an Assistant Professor at the Department of Electronics of the Technological Educational Institute of Crete/Greece. He is currently an Associate Professor at the same Department.

His fields of expertise are: Stochastic signals and systems, stochastic fault detections and isolation, precision and intelligent agriculture. He was partner and coordinator of numerous national and international projects. He was guest professor and advisor in numerous European Universities.

Konstantinos Petridis

Input

Kelly Casal Mosteiro

Kelly has finished her studies in master Informatics in 2004. The first 3 years of her career she build-up practical and applied knowledge as software developer, team lead and project manager of IT projects. She has experience in functional analysis, Java development, leading teams and project methodologies. She is head of the department of Bachelor Applied Informatics and Associate Degree Programming. She teaches courses like Project analysis and coaches interns.

She is responsible for operational deployment and support of 45 staff members and 600 IT students, quality, curriculum development, cooperation with labor market, alumni and organizations, international networks and companies and coordination of R&D at the department.

Expertise: functional analysis, UML, Java, databases, project methodologies.

Research experience in TETRA and Interreg projects.

Yves Masset

Head of department Bachelor Electronics-ICT, Associate program Computer Network and System Administration and Associate program Internet of Things

Lecturer at Electronics-ICT, specialized in computer networks and network security

Responsible for operational deployment and support of 45 staff members and 600 IT students, quality, curriculum development, cooperation with labor market, alumni and organizations, international networks and companies and coordination of R&D at the department.

Expertise: Computer networks, CCNA, CCNP switching and routing, server technology, wireless technology, network security.

Research experience in TETRA and Interreg projects.

Geert Van Grieken

Geert Van Grieken holds Bsc. Electrical engineering, has finished his engineering studies in Electromechanics in 1997. The first 12 year of his career he build-up practical and applied knowledge as industrial engineer. He automated industrial warehouses, distribution centrums, production processes and cooling water facilities within Europe.

His educational experience started in 2009 where he teaches industrial automation to the Electromechanic Bsc students of the AP University of Applied Sciences. Since 2017 he his active as researcher for the AP University of Applied Sciences in the field of industrial automation.

Geert is specialized in PLC and HMI programming on Siemens PLC.

Dirk Van Merode

Ing. Dirk Van Merode MSc finished his engineering studies in Electronics back in 2002. After his studies, he found his passion in learning, developing, teaching and preaching technology, as a researcher, lecturer and international projects coordinator. Having worked in several other higher educational institutes, Dirk now works as a lecturer and research engineer at AP University College in Antwerp.

His field of expertise is in Internet-of-Things, digital systems design, printed circuit board design and production, embedded systems and audio-video production.

Research topics are mainly in European projects, both on curriculum development and student and staff mobility with countries outside the EU. He did research in space applications and satellite development for a couple of years.

He was partner and coordinator of numerous international projects.

He was guest professor and advisor in numerous European, Asian and African universities.

Dirk is currently coordinator of ACTEA: Applied Curricula in Technology for East Africa (www.actea.net).

Dirk is also partner in in Erasmus+ KA2 SPACECOM: New study program in space systems and communications engineering (https://spacecom.uz/en).

Ian Taremwa

Ian holds a bachelor of engineering in Electrical engineering from Kyambogo university Uganda and a national diploma in Electrical engineering.

He has a rich experience in industrial power systems, automation, control and instrumentation.

He has previously worked with Coca-Cola Beverages Africa at CBC mbarara Plant, CBC Namanve plant and Rwenzori Bottling company Namanve.

He currently heads Engineering laboratories' activities at MUST and teaches courses like Electrical installation design, Power systems, Control engineering and workshop practice.

Partner universities

MUST

Mbarara University of Science and Technology also known as MUST was opened in October 1989 after extensive modification of physical facilities of the former School of Midwifery at the Mbarara District hospital. The Mbarara University of Science and Technology Statue 1989 as passed by the National Resistance Council was the enabling law that established MUST as a body corporate. At that time Uganda's economy and social infrastructure which had collapsed, due to civil wars in the 1970's and 1980's. Therefore, with the government's realization that higher education was a critical asset for nation building, and in particular that Science and Technology was the most realistic driver to lead this initiative, MUST was therefore a welcome idea and has to date lived to that expectation.

Overcoming several set-up challenges the new Vice Chancellor Professor Frederick I.B Kayanja, in collaboration with 4 Cuban professors started the pioneer Faculty of Medicine opening its gates to the first 43 students admitted to the Bachelor of Medicine and Bachelor of Surgery (MBChB) program. Since October 28th, 1989 MUST has seen many community innovations, which have contributed to its development and that of our motherland Uganda.

In May 2012, the University finally unveiled and commissioned the much talked about move to a spacious campus at Kihumuro located 7 km on Mbarara- Bushenyi road with the commissioning of the Estates and works Block and handing over the site for the construction of the Faculty of Applied Science and Technology bringing to fruition the whole spectrum of this great University of Science and Technology.

Muni University

Muni University is the sixth public University legally established by Statutory Instrument No. 31 of the Parliament of Uganda in May 2013. It is located in Arua City, three (3) km south of City. The University was established to deliver tertiary education, conduct research and innovation activities, and run community outreach programmes for societal transformation. The Vision of the University is “to be a model University for transformation and development”, while the Mission is “to provide quality education, generate knowledge, and promote innovation and community empowerment for transformation”. The University promotes core values of quality, equity, responsiveness, professionalism, honesty, accountability, and innovativeness in all her people, processes, and products.

Muni University is further mandated by the Government of Uganda to undertake teaching and learning, conduct research and innovation, and implement community outreach programmes. Under these broad mandates, the establishment objectives of Muni University are to expand access to higher education, increase the number of scientists in both basic and applied sciences, train medical doctors, engineers, technologists, nurses, agriculturalists, science teachers, etc., and develop human resources appropriate for a decentralized system of governance for rural industrialization.

In line with its core mandate of teaching and learning, the University offer undergraduate and postgraduate programmes uniquely tailored to produce high quality graduates. The current student population is 429 (316 male and 113 female) pursuing studies in five faculties taught by 104 highly qualified teachers.

Therefore, the overarching objective of ACTEA Project is aligned with the core object of Muni University to expand access to higher education, and train engineers and technologists for industrialization of the nation.

Ardhi University

Ardhi University (ARU) is a public academic institution established under the Ardhi University Charter of 2007. Despite its relatively new status as a University, ARU has a long history dating back to colonial times when it was established as a Survey Training Centre (STC) in 1956. In 1972 the STC was expanded and renamed Ardhi Institute. Ardhi Institute became a Constituent College of the University of Dar es Salaam (UDSM) in 1997. It was named the University College of Lands and Architectural Studies (UCLAS) through Government Notice of June 29th, 1996, and UDSM Act No. 12 of 1970. In 2007, UCLAS was transformed to Ardhi University. The Vision of ARU is to be a leading center of excellence in knowledge generation and dissemination responsive to the dynamics of the national, regional, and global conditions. The mission of ARU is to provide innovative and integrated learning, research, and public services

that advance sustainable development at the national level and beyond. The core functions of the University are provided and stated in the University Charter (2007). They revolve around offering training, conducting research and innovation, and public service. ARU is a unique institution, being the only one of its kind in Tanzania and in Africa so far offering integrated training, research, and public services in the various matters related to land, the built environment, and other environmental-related disciplines, under one roof. In addition, ARU also offers other programmes in computer systems, arts, humanities as well as social and natural sciences. One of the goals of ARU 10 years corporate plan is to improve mainstreaming cross-cutting issues including industrialization with a target to produce skilled personnel with hands-on industrial technologies. The ACTEA project is in line to contribute to the ARU plan towards industrialized Tanzania.

HMU

HMU is a Public Educational Institution. It provides Undergraduate and Postgraduate Education, research and direct contribution to the regional and broader development of Crete and the Country, through lifelong learning, offering high profile technological and consultancy services to the industry, and technology transfer.

HMU, with its ca. 400 highly qualified teaching staff and fully adequate technical and clerical staff, provides high quality education (documented by all external evaluators) to more than 14,500 students. Education is delivered at the base campus in Heraklion city and at 4 branches in towns of Crete (Chania, Rethymnon, Aghios Nicolaos and Sitia). Degree Courses comprise Engineering and Informatics, Business Administration and Economics, Agriculture, Health and Welfare.

All courses are completed within a five year period and they are comprised by both theoretical lectures and laboratory experiments and exercises. Furthermore, Students are called before graduation to submit a dissertation and participate a six months long internship.

AP

AP University of Applied Sciences and Arts - Antwerp (AP) is a higher education institution located in Antwerp, Belgium. In its current form AP is a rather young university, resulting from the merger of two universities with a large history: Artesis University College and Plantijn University College. AP has 12000 students, 24 bachelor and 8 art programmes, clustered into 4 faculties and 2 schools of arts. Since

2010 the university is also hosting several programs of adult education and vocational training.

In the last few years the university has been involved both as partner or as coordinator in a large number of challenging international projects (Erasmus+, Creative Europe, Fundamental Rights and Citizenship, AMIF, ERDF/Interreg, Youth in Action, Tempus, Erasmus Mundus, ESF).