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

Applied Curricula in Technology for East Africa

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

Training Dates

23-31 October 2021

Place

Ardhi University – Dar Es Salaam

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

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.

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

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 PLC

Content

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.

Over 2 courses, from a basic course to an advanced course, we will build-up practical and applied experiences with Siemens, one of the leading manufacturers in the world of industrial automation.

Prerequisites

- 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 chord
- Ethernet download cable (green download cable delivered with ASTI PLC Training panels)

Master Class Motors & Drives

Content

Motors are omnipresent in modern-day industry. A good example to illustrate the need for electronic drives of electric motors is a pump installation.

Starting up an electromotor we can have excessive current. This can lead up to overheating.
To control a process we need to control the process flow. We can control this easy with valves but at a high energy consuming rate. Better is to control the speed of the pump self.
A motor drive will help us to control the speed of electromotors and other motor parameters. This can have its benefits in controlling the process, in energy consumption, in decreasing disturbances on the grid, in controlled acceleration of conveyer belts.

In this course:

- we will be introduced to Control Technics drives,
- we will explore how to use it,
- we will make basic adjustments to the parameterization.
- in short, we will lay a foundation so the user can figure out how to program the drive to control their motor.

Prerequisites

- Motor drive case
- Power cable IEC-320-C13 female to local plug
- Computer with following software installed: https://acim.nidec.com/en-us/drives/control-techniques/products/software/commissioning/unidrive-m-connect
- C300 datasheet: https://apps.controltechniques.com/Downloads/SharePoint/Download.aspx?SiteId=1&ProductId=258
- Student course: LAB Electrical motor & drives

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:

- we will be develop several low-power sensor nodes for temperature, humidity and light,
- we will set up a LoRaWAN gateway,
- we will register our sensor nodes in our network,
- send the sensor data to the Internet through the gateway,
- display the data in a Node-Red dashboard,
- drive a lamp through the Nod-Red dashboard.

Prerequisites

- Embedded Kit: kit with microcontrollers, electronic components, sensors and actuators.
- Arduino IDE installed: https://www.arduino.cc/en/Main/Software

Master Class Technology in VR

Content

Virtual reality is one of the most highly requested skill sets in the jobs market, and this master class will give you an introduction to the subject and key skills in the field. We discover the fundamentals of Virtual Reality, the hardware and different applications, and the psychology and challenges of the medium.

We will use Unity to develop our own VR environment.

We learn the basics of 3D graphics, how we create objects and how to lay them out to create an environment. We explore how to interact with a VR world.

By the end of the master class you will be able to develop your very own lab environment in VR.

Prerequisites

- Install and open Unity Hub:
  Go to the Download - Unity (unity3d.com) and select Download Unity Hub
- Open Unity hub & install Unity 2020.3 LTS:
  From Unity Hub, in the installs tab, click Add and Select Unity 2020.3 (LTS)
- Install the Android Build Support Module
  when prompted to install additional export modules, select Android Build Support

Agenda

Sunday 24/10/2021	**Meeting local coordinator / arrival African participants** Welcome, administration, hotel check in, practical arrangements
Monday 25/10/2021 **09h00-12h00**	**Geert Van Grieken / Bart Van Mol, AP University of Applied Sciences and Arts, Antwerp, Belgium** **Topic:** Master Class System Administration - lab maintenance **Content:** **Link:**
Monday 25/10/2021 **13h00-16h00**	**Geert Van Grieken / Bart Van Mol, AP University of Applied Sciences and Arts, Antwerp, Belgium** **Topic:** Master Class System Administration - lab maintenance **Content:** **Link:**
Tuesday 26/10/2021 **09h00-12h00**	**Geert Van Grieken, AP University of Applied Sciences and Arts, Antwerp, Belgium** **Topic:** Master Class Automation - basic **Content:** **Link:**
Tuesday 26/10/2021 **13h00-16h00**	**Geert Van Grieken, AP University of Applied Sciences and Arts, Antwerp, Belgium** **Topic:** Master Class Automation - advanced **Content:** **Link:**
Wednesday 27/10/2021 **09h00-12h00**	**Dirk Van Merode, AP University of Applied Sciences and Arts, Antwerp, Belgium** **Topic:** Master Class Embedded Measurement & Control – sensor nodes **Content:** In the Master Class we will set up a basic system with remote low-power sensors for temperature, humidity, light and dust. These parameters will be communicated to the LoRaWAN gateway to get it on the Internet. We will also make a dashboard to visualize data and steer some distant outputs. **Link:**

Wednesday 27/10/2021 **13h00-16h00**	**Dirk Van Merode, AP University of Applied Sciences and Arts, Antwerp, Belgium** **Topic:** Master Class Embedded Measurement & Control – IoT system **Content:** In the Master Class we will set up a basic system with remote low-power sensors for temperature, humidity, light and dust. These parameters will be communicated to the LoRaWAN gateway to get it on the Internet. We will also make a dashboard to visualize data and steer some distant outputs. **Link:**
Thursday 28/10/2021 **09h00-12h00**	**Bart Van Mol, AP University of Applied Sciences and Arts, Antwerp, Belgium** **Topic:** Master Class Motors & Drives **Content:** In this master class we explore the theoretical possibilities, we look at the hardware setup of the drive. We use the data and make some basic adjustments using only the drive. **Link:**
Thursday 28/10/2021 **13h00-16h00**	**Bart Van Mol, AP University of Applied Sciences and Arts, Antwerp, Belgium** **Topic:** Master Class Motors & Drives **Content:** In this master class we connect the drive with our computer to have an easy access to the parameters for more complexed adjustments. **Link:**
Friday 29/10/2021 **09h00-12h00**	**Tom Peeters, AP University of Applied Sciences and Arts, Antwerp, Belgium** **Topic:** Master Class Technology in VR **Content:** In this master class we discover the fundamentals of Virtual Reality. We will use Unity to develop our own VR environment, and learn the basics of 3D graphics, how we create objects and how to lay them out to create a VR environment. **Link:**
Friday 29/10/2021 **13h00-16h00**	**Opening ceremony Ardhi labs** Speeches Opening the labs Reception

Saturday 30/10/2021 **09h00-12h00**	**Visit local stakeholders / Technology Roadshow Karume Institute of Science and Technology** Visit technology companies, external stakeholders, dissemination of the ACTEA project
Saturday 30/10/2021 **13h00-16h00**	**Visit ARU / Technology Roadshow Karume Institute of Science and Technology** Visit the local labs, dissemination of the ACTEA project

Trainers

Geert Van Grieken

Geert Van Grieken Bsc 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.

Bart Van Mol

Ing. Bart Van Mol MSc is specialized in electricity.

After a short career in the private sector he started teaching about 20 years ago at AP University College, with a specialization in practical training.

His majors are electricity, basic electronics, electrical machines and automation.

Tom Peeters

Tom Peeters graduated as a Master of Industrial Sciences, specialized in Electronics-ICT. He started in 2003 as a software engineer and project manager for Agfa-Gevaert. Since 2009 he is lecturer software and web development for the educational program of IT (AP University of Applied Sciences and Arts). He is also responsible for the international collaboration projects of Electronics-ICT, therefore he gives guest lectures abroad: in Finland (Oulu), Austria (Skt-Pölten), etc.

Besides he is a senior researcher and has worked on several projects, such as Show & Tell! Immersive Storytelling (a multidisciplinary project concerning VR, AR, 360° video).

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).

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).