

Competence Center on Automation: Developing Competences in Industrial Automation for the Moroccan Job Market

01 Cover**02** Table of Content**03** Forewords**03.1** “Creating jobs through the qualification”**03.2** “AHK Morocco and CCoA: Complementary Activities”**03.3** “Industry 4.0 and AI - drivers of economic development”**04** Framework & Partners**05** Module 1: Technical Competences with PLCnext Technology and Sustainable Knowledge Transfer**05.1** Train-the-Trainer Sessions: Training Content**05.2** Training Impressions and Testimonials**06** Module 2 : Diversification of Continuing Education**07** CCoA Partner Survey**08** Interviews with Students on their Automation Projects**08.1** Automated Loom 4.0**08.2** Digital Twin**08.3** Fuel Cell Hardware in the Loop**09** CCoA Conference: Creating Competences in Automation**09.1** Impressions of the CCoA Conference**09.2** Winners of the Young Talents in Automation Award**10** Start-Ups**11** Morocco 4.0: Talents & Technology**12** PLCnext Training for Professional Engineers & Technicians**13** Digitalizing Industry 2.0 Machinery at ENSET Mohammedia**14** CCoA Factsheet & Imprint



Forewords

Creating jobs through the qualification

In December 2020, we started the ‚Competence Center On Automation‘ project with our main German partners, including ZVEI, Deutsche Messe Technology, Phoenix Contact, Pflitsch GmbH, Rittal and Siemens and entrusted the implementation in Morocco to Steinbeis University, which has extensive experience in the implementation of competence centers worldwide. The establishment of CCoA was realized with the support of the Special Initiative „Decent Work for a Just Transition“ - Invest for Jobs of the German Federal Ministry for Economic Cooperation and Development (BMZ) implemented, among others, by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. In Morocco, the Special Initiative is implemented in cooperation with the Ministry of Industry and Trade.

In line with the objectives of Invest For Jobs, CCoA has set itself the task of creating jobs through the qualification of resources and the exchange of experience bet-

“The ambition is also to bring together Moroccan and German but also European SMEs and start-ups.”

ween Moroccan and German partners. The ambition is also to bring together Moroccan and German but also European SMEs and start-ups.

With the support of the Moroccan team and our experts from GIZ Morocco, we have mobilized our Moroccan networks to take part in the project. In total

- 19 training institutions - including: Hassan II University Casablanca, Office de la Formation Professionnelle de Promotion du Travail, Institut de Formation aux métiers de l'Industrie Automobile, Institut Agronomique et Vétérinaire Hassan II, Ecole Nationale des Sciences Appliquées de Tétouan et Kenitra, Ecole d'Agriculture de Temara, Cité de l'innovation de l'université Cadi Ayyad de Marrakech, Fablab de Casablanca and Ecole Supérieure des Industries du Textile et Habillement
- 128 Moroccan companies - including: Tectag Maroc, Masra Maroc, Nextronic, OCP Group, Union Telecom, Akka technologies, Groupe Unimer, Safilait - Groupe Bel, Agile Systèmes, AirTelecom Technologies, Maghreb Steel, Electrolux, SETEXAM, Cosumar and AIC Métallurgie
- 36 European companies - including : Siemens AG, Hucon AG, P3 Group, Bertrandt AG, Volkswagen, ETAS (Bosch

Group), INOYAD Technologies, Multivac Group and Abicor Binzel

took part in our activities, for the 2 modules:

Module 1: Concerns pedagogical aspects: Following a training needs analysis carried out with companies and training institutes, a program was developed and delivered to multiplier trainers, who in turn trained trainers in their institutions on the PLCNext technology from PhoenixContact. To date, 66 trainers have built their capacity and delivered these trainings to young people of different levels (technicians or engineers), who have applied the acquired skills in their final projects. As of November 2022, more than 469 young people have been trained, 150 of whom have entered the workforce

Module 2: Networking, conferences, workshops and scientific activities that have contributed to the outreach of the Center and its activities. These activities have mobilized a community of 625 members, who have exchanged during the events and continued the discussion: <https://competence-automation.ma/welcome-community/>

The Bizfit.ma platform was developed with the ambition of connecting German and Moroccan companies through

a unique mechanism that will facilitate the establishment of potential contacts between companies from Morocco, Germany and Europe. In addition direct contacts were facilitated by the CCoA teams in Morocco and Germany.

With the conviction that much has been done, but that much remains

“Much has been done, much remains to be done”

to be done, we share with you the testimonies of some of our beneficiaries and we commit our partners to continue the sustainable use of the trainings and platforms acquired through the support of the Special Training and Employment Initiative.



Saloua HAJJI LAASSEL
Conseillère Technique
– Formation
Professionnelle

Partenariat pour l'Emploi et Appui aux Moyennes Entreprises au Maroc

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

AHK Morocco and CCoA: Complementary Activities

The AHK Morocco welcomes the cooperation with the CCoA which started in the framework of the Special Initiative „Decent Work for a Just Transition“ (“Invest for Jobs”). The Business Desk Casablanca was created as a contact point and one-stop shop for the special initiative in order to address and accompany German or European companies as well as to make the portfolio of support,

within the initiative, known to the business community. Since the beginning of the project, the Business Desk and CCoA cooperate and exchange in a very pleasant and productive way to exchange on training offers and possibilities for companies. Both complement each other in their core activities and knowledge. We believe that the cooperation will also remain in the future and get even stronger by working together on several upcoming events which connect academia with the business community.

We are confident that CCoA's initiatives will be beneficial and helpful for the AHK Morocco members and partners.



Preparing industries for technologies of the future

An ongoing challenge for the Moroccan industry is the often present misfit between the needed skills and mostly theoretic educational methods. CCoA activities such as specific trainings tailored to the needs of the industry can help to build the needed bridges. Moreover, they are also facilitating skills that will be required to level up and prepare industries for technologies of the future. Especially the Moroccan automotive industry grew significantly in the last years and it has gained international recognition. In order to keep up with the development of newest technologies and trends it is important to dispose over respectively trained workforce. To create this link between industrial needs and adequate promising training for the workforce, the initiatives of the CCoA come into play.

Furthermore, the CCoA facilitates a platform for bilateral knowledge exchange, which provides necessary impulses for the industry as well as the educational sector. Guidance on automatization is also highly beneficial for the strengthening of Morocco's competitive advantage.

We as AHK Morocco see promising opportunities to further develop our cooperation with CCoA in our shared mission to bring education and academic knowledge into practice by working closely together with the industry.



Deutsche Industrie- und
Handelskammer in Marokko
Chambre Allemande de Commerce
et d'Industrie au Maroc

Industry 4.0 and AI - drivers of economic development

The German Electrical and Electronic Manufacturers' Association (ZVEI) represents the economic, technological and environmental interests of the German electrical industry. With around 900,000 employees nationwide and an industry turnover of around 225 billion euros (2022), the electrical and electronic industry is the second largest industrial sector in Germany after mechanical engineering in terms of the number of employees. The ZVEI is made up of 22 trade associations of member companies, most of which manufacture electronic components for the digital transformation of society and industry. The innovative products and solutions of ZVEI member companies pave the way for emission-neutral production, more sustainable business and the achievement of Germany's climate policy goals. The innovative strength of the German electrical and mechanical engineering industry has made Germany one of the world's leading nations in the development, production and application of modern automation technology.

Industry 4.0 and AI are related but distinct concepts

Industry 4.0 refers to the integration of advanced technologies, such as the Internet of Things (IoT), robotics, and automation, into industrial production processes. This integration enables greater connectivity and communication between machines and systems, leading to increased efficiency and productivity. Artificial Intelligence, on the other hand, is a subset of computer science that involves the development of algorithms and computer systems that can perform tasks that typically require human intelligence, such as learning, problem-solving, and decision-making.

Drivers of productivity, competitiveness and sustainability

Together, Industry 4.0 and AI deliver significant benefits to a nation's economy. Key benefits of these technologies are e.g.

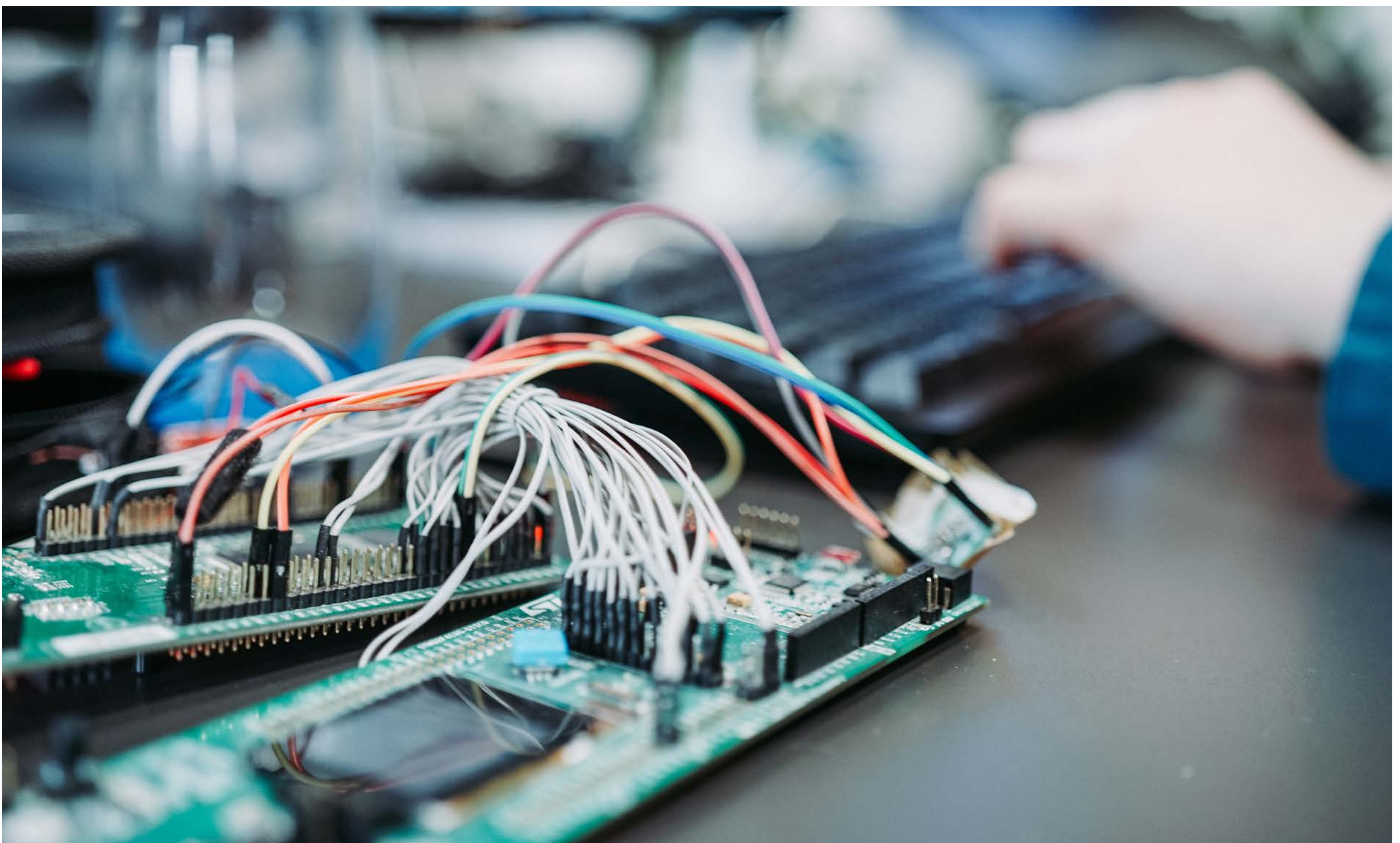
- Increased productivity and efficiency: Industry 4.0 technologies such as IoT, robotics and automation can help streamline processes and reduce waste, leading to increased productivity and efficiency. AI can further enhance this by providing advanced analytics, predictive maintenance, and optimization

algorithms, which enable companies make better use of their resources.

- Improved competitiveness and quality: By using Industry 4.0 and AI technologies, companies can produce higher quality products more efficiently, which can help them to compete in a global market. They can also use AI-powered predictive analytics to identify new business opportunities and optimize their operations.
- Sustainable development: Industry 4.0 and AI can help reduce the environ-

mental impact of industrial production by optimizing energy and resource use and reducing waste. For example, AI-powered energy management systems can optimize energy use in buildings and factories, while IoT sensors can monitor water and air quality to prevent pollution.

- Economic growth: By improving productivity, competitiveness and innovation, Industry 4.0 and AI can contribute to economic growth and prosperity of nations.



New jobs for the future through Industry 4.0 and AI

Industry 4.0 and AI are creating new jobs and transforming existing jobs in many industries. While it is true that some jobs will be displaced by automation and other advanced technologies, new jobs will be created in areas such as software development, data analytics, cybersecurity and maintenance of new technologies.

For example, Industry 4.0 technologies such as the IoT and robotics require skilled personnel to design, install, operate and maintain them. Similarly, AI technologies require data scientists, machine learning engineers, and software developers to develop and implement AI-powered systems and applications. In addition, the increased efficiency and productivity may create demand for new products and services, which in turn may create new jobs in sales, marketing, and customer service.

It is important to note, however, that the new jobs created by Industry 4.0 and AI may require different skill sets than the jobs that will be displaced. This means that education and training programmes will be needed to ensure that workers have the skills they need to succeed in the new job market.

Digital transformation has just begun!

Industry 4.0 and AI have triggered major changes in our world and will transform it into an all-electric society within the next few years. ZVEI member companies contribute to this digital transformation process by developing, introducing and optimizing electronic components and new concepts. Technological innovations from ZVEI members thus support global efforts to make this world more sustainable, not least in the interests of sustainable climate protection and the worldwide conservation of resources. Against this background, the concept of the Competence Centre on Automation was jointly developed and implemented jointly by GIZ, ZVEI and Steinbeis University. This exciting story has only just begun.



Johannes Kirsch
Senior Director at ZVEI
International Trade and
Future markets

zvei
electrifying
ideas



Partners & Framework

Introduction

In recent years, Morocco is making strong economic progress and is rapidly establishing itself as an industrial site and hub for the African continent with extensive development plans for key sectors such as mobility and transport (automotive, aviation, airport, port, traffic control, etc.), data processing, renewable energy, agriculture and agribusiness. Today, Morocco is one of the most attractive countries for foreign direct investment in Africa. For this development, Morocco needs industry experts in automation technology to support the industry. The Competence Center on Automation (CCoA) was launched in 2020 to support the Moroccan industry by facilitating industrial knowledge transfer from Germany to Morocco and to create jobs as well as competences for the Moroccan job market, thus promoting economic growth. Through sustainable knowledge transfer, Moroccan young talents were trained to become experts in automation for the Moroccan industry.

Automation has developed into an important technology to increase company agility and international competitiveness significantly. By implementing automation, Moroccan industries will be more attractive for foreign companies, increase the diversity and quantity of their production, and create additional jobs.

In order to strategically contribute for job creation and improvement in Morocco, CCoA is focusing on the qualification of young graduates, technicians and engineers in automation technology, mainly for the automotive and food processing sectors. Other economic sectors, such as energy and infrastructure will also be impacted by CCoA, since digital automation technologies are generally not sector-specific but may be practically applied in different industrial sectors..

To create the most effective environment for the Moroccan industry, CCoA analyzed the current situation of automation and digitalization in the Moroccan industry. Based on a survey with over 100 responses from higher education institutions and companies as well as interviews with 16 experts, German and Moroccan experts developed the training concept and defined main topics for CCoA. Topics that were considered relevant for automation and Industry 4.0 for Morocco, but not to be included in the trainings of Module 1, were offered in seminars open to members of educational and industry institutions in Module 2.

The active participation of numerous university lecturers and companies from Morocco made the uniquely broad participation possible. The prerequisite for this was that the CCoA had already im-

plemented a well-thought-out concept of train-the-trainer measures since summer 2021. The first teachers from Morocco's most renowned universities who took part in the measures were already able to apply the technological and didactic skills they had gained to

train students in state-of-the-art technology for Industry 4.0 and to supervise them in practical projects. To this end, the CCoA team was able to successfully win more than 50 companies and institutions from Morocco and Germany to assign tasks for the PFE and PFA projects.



CCoA is supported by the Special Initiative „Decent Work for a Just Transition“ of the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. The Special Initiative, which also operates under the brand Invest for Jobs, aims to team up with companies to create good jobs in the eight African partner countries, and to improve local working conditions. CCoA is led by Steinbeis University in a joint effort of the German Electro and Digital Industry Association (ZVEI) and the German Chamber of Commerce in Morocco (AHK Morocco), together with Phoenix Contact Group and Deutsche Messe Technology Academy (DMTA).

Deutsche Gesellschaft für Internationale Zusammenarbeit in Morocco (GIZ Morocco)

Since 1975, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH has been active in Morocco on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) and supports its Moroccan partners in promoting sustainable development. GIZ is also increasingly working for other clients such as the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU),

the Federal Ministry of Foreign Affairs (AA), the Federal Ministry of Economics and Energy (BMWi), the European Union and Moroccan companies. On behalf of BMZ, GIZ is involved in sustainable economic development, integrated water resources management, renewable energy and energy efficiency. GIZ also implements projects in the fields of environment and climate as well as good governance, decentralization and migration. The GIZ office has been located in Rabat since 1999. It currently has more than 228 national and 46 international staff serving in the country.

German Chamber of Industry and Commerce in Morocco (AHK Morocco)

The German Chamber of Industry and Commerce in Morocco (AHK Morocco) is the competent partner for German-Moroccan economic relations. The AHK Morocco is the first contact for many questions concerning the German or Moroccan market. With its more than 500 members, it has been an efficient system of mutual support since 1997. The AHK Morocco is part of the worldwide network of German Chambers of Commerce Abroad (AHK) with 140 locations in 92 countries. This network advises, supports, and stands for German companies worldwide that wish to establish or expand their foreign business. AHKs

are institutions of German foreign trade promotion. The Association of German Chambers of Industry and Commerce e. V. (DIHK) coordinates and continuously develops the network of German Chambers of Commerce Abroad. They are proportionately funded by the Federal Ministry of Economics and Energy (BMWi).

German Electro and Digital Industry Association (ZVEI)

ZVEI is committed to the common interests of the electro and digital industry in Germany and at the international level. The basis of the association's work is the exchange of experience and views between the members about current technical, economic, legal, and socio-political topics in the field of the electrical industry. From this exchange, common positions are drawn up.

With proposals on research, technology, environmental protection, education, and science policy, the ZVEI is a pace-maker of technological progress. It supports market-related international standardization work.

Over 1,600 companies have opted for membership of the ZVEI. They employ around 90 percent of the employees and

staff of the electrical industry in Germany. Its members include global players, medium-sized and family-owned companies. The sector has 885,000 employees in Germany plus more than 790,000 employees all over the world.

Steinbeis University

The Steinbeis Network currently encompasses more than 1,000 centers and institutes. Each specializes in a specific field, servicing the requirements of all technical and management disciplines. Most centers are managed and run by university professors who actively embody the Steinbeis principle of merging academic theory and learning with everyday business practice.

The Steinbeis University is a subsidiary of the Steinbeis Foundation for Economic Development. Spanning a worldwide network of specialists and experts, as well as offering training and employee development, the Steinbeis organization provides a variety of services including: consulting and advisory services, research and development support, evaluations and expert reports.

Deutsche Messe Technology Academy (DMTA)

The Deutsche Messe Technology Academy (DMTA) is a joint venture between Deutsche Messe and the Volkswagen Group Academy. Since the foundation in 2009, DMTA built up a unique network. Leading companies in production technology and public initiatives for innovation support this institution. DMTA sees itself as a joint platform for the transfer of industrial knowledge. Since its foundation, it has gained strong partners for this purpose - leading companies from the production technology sector, public initiatives for innovation and technology transfer, research institutions, universities and specialist publishers.

DMTA brings together suppliers, users and knowledge partners worldwide in a unique ecosystem of intelligent production technology. The academies and the network serve the transfer of technological knowledge. Industrial production technology, numerous robots from leading manufacturers and two real production facilities are in operation at all events and allow visitors to experience technology live.

Phoenix Contact Group

Phoenix Contact is the worldwide market leader of components, systems and solutions in the area of electrical engineering, electronics and automation. Today, the family-owned company employs 17,600 people worldwide and had a turnover of 2.48 billion euros in 2019. The corporate headquarters is located in Blomberg in Germany. The Phoenix Contact Group has eighteen companies in Germany as well as more than 55 international sales subsidiaries.

Internationally, Phoenix Contact is on site in more than 100 countries. It supports the digital transformation with products, systems and solutions. Based on the experience in the in-house machine building, the company knows the requirements of the digitalization and integrated data flow from the engineering through the production and furthermore along the whole product life cycle.

The company has been continuously training technical and commercial specialists since 1957 and has received several awards for its educational work. For more than 25 years, the company has also been involved in international education work and has more than 150 education partners in the academic and vocational fields in over 40 countries.



Module 1

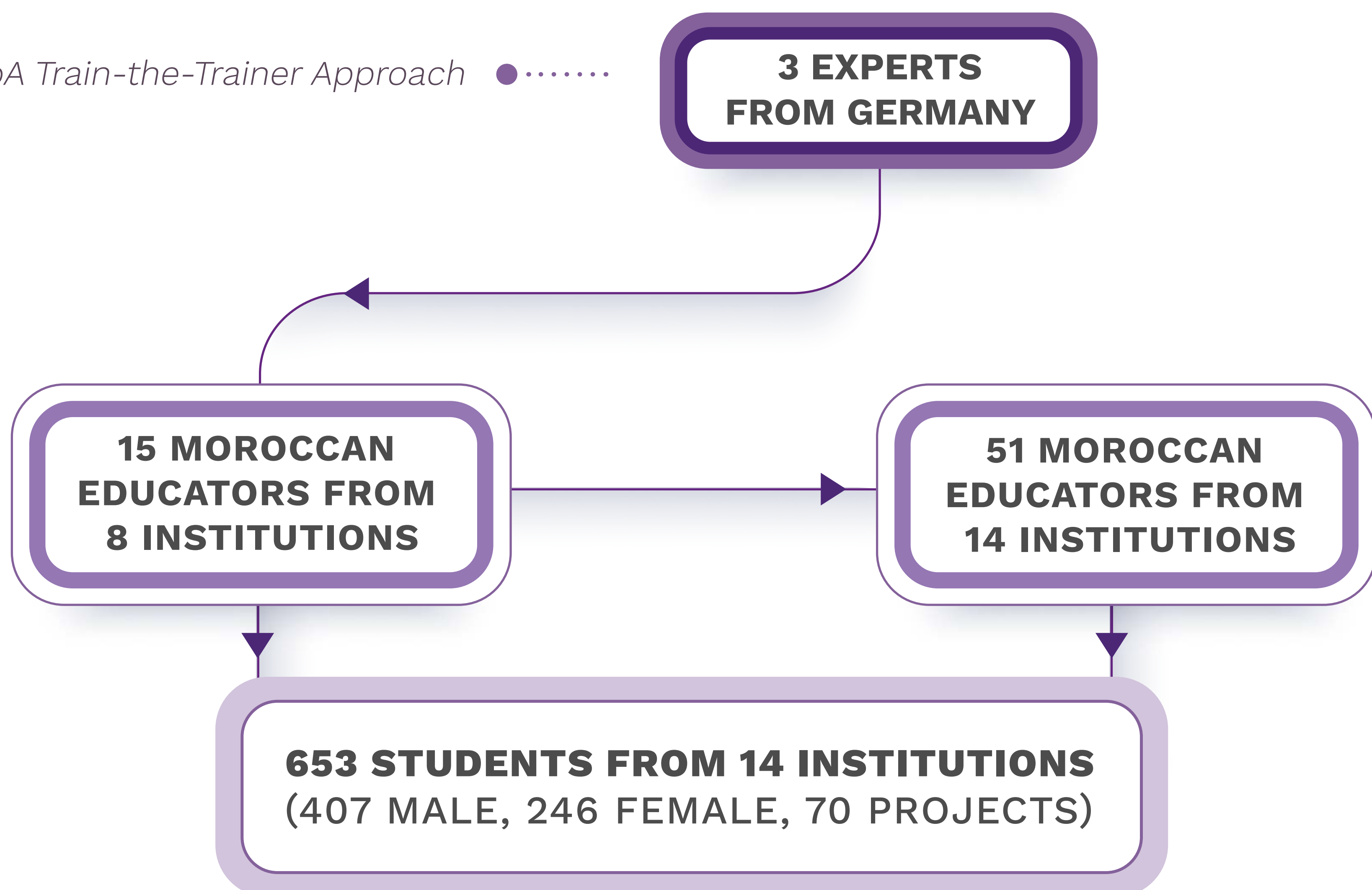
Technical Competences with PLCnext Technology and Sustainable Knowledge Transfer

Sustainability of knowledge transfer is one of the main goals of CCoA. In Module 1, CCoA distributed 47 PLCnext boards to the partner institutions for automation trainings and Moroccan educators trained on automation technology on these boards. In a train-the-trainer approach, the 3 German experts on automation, industrial education, and global innovation management, trained 15 Moroccan educators from universities and vocational schools. These 15 educators became training multipliers and continued to

train 51 additional Moroccan educators. Out of a total of 66 educators, 16 were women, which represents 24 percent. The Moroccan educators were not only qualified in PLCnext technology during the trainings, but also trained in topics such as Industry 4.0, programming languages, as well pedagogical possibilities.

The 66 educators transformed the training content into seminars and classes at the vocational and university level to qualify engineering and technician

CCoA Train-the-Trainer Approach ●



students in automation technology. As of April 2023, 653 students in their 2nd, 3rd, 4th, and 5th year received training in PLCnext technology through CCoA. Of these, 246 (37.6 percent) are women and 641 are younger than 25 years old.

After students received training in automation technology, they applied their theoretical training in practical industry projects for Moroccan and German companies. Through this approach of integrating theoretical knowledge and practical experience in industrial automation, CCoA can support Moroccan institutions and companies to become innovation centers, and therefore support and speed up Moroccan industrial innovation. The duration of the training and the projects implemented depended on the respective institution and program. Students' industry projects were categorized into two groups:

- **Projets de fin d'études (PFE):** It is a determined period of 3 to 4 months during which the student works on an industry project at a company or on technologies to solve a defined problem. The PFE marks the end of the curriculum in engineering school, university, or vocational school.
- **Projets de fin d'année (PFA):** It is a project carried out by 3rd or 4th year students during the last 2-3 months of the academic year. They are generally projects carried out within the school on real-world applications.

The industry projects were mostly team projects and required students to work interdisciplinary. In addition, for many students this was the first time they worked in a professional setting, which gave them the opportunity to develop their soft skills as well.

Train-the-Trainer Sessions: Training Content

Session 1	Session 2	Session 3
<ul style="list-style-type: none"> • Industry 3.0 & 4.0 • Industrial Communication • PLCnext & Industry 4.0 • Installation PLCnext Engineer • WBM and Node-RED Application • Commissioning of Axioline and Profinet • Definition of variables and mapping of process data • Classic PLC programming and IEC61131 • Task and Data Management • Program organization units F • Standard and function modules • Function module languages • IP Communication Modules • Real time and data consistency • Practical Examples: ESM / GDS, traffic lights, testing and debugging 	<ul style="list-style-type: none"> • Industry 4.0 and the Industrial Internet of Things: Implementation, PLCnext technology, Controller AXC F2152 • Starter-Kit Commissioning: Web Based Management WBM, Periphery (Axioline, Profinet) • Programming environment: configuration, programming and testing • PLC standard IEC61131: program organization, data types and programming languages • Project from the scratch • ESM & GDS Project Rehearsal, re-evaluation, pedagogical and didactic aspects: OPC UA, Node-RED, MQTT, Web HMI 	<ul style="list-style-type: none"> • Networks: IP communication, WiFi access point, Digital twin • Process simulation: Factory I/O • Predictive maintenance: data logger • High level languages I: C# • High level languages II: C++ and Matlab



Content Approached on Train-the-Trainer Sessions

Training Impressions and Testimonials





“I was pleasantly surprised by the high quality of university education in Morocco. There is no significant difference in the training courses here compared to graduates from technical institutions in Germany.”

Götz Jäckel, German Expert



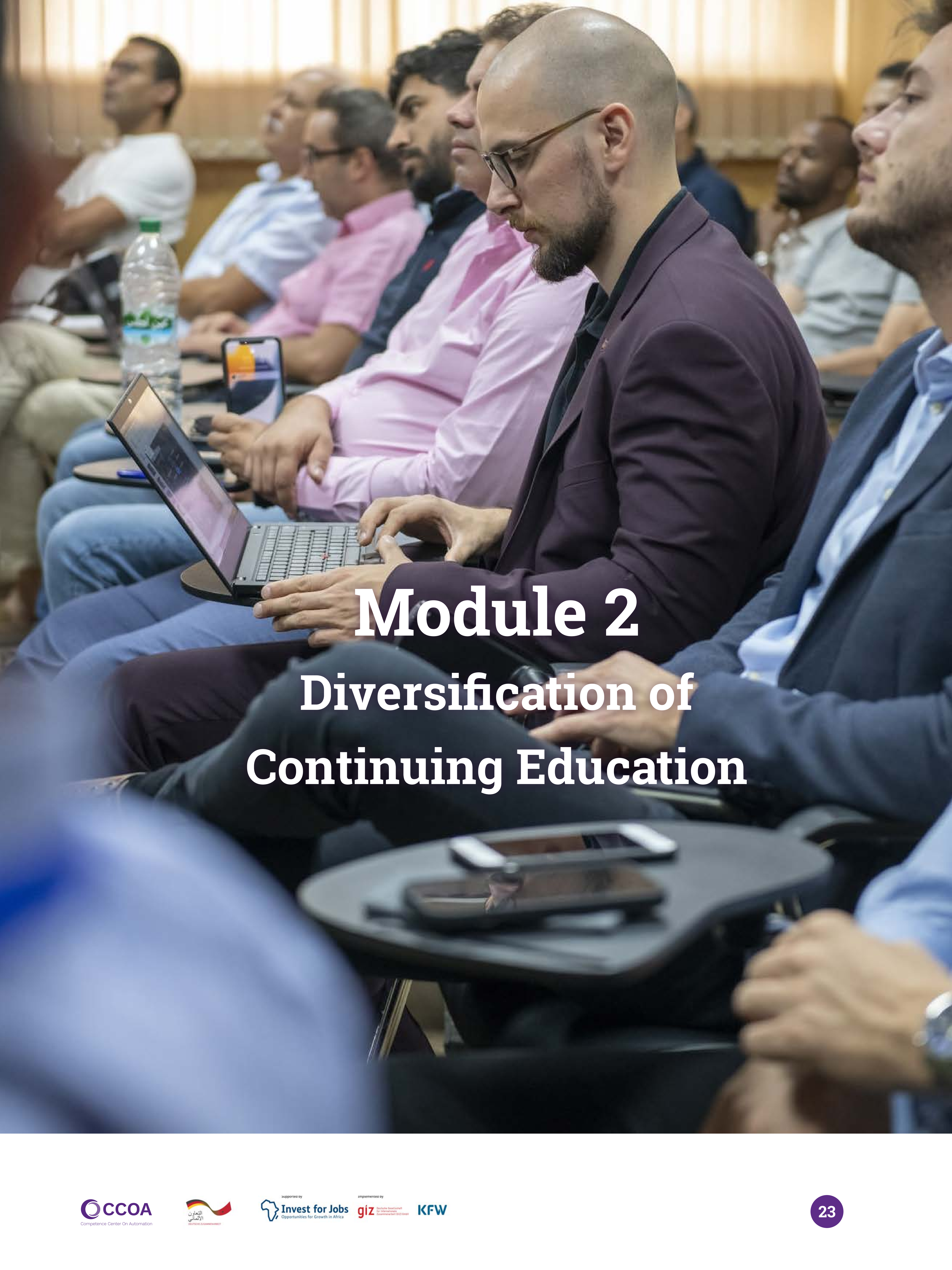
“As a participant of CCoA’s train-the-trainer under the topic Industry 4.0 and PLCnext, I would like to express in a few words that the training was rich in information and very beneficial for me as a trainer in the field of automation. It helped me, on the one hand, to transfer to my students the notion of Industry 4.0 and it opened up the new powerful brand of PLCnext controllers.”

Abdessamad Harrandou, Vocational School Trainer



“During the training, we learned everything related to programming, Node-red, data exchange, informational exchange, and how to control the system. With this training, the aim is to bring this new technology to our students at ENSAM and to all students from higher education. This way, they will gain access to new generations of PLC such as the one from Phoenix Contact.”

Prof. Dr. Nabila Rabah, ENSAM Casablanca

A group of men are seated in a classroom or meeting room, facing forward. They are dressed in business casual attire. Some are using laptops, and others are looking at their smartphones. The room has large windows with blinds in the background. The text "Module 2 Diversification of Continuing Education" is overlaid in white on the image.

Module 2

Diversification of Continuing Education

In addition to the training content delivered in Module 1, CCoA offered seminars to a broader public on topics related to automation and Industry 4.0 in collaboration with Moroccan and German partners. Whereas these seminars were initially only online, they were held in hybrid format as soon as it was possible observing COVID regulations in Morocco. The focus in Module 2 was on applying experiences from the first module and meeting the necessities of the Moroccan economy by conveying knowledge and practical experience in the field of automation.

The „Automated Robot Welding in collaboration with Abicor Binze and FANUC“ was the first seminar. It provided an overview of the different welding methods and processes and an insight into the prospects of innovative welding technologies. At „How to Become an Intelligent Enterprise in the Era of Industry 4.0“, Walid Belahmer of SAP North Africa, emphasized the importance of ERP systems in optimizing business processes and how industrial processes can be mapped digitally and designed efficiently.

The third CCoA event, „Automation and Employment – Shaping the Future of work“, symbolized the official kick-off of the project after the difficulties brought



“As a cooperation partner of the CCoA, the DMTA has made available all its know-how developed over many years in the field of knowledge transfer, event management and modern content marketing. With Module 2, we pursued the objective of promoting and improving the know-how transfer of automation solutions to Moroccan companies through seminars, workshops and networking events. To this end, we invited German and Moroccan experts from companies, universities and research institutions to present their respective solutions to interested participants and to be available as discussion partners. “

Reinhold Umminger,
Director Global Business DMTA

by the COVID-19 pandemic and was hosted with GIZ, AHK Morocco, and ZVEI. This event addressed several topics such as: (a) automation for the manufacturing industry in Morocco, (b) Morocco as an attractive market for high-tech in North Africa, (c) importance of industry 4.0, (d) Automation technologies and jobs of tomorrow.

The Human-Robot Collaboration seminar was the first hybrid event held online and at ENSAM Casablanca. The seminar explored the cooperation between humans and robots in depth by combining the experience, expertise, and flexibility of humans with the power, endurance, and precision of robots.

In the following Smart Factory seminar, organized in collaboration with Siemens, methods for manufacturers and SMEs to organize smart production to survive in international competition were introduced.

CCoA held two seminars at ENSET Mohammedia. The „Cabinet Construction“ seminar was a live tour inside the Phoenix Contact smart factory with their experts presenting the product range for smart production and efficient engineering as well as the software tools for cabinet construction. In „Industrial Cybersecurity: Success Factor for Africa’s Digital

Transformation“, experts addressed the challenges, strategies, and concepts as well as best-practice approaches for ensuring cybersecurity in the area of the manufacturing industry.

For the food industry, CCoA offered a seminar on Automation Solutions for the Food Industry in Morocco in Kenitra. In this seminar, experts demonstrated the importance of the agri-food sector to digitize its industry.



Overview of CCoA Seminars

Date	Topic	Partners	Number of participants	Number of organizations
08.06. 2021	Automated Robot Welding	Abicor Binze & FANUC	10	10
17.06. 2021	How to Become an Intelligent Enterprise in the Era of Industry 4.0	SAP	31	16
08.07. 2021	Automation and Employment – Shaping the future of work	AHK Morocco, GIZ Morocco, Steinbeis, Rittal, Pflitsch, Siemens & Phoenix Contact	26	18
10.12. 2021	Human-robot Collaboration	LLCPS (ENSAM), INOYAD Technologies & Yuanda Robotics	175	24
04.03. 2022	Smart Factory: Transforming Industry Together	EMSI, Siemens & MyLifeZone	124	18
13.05. 2022	Discovery Tour Cabinet Construction	ENSET Mohammedia & Phoenix Contact	160	37
27.05. 2022	Automation Solutions for the Food Industry in Morocco	ENSA Kenitra, FENAGRI, Multivac Group, Ingenieurbüro Waidelich, Mitsubishi Electric Europe B.V.	51	21
05.07. 2022	Industrial Cybersecurity: Success factor for Africa's digital transformation	ETAS Bosch, Phoenix Contact & Tectag Group	78	35

Impressions of the CCoA Seminars







CCoA Partner Survey

“ How important was the cooperation with CCoA in the framework of PLCnext training?



The cooperation with CCoA within the framework of the PLCnext training was of great importance to us, insofar as our teachers and our students discovered a new and very effective material in the field of industrial automation. It was a very beneficial collaboration in which there were many results that can serve the industrial world and our future engineers.

Prof. Dr. Omar Bouattane,
Director, ENSET Hassan II,
University Casablanca



As a professor in the food science department, the PLCnext training with CCoA was of great importance to me as it was a good introduction to industry 4.0 and its implementation tools, which is an area to which our department must give more importance.

Prof. Dr. Majid Mounir,
Associate Professor, Institut
Agronomique et Vétérinaire,
Hassan II

“ How important was the cooperation with CCoA in the framework of PLCnext training?



The cooperation with the CCoA was a very important step in the PLCnext training, it is through the CCoA that we were able to discover their wide fields of application and didactic utility.

Prof. Dr. Raja Elboq,
Professor Researcher,
ESITH



How to develop and implement in an educational, convincing and sustainable way in regards to the topic of automation is very important, especially using the PLCnext technology in Industry and Agriculture 4.0.

Prof. Dr. Younes El Fellah,
Associate Professor, Institut
Agronomique et Vétérinaire,
Hassan II



It is very important for our trainers coming from different institutions of Hassan II University of Casablanca, giving them these new technologies.

Prof. Dr. Mounir Rifi, Director,
Centre & Innovation et de
Transfert de Technologie
CITT/UH2C

“ How do you evaluate the use of the PLCnext platform in the qualification of your students?



Using the PLCnext platform was very flexible. In terms of educational applications it offers a lot of learning opportunities and various applications. It is a platform very appreciated by our students, it is also easy to implement and program by different languages. This will facilitate their qualification in the field of industrial automation.

Prof. Dr. Omar Bouattane,
Director, ENSET Hassan II,
University Casablanca



The use of the PLCnext platform has allowed our students to raise the level of the proposals conducted in their internships and their final projects.

Prof. Dr. Raja Elboq,
Professor Researcher,
ESITH



The use of the PLCnext platform by our students allow them to increase their chances to reach the work market more easily.

Prof. Dr. Mounir Rifi,
Director, Centre & In-
novation et de Trans-
fert de Technologie
CITT/UH2C

“ How do you evaluate the use of the PLCnext platform in the qualification of your students?

The PLCnext programmable logic controller is a model suitable for the academic world at the same time as it is powerful enough to manage projects of an industrial scope.




Prof. Dr. Majid Mounir,
Associate Professor, Institut
Agronomique et Vétérinaire,
Hassan II

The ergonomics; i.e. Adopt and Adapt the PLCnext platform to the needs of both researcher and student in a tangible and concrete way which allows a better understanding and accessibility to the many functionalities.



Prof. Dr. Younes El Fellah,
Associate Professor, Institut
Agronomique et Vétérinaire,
Hassan II



Interviews with Students on Automation Projects

Automated Loom 4.0

Team Members: Abouzoul Walid, Achraf Ziat and Karim Gehad

Dr. Sarah Kunkel: I'm very excited about your project! Tell me about it.

Abouzoul Walid: The name of our project is Artissage 4.0, a combination of art and tissage, which means weaving. And 4.0 refers to Industry 4.0. It is about a traditional loom. The concept of our project is the automation of a traditional loom we built ourselves with Phoenix Contact's PLCnext. We finished the structure and the mechanical parts of the assembly. The next step is to automate the loom

with the PLCnext with sensors. The purpose of the project is to integrate the loom into the traditional craft industry in Morocco. We visited artisans who use a handloom, which takes a lot of time and effort. The purpose is to make the same textile products using the automated loom with less effort and time. In this loom, there are three main movements automated. The first movement replaces the effort that makes the loom move with the foot. The second one is the weft insertion, by using an electrical motor. Here we have the part that pushes the shuttle to move from one side to another. The third movement is the movement of reed. We developed a software for the project by using the Python language. The machine is already working but it is still noisy. We can minimize the noise by applying sensors and the PLCnext.

Dr. Kunkel: How did you come up with this project?

Walid: First of all, it was a personal project, just for fun. However, while preparing the machine and talking to other people, we have seen that this is a problem in Morocco. It's a lot of physical work. And we said why not develop this automated loom and integrate it into the traditional craft in Morocco, to help people use less physical effort, as well



as to involve young people. Young people do not want to carry out this work because of the physical effort that their parents are making while earning just little money. This is why we thought about integrating the machine in this field.

Dr. Kunkel: How did you decide to integrate the PLCNext to automate the loom?

Achraf Ziat: It was actually the idea of Professor Ennaji. We did not think of it at first. He told us that we can use PLCnext to improve the automation of the machine.

Digital Twin

Team members: Younes El Amrani, Chouaib Boussattine and Abderrahmane Fafouri

Dr. Sarah Kunkel: Can you tell me more about you and the project?

Younes El Amrani: We developed a digital twin of a conveyor unit, which we did by using SolidWorks to create the different parts of the unit and then assemble them together in order to use them later on in our digital twin. In the digital mock up part we took all the parts of our conveyor unit and assembled them in the SimuLink Matlab.

Dr. Kunkel: Okay, interesting! This is very exciting to see! It is good to see PLC is used in traditional manufacturing.

Walid: Yes! This is the purpose of the project. It has to maintain the traditional craft by adding new technology. This is why we added the 4.0 in the name of the project.

Dr. Kunkel: Yes, very exciting, thank you so much for presenting this, very exciting project!

Abderrahmane Fafouri: Actually we started with Factory IO.

Amrani: Yes, but it was very limited in terms of being able to import our own model for our own conveyor unit to the software so we had to switch to MATLAB Simulink in order to be able to achieve all the requirements of the solution.

Dr. Kunkel: You seem to be quite passionate about this project. Did you enjoy working on this?

Amrani: Definitely, it was quite interesting for us and as experience, it was its first of its kind. We learnt many things

and we had many people that helped us from CCoA and from the Fablab who gave us all materials.

Dr. Kunkel: Did you have a project similar like this in your studies, or how was this project different?

Amrani: It was different, it was the first of its kind and it was more practical and even the topic had more aspects such as electronics and automation. It included many fields in engineering, which was something we have not experienced to be honest.

Chouaib Boussattine: And it is also interesting to see the advances in the field of industry 4.0.

Fafouri: The use of a digital twin is not very common here in Morocco. It is a tool of the big and international companies. Companies based in Morocco do not use it.

Amrani: It has a lot of advantage in improving any industrial company.

Boussattine: You can simulate the process of conveyor for production to detect failures before.

Fafouri: Or even during production, if you want to make some tweaks you can make them in the digital twin and you will see how the system behaves and react to the change, so you can implement it in reality.

Boussattine: And it works. It has a massive advantage because you can do it in a digital twin and not on the physical assembly so that is a massive advantage for production.

Dr. Kunkel: That is a very interesting point. You will be the ones transferring this method to Moroccan industries now. Thank you so much for telling me about your experience with CCoA and your project.



Fuel Cell Hardware in the Loop

Team Members: Nasrellah Irehmar, Abdenour Rhanja, Jawad El Ahmar, Mohamed El Hazami and Ismail Lasri

Dr. Sarah Kunkel: Thank you for telling me about your project. Can you explain it some more?

Nasrellah Irehmar: It was purely a Market Study. We started the market study by researching partnerships, suppliers, and all other information needed to understand the Fuel Cell Market. After that, we

will make a prototype of a Fuel Cell System, including motors, the five powertrains, and other components. The project has three parts. The first part is the hardware in the loop. It is a simulation in Matlab, followed by an implementation in the hardware. The second part is a system for stocking energy using that wheel Fuel Cell and using a super convincer. The last part is the electrolyzation of hydrogen to turn H_2O into H_2 & O_2 to reuse it on the fuel.

Dr. Kunkel: How was your experience with CCoA?



Abdenour Rhanja: Pretty great actually! Very interesting! We got the chance to work closely with the industrial partners. Working with ETAS or similar companies who are in the field and have experience in the domain is very helpful for us to have better information, and better perspectives and it is enriching our experience. It will facilitate our integration into the job market. The project was first suggested by our teacher in school based on the experience of a former ENSAM student who worked with Fuel Cell. So, we were immediately interested in the project because it involves new technologies and it is a growing market and will resolve the pollution crisis. The experience was good. I want to thank our Team Lead at ETAS and Yvon Lusseau for this opportunity. They were responsive, they shared with us a lot of information. Despite their busy schedule, they have scheduled meetings with us and shared with us a lot of sources, materials, and articles, and were available all anytime we needed their support. We really really enjoyed with ETAS.

Dr. Kunkel: How did your experience with CCoA prepare you for life after university and gain insight into what working in the industry is really like?

Mohamed El Hazami: In my case, in an internship before I went to an energy plant and all I had to do is to observe employees how they work and processes they follow. But in this internship, we have a real mission to do. We have a real system to produce.

Irhmar: We actually developed so many skills in this project internship. Mainly soft skills like time management, project planning, follow-up meetings, prior preparation, etc. We would like to thank CCoA for this opportunity because it is not the only one. It feels good!

Dr. Kunkel: That's really nice to see that you all are enjoying your projects and you run it like a real-industry project. Thank you so much for telling me about it!

CCoA Conference: Creating Competences in Automation



In September 2022, CCoA presented the activities and achievements at the International Conference on Smart Applications and Data Analysis for Smart Cyber-Physical Systems in Marrakech. German and Moroccan experts presented job-creation through CCoA activities, sustainable development, and pedagogical methods of automation training.

Prof. Dr. Reinhard Langmann from the EDUNET World Association gave the keynote on ETAT Smart Labs and the Pedagogical Approach for Automation 4.0 Training. A panel led by Johannes be Isa with Götz Jäckel, John Ulrich Fimpel, and the Moroccan educators Prof. Dr. Mohamed Ennaji, Prof. Aicha Isser, Ali El-Alaoui, and Ahmed Kousta discussed challenges and opportunities of the Moroccan industry and education, focusing on talents and technologies for creating competitiveness.

Oussama Laayati from Mohammed VI Polytechnic University (UM6P) introduced at the event his Ph.D. project PLC Assets in Digital Twin for industrial Management Using the PLCnext Technology. As a de-

monstration of the successful cooperation between a German company and students in the framework of CCoA, the P3 Group from Germany represented by Dustin Kraus, David Schwarz, and Sebas-

The poster is for a conference titled "CREATING COMPETENCES IN AUTOMATION". It features logos for CCoA (Competence Center On Automation), the German-Moroccan cooperation logo, "Invest for Jobs Opportunities for Growth in Africa", "giz", and "KFW". The main title is in large white letters on a purple background. Below the title, it says "Talents and Industry 4.0 Projects for Moroccan Manufacturing". A white box contains three icons: a calendar for "September 24, 2022", a location pin for "Faculté des Sciences Semlalia Marrakech", and a clock for "10.30 AM - 1.00 PM". At the bottom, a photo shows a speaker at a podium facing an audience. A caption below the photo states: "The CCoA Event is part of the International Conference 'Smart Applications and Data Analysis for Smart Cyber-Physical Systems' (SADASC)".

Conference Poster

tian Becker, and the students of HESTIM university presented their project Production Tracking for Injection Machines – Creating an OpenSource Digitalization Solution.

Another highlight of the conference was the award ceremony for the Young Talents in Automation Award. Due to the outstanding performance of the students, Phoenix Contact awarded the Young Talents in Automation Award to the three best projects. The award was endowed with 1,000 Euro for the first prize, 750 Euro for the second prize, and 500 Euro for the third prize. To participate, students submitted academic posters of their projects with a summary description of their projects. A committee of German and Moroccan industry and educational experts evaluated the submissions and selected the winners.

The following projects were selected:

1. Prize: 4.0 Automated Loom

Team members: Achraf Ziat, Walid Abouzoul, Karim Gehad

2. Prize: PCBs defect detection and classification using Deep Learning

Team Members: Ilyas Irgui, Mohamed Nabil

3. Prize: Fuel Cell Hardware in the Loop
Team Members: Nasrellah Irhmar, Abdenour Rhanja, Jawad El Ahmar, Mohamed El Hazami, Mohamed Soulimani



The awards were presented by Klaus Hengsbach, Head of Didactics of TechEducation of Phoenix Contact. In addition to the three winning projects, Klaus Hengsbach and Youssef Asmi, Country Director of Phoenix Contact in Morocco, were deeply impressed with the project developed by the students of HESTIM, Armand Dzessoou, Japhet Ayassou, Tadjou Tchota, and Jacintho Mpeteye in collaboration with P3 Group that was presented at the conference, and decided to give them an award as well.

Impressions of the CCoA Conference







Winners of the Young Talents in Automation Award

4.0 Automated loom

Authors: Achraf ZIAT | Walid ABOUZOU | Karim GEHAD

Company Supervisor: FabLab Casablanca

Professor Supervisor: ENNAJI Mohamed



1. Background

The project is inspired by the Hattersley loom in which the weaving process consists of three primary motions: **Shedding**, **Picking**, and **Beating-in** (Fig1), and some other secondary motions. The Hattersley loom is a shuttle loom where the filling yarn insertion is given by a shuttle going from one side of the fabric to the other (B- Fig1).

The earlier power looms used mechanization to automate much of the weaving process. But still has many disadvantages such as:

- It gives a lot of noise and vibration up to 80 dB.
- The Fabric quality is difficult to control.
- For the loom to be suitable for different types of fabric, a mechanical adjustment is required when changing the yarn.

From here came the idea of using the PLCnext technology to automate the machine and integrate it into the Moroccan traditional crafts to encourage young people, especially when we noticed that many old craftsmen are still using handlooms that are time-consuming, and require a huge physical effort.

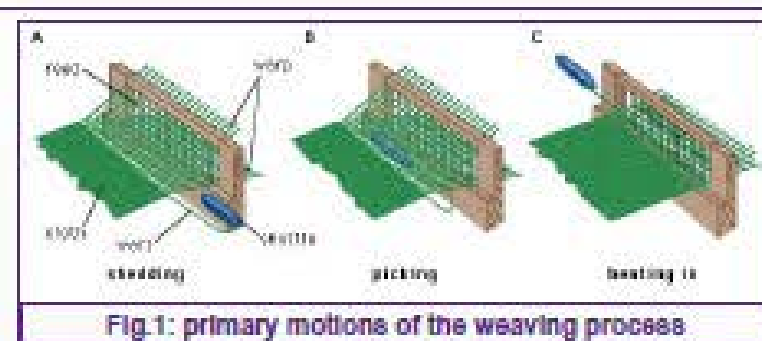


Fig.1: primary motions of the weaving process

2. Problem decomposition

(*) For looms using mechanization to automate the weaving process, the filling spacing p_2 remains constant for any value of d_2 except using a mechanical adjustment, which is also a problem because it is not precise and it does require stopping the machine to adjust the distance p_2 depending on the thickness of the filling yarn d_2 .

The fabric cover factor is the ratio of the surface area covered by yarns, to the total fabric surface area :

- Warp cover factor: $C_1 = P_1 \cdot d_1$
- Filling cover factor: $C_2 = P_2 \cdot d_2$
- Total cover factor: $C_f = (C_1 + C_2 - C_1 \cdot C_2) \cdot 100$

To increase the precision of the fabric, the total cover factor should be as close as possible to 100%. Since primary motions don't affect directly the total cover factor, the mission of our project is to work on the secondary motions for the loom to be suitable for different types of fabric.

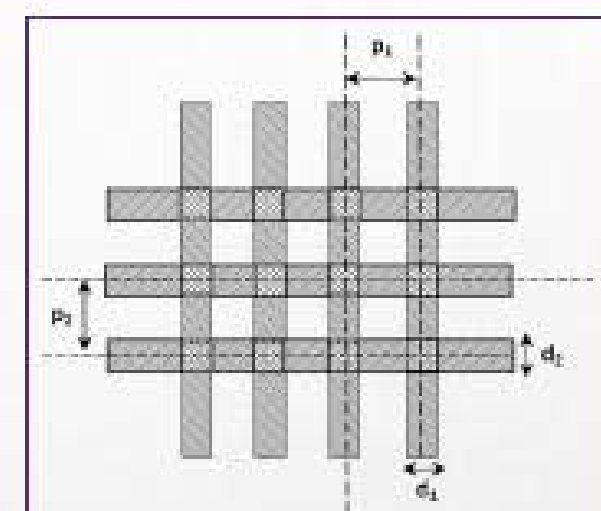


Fig.2: basic structure of a fabric

3. Methods

Two secondary motions called **letting off**: winding newly formed cloth onto the cloth beam and **taking up**: releasing yarn from a warp beam (Fig3), must also be added and synchronized with the primary motions (Fig.1). Earlier power looms use single motorization and mechanical synchronization to operate the whole weaving process in which secondary motions depend on primary ones, and that exposes the problem already mentioned in (*). Our method consists of separating primary motions (non depending on the type and thickness of the filling yarn) from secondary ones that are directly related to the problem mentioned in (*). The filling spacing p_2 (Fig.2) can only be controlled by the rotation of the cloth beam and the warp beam (Fig3), this rotation should be adapted to each type of yarn, so the need of having more actuators to control the secondary motions. The separation of these two motions leads us to replace mechanical synchronization with an automatic one, so the need of using sensors.

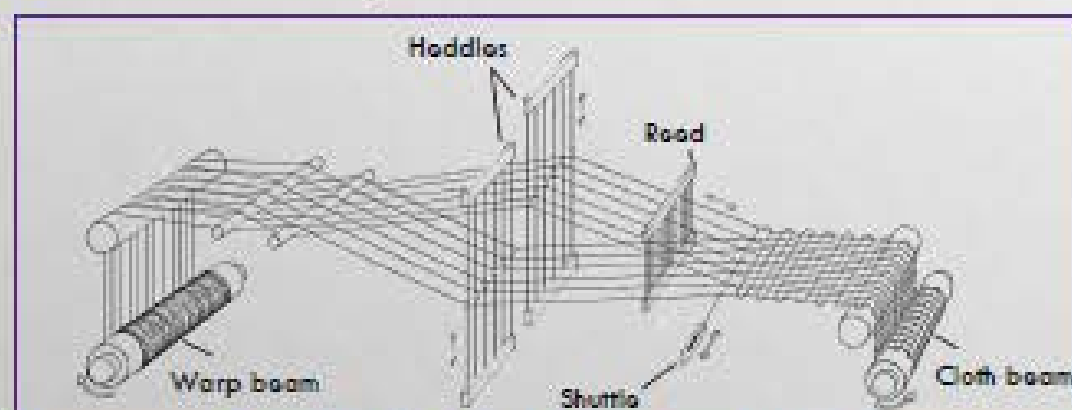


Fig.3: Basic structure of weaving process and loom

4. Our solution

The **shedding** is given by a roller follower and cam mechanism (7), which actuates the heddles (15) to translate vertically allowing the separation of the warp yarns via the pedals (8).

Two limit switches (10) and (11) are placed at the end of the heddles displacement to catch their maximum position and to enable the pneumatic cylinders (3) and (4) (each limit switch operates a cylinder) to insert the filling yarn via the shuttle, this motion is called **Picking**.

Beating-in is given by a crank and rod system (6) in the upper shaft (12) that is driven by the motor (2) via the pulley and belt mechanism (13), and another limit switch (9) is placed in the maximum position of the reed (16), when the reed reaches the limit switch meaning that another filling yarn is added, two servo motors (5) and (17) rotate the cloth beam (14) and the warp beam (18) depending on the diameter of the yarn. The servo motor (5) is also acting as a sensor that calculates the length of the fabric, and the servo motor (17) is maintaining the tension of the warp.

Using the PLC (1) in this traditional loom will help increase the quality of the fabric and synchronize all of its motions.

The advantages of this concept are:

- Keeping the traditional aspect of the loom while integrating 4.0 technology into it.
- Reducing the noise of the loom using pneumatics and servo motors.
- Controlling the quality and density of any type of fabric.

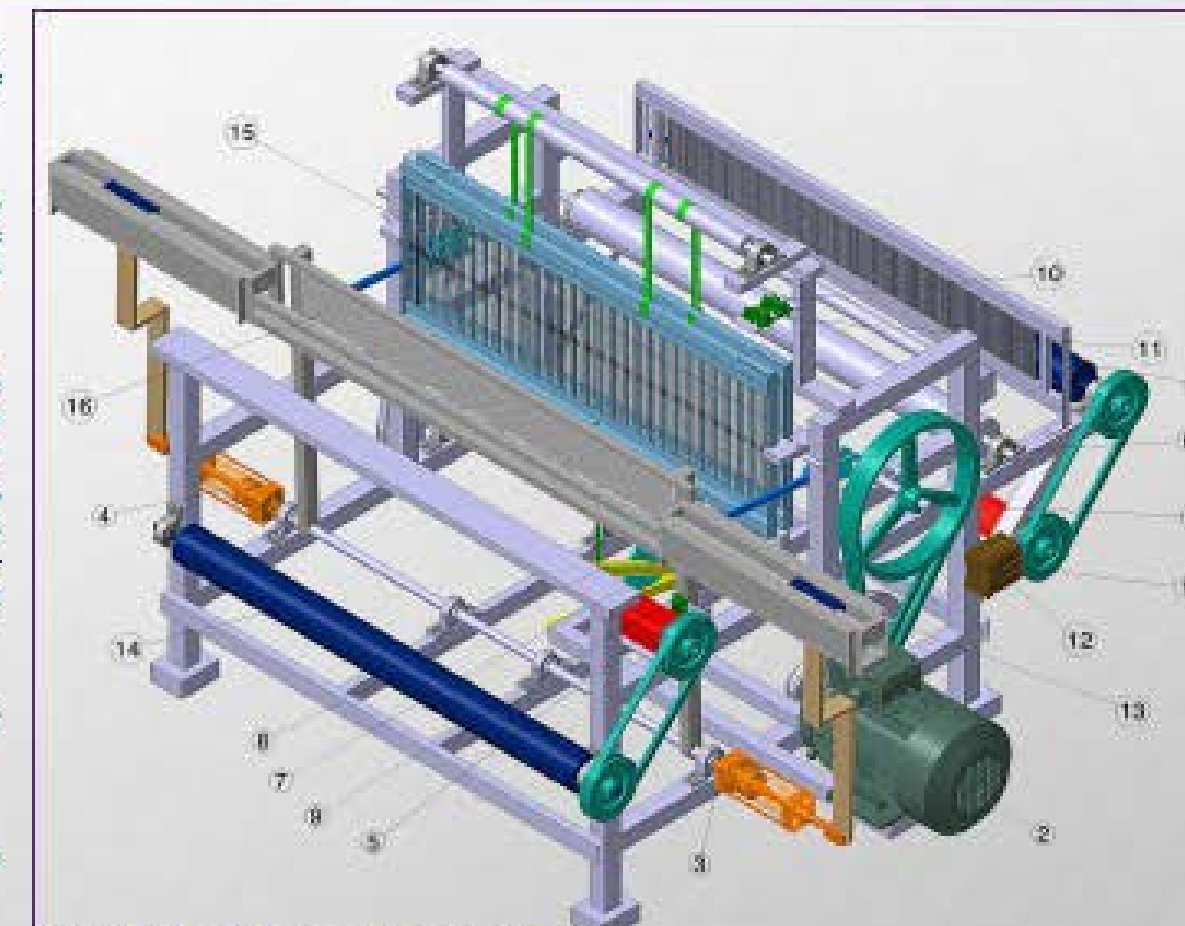


Fig.4: 3D model of the automated loom

5. Discussion & Next Steps

This project was interesting because it combines many disciplines at the same time namely: textile, electricity, mechanics, and automation. Our project is not meant to compete in today's industry where mass production seems to be their purpose, but to help Moroccan handicrafts weavers who are still struggling with old handlooms issues, and to ensure the continuity of a precious heritage in our country.

Some of our next steps will be:

- Working on the safety of the machine: proximity sensors will be added so it can stop when someone gets so close to it.
- Adding some additional sensors to the machine to detect weft break or split...
- Optimizing the cost and the design of the machine.
- Investigating how to change the shuttle without having to stop the machine (ex: adding a clutch to the loom).

Ps: You can find some photos of it in the link below (Files are slowly being added):
<https://drive.google.com/drive/folders/1qb55aQiyHAoQz3LhxN7MNRDwR1XjsXv?usp=sharing>



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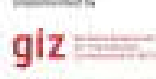
Poster - 4.0 Automated Loom

PCBs defect detection and classification using Deep Learning

Authors: IRGUI Ilyas & NABIL Mohamed

Company Supervisor: NEXTRONIC

Professor Supervisor: ENNAJI Mohamed



Introduction

In the electronics industry, defect detection is an essential part of the Printed Circuit Boards (PCBs) production process in order to control their proper functioning and quality. These PCBs are found in most electronic products, supporting and mechanically connecting components along conductive paths. Their prevalence underlies the modern electronics industry, with a growing global market expected to reach \$89.7 billion by 2024.

PCBs are prone to a variety of defects that prevent proper manufacturing, costing companies a lot of money. Defects such as missing holes, mouse bites, and short circuits cause problems including current leakage and open circuits, rapidly degrading PCBs' performance. Traditionally, PCBs are inspected by a human operator or by Automated Optical Inspection (AOI) techniques. Our project offers a real-time AOI solution for PCBs quality control based on Deep Learning. The experimental results show that the improved network achieved a high performance successfully detecting 97% of all defects at 56.98 Frames Per Second (FPS).

Take-Home Points or Main Finding

- Our solution builds a real-time computer vision that automatically detects the defects present on the PCBs (manufactured by Nextronic) and classify them by category using a camera and the **PLCnext Technology**.
- We focused on three common types of PCB defects in our work : (a) **Missing hole**, (b) **Mouse bite**, (c) **Short**.
- We achieved simultaneously high detection accuracy (97%), high detection speed (20ms), and low memory consumption.
- We tested our solution on public datasets of defect PCBs, and results have proven the validity of our method.



(a)



(b)



(c)

Methods

The proposed method for PCBs defect detection is established based on a one-stage detector YOLOv4, and was developed in three steps: Dataset building, Model training, and Performance evaluation as described in Figure 1.

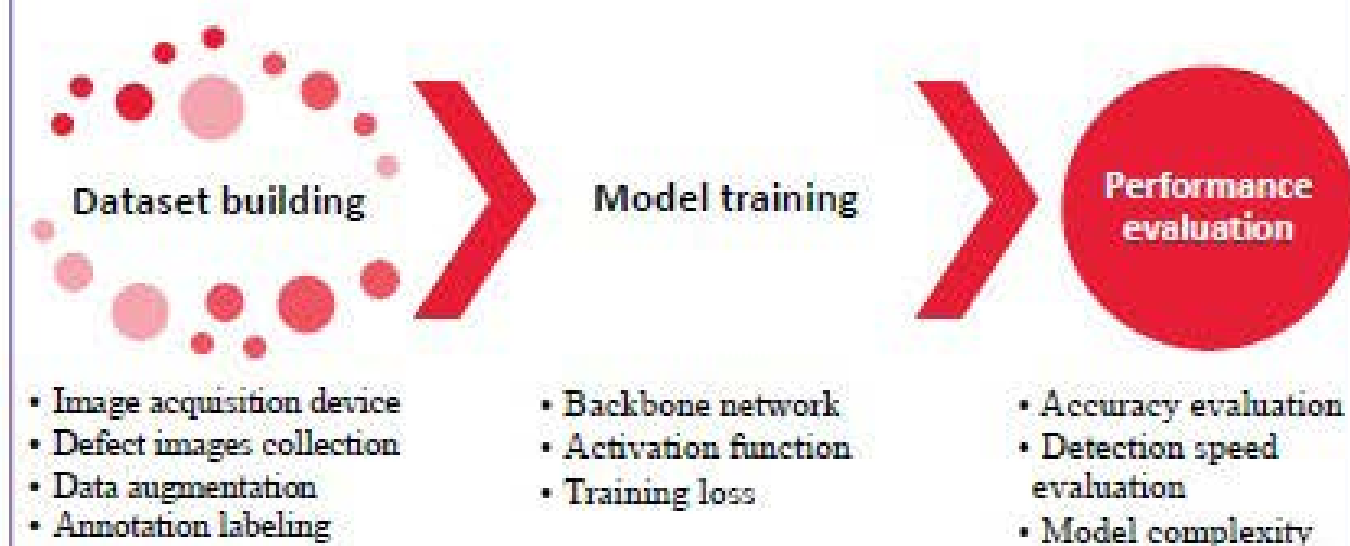


Figure 1 : Framework of the proposed methodology

Results

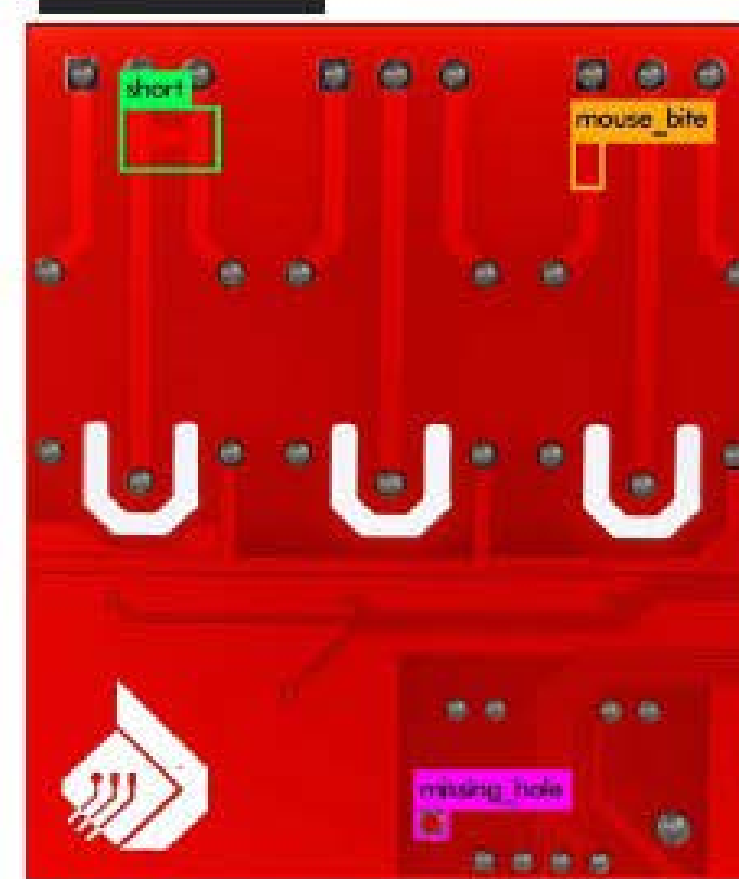


Figure 2 : A successful detection of the three defects

```

calculation mAP (mean average precision)...
108
detections_count = 999, unique_truth_count = 405
class_id = 0, name = missing_hole, ap = 98.52% (TP = 150, FP = 2)
class_id = 1, name = mouse_bite, ap = 89.77% (TP = 116, FP = 5)
class_id = 2, name = short, ap = 94.68% (TP = 116, FP = 3)

for conf_thresh = 0.25, precision = 0.97, recall = 0.94, F1-score = 0.96
mean average precision (mAP@0.50) = 0.942951, or 94.30 %
  
```

Figure 3 : YOLOv4 performance on each defect category

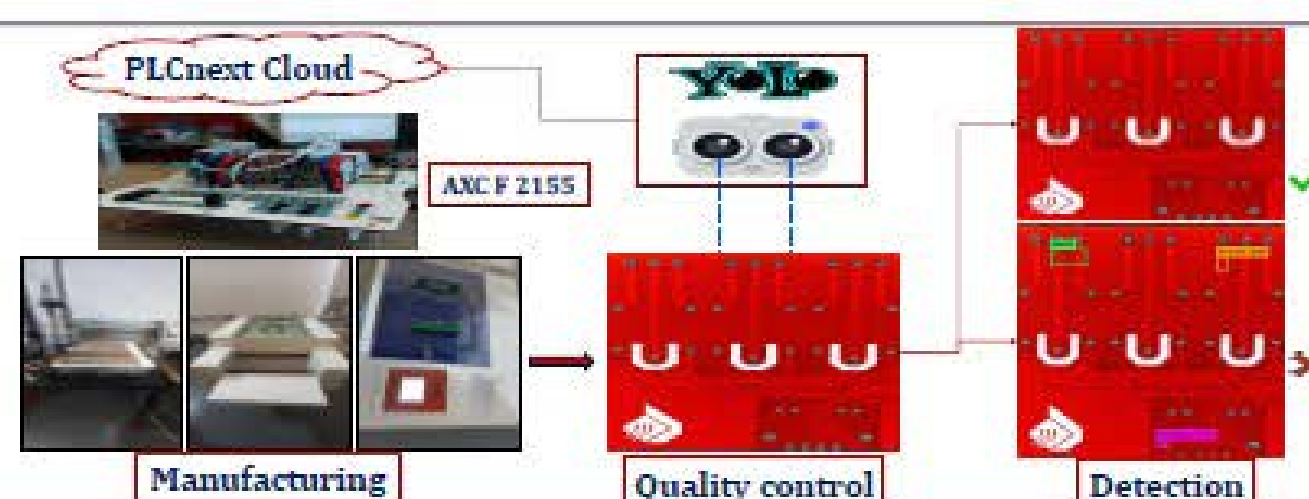
```

/content/drive/SharedDrives/PFE/3_errors_images/03_all_02.jpg: Predicted in 20.976000 milli-seconds.
short: 91%
missing_hole: 100%
mouse_bite: 94%
  
```

Figure 4 : YOLOv4 prediction speed

Discussion or Next Steps

As we can see, the prediction is performed in a time span of 20 milliseconds (Figure 4) which can be considered as a real time prediction. Moreover, the prediction score (Figure 3) exceeds 97% which is very satisfactory and meets the requirements of the plant. The result confirms the efficiency of our approach and proves the possibility of industrializing our solution. To do so, the chart in the right shows the best case scenario workflow. Our aim is to upload the classification algorithm to the **PLCnext Cloud**. Doing so will enable a real time detection and filtering of defected PCBs in the production line operated by the PLC.



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Poster - PCBs Defect Detection and Classification using Deep Learning

Fuel Cell Hardware in the Loop

Authors: Nasreliah IRHMAR, Abdenour RHANJA, Jawad EL AHMAR, Mohamed ELHAZAMI, Mohamed SQUALIMANI
Company Supervisor: ETAS
Professor Supervisor: Pr. Mohamed ENNAJI

ETAS

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Introduction

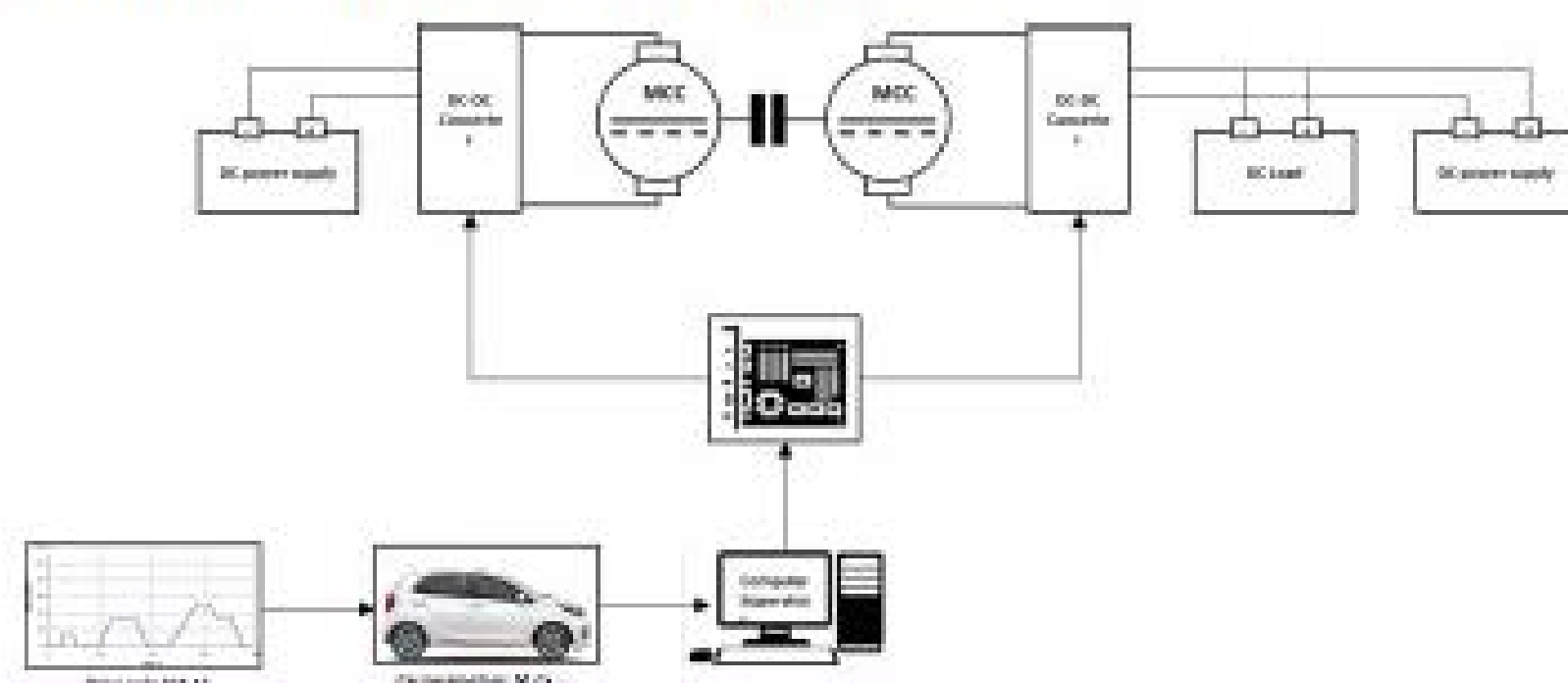
In a world, today, where climate change is more and more prominent and its effects on our daily lives have become noticeable, a need to transition to more green and non polluting ways of transportation has become an unquestionable priority. Thus, hydrogen and its applications, especially the fuel cell, have become a desired viable alternative to traditional means of motorization. Thus and due to our previous work on a market study on fuel cells with ETAS, we decided to elaborate a hardware in the loop for a power system, with fuel cell being the main component and to realize that system into a functioning prototype.

Take-Home Points or Main Finding

- The hardware in the loop emulation platform is used :
 - 1.To optimize fuel cell vehicle command
 - 2.To maximize energy efficiency
 - 3.To study the behavior of the fuel cell and DC motors for a specific drive cycle
 - 4.To test the vehicle in so many road conditions

Methods

The FCEV emulation platform presented in this consists of readily available hardware and simulation tools. It consist of two 100W DC Permanent magnet motors,two DC motors H bridges , a 50W Fuel cell, a 8.33Ah Battery. The realtime control and data acquisition system is STM32F4. The simulation model is built in Matlab/Simulink and interfaced to STM USART for visualization of experiments.



Results

We were able to create the Hardware in the loop emulation platform and achieve the wanted results :

- Validating the European drive cycle on the 50W-10KW vehicles
- Increasing the energy efficiency from 60W to 20W for the same drive cycle
- reducing the error between the simulated and the real velocity to obtain a peak error of 0.3 m/s



Fuel cell Hardware in the loop emulation platform

Discussion or Next Steps

We are looking forward to add a hybrid energy stocking system by including a supercapacitor with the fuel cell , and also adding the gear command to simulate a real vehicle with every part included , and finally adding an electrolysis process in order to reuse the hydrogen and maximize the energy efficiency and lower the hydrogen consumption.

References

- 1.DEVELOPMENT OF AN ELECTRIC VEHICLE HiL EMULATION PLATFORM
- 2.MATLAB/Simulink
- 3.STM32
- 4.Fuel Cells

Poster - Fuel Cell Hardware in the Loop



Start-Ups

Morocco's Start-ups and SME - Partners for digitalization

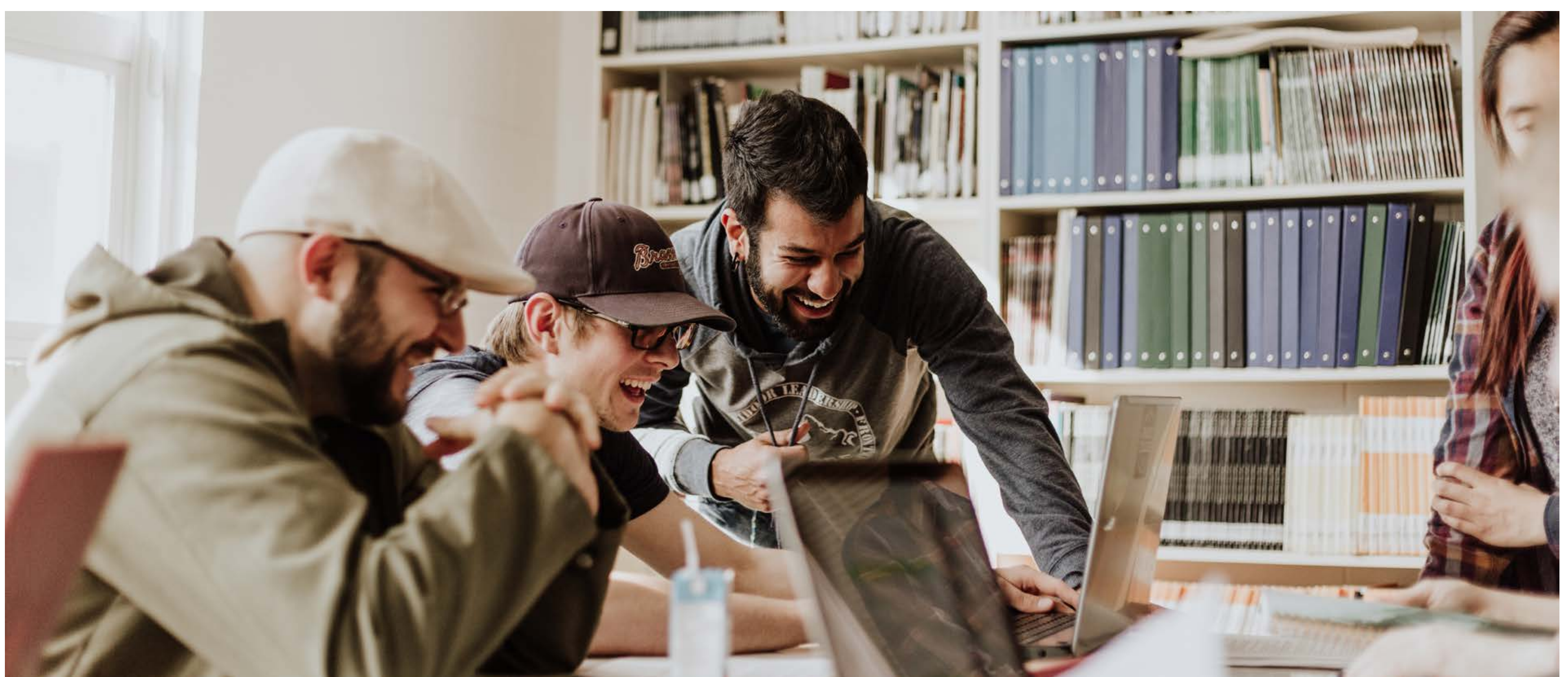
CCoA promoted dialogue between Moroccan start-ups, SMEs and the German industry in a webinar in December 2022, and discussed perspectives for cooperation.

At an online matching event on 07 February 2023, the young companies presented themselves in pitches - and showed a high level of industrial solutions development. Morocco offers rich potential for industrial cooperation, due to its renowned universities and its dynamic start-ups and SMEs within a global network.

The seminar in December provided information on how internationally active companies can cooperate successfully with Moroccan partners, and discover potential for R&D projects in Morocco.

For industrial companies, the forms of cooperation range from classic off-shoring, to participation in companies, to setting up their own subsidiaries, which can then take over development or cross-national sales in Africa.

Johannes Kirsch of ZVEI (German Electro and Digital Industry Association) analy-



sed the resource requirements and international perspectives of the German electrical industry. Alen Avdic, founder of the Dortmund-based cybersecurity company Tectag, reported why and how he chose Morocco as a location for expansion to Africa.

Moroccan Ecosystems: huge potential

The ecosystems around the country's renowned universities are already attrac-

ting great interest from countries such as the USA, Spain and Israel.

The online matchmaking on 7 February 2023 featured eight start-ups from Morocco specialising in industry-related services and data solutions. The founders showed how they can also support German companies in building digital resources with their solutions.

The featured Start-Ups



PCS Agri

PCS Agri develops solutions for agriculture based on artificial intelligence, IoT and image processing. Hardware and software help to secure crop yields.



OCP Maintenance Solutions

OCP Maintenance Solutions is a start-up that specialises in providing maintenance 4.0, reliability and digitalisation solutions for industry. It offers a range of products and services, including a cloud-based IoT platform, as well as hardware innovations and AR-based training.


GENIVAR
 We innovate for you

Genivar

Genivar offers a SAAS platform for the management, monitoring and traceability of objects via IOT (GPS / RFID) / GPRS to help companies implement effective energy management.


NOUSPO

Nouspo

Nouspo specialises in machine learning. A cloud-based solution can automate the training and deployment of models, enabling real-time, low-latency analysis of visual data.


ATAREC

Atarec

Atarec develops innovative solutions for renewable energy and its efficient application. The patent Wave Beat protects infrastructures from the sea and helps to generate green energy.


AI inside

AI inside

AI inside specialises in solutions based on artificial intelligence and advanced data analytics.



STONE Engineering

STONE Engineering is dedicated to Industry 4.0 solutions, software implementation and industrial engineering. It offers wireless and cloud-based monitoring systems, digital twins, smart sensors and predictive maintenance solutions.



AZA

AZA has already captured a relevant market share with its innovative IOT solutions „AFMS“ (AZA Fuel Management System) and is on the verge of internationalisation in the Middle East.

In the discussion with the start-ups, the question arose as to how the young companies assess their further growth potential. Almost all companies were optimistic - especially when it comes to resources and potential in their own country. Fatima Ezzahra Azemzi, AZA Petrosolutions: „We have huge potential and our employees will tap into it wholeheartedly!“



“We see huge potential in our country - and we will develop it!”

Fatima Ezzahra Azemzi,
AZA Petrosolutions



Morocco 4.0

Tchoto Tadjou
Morocco 4.0
Talents & Technology
CCOA

Morocco 4.0: Talents & Technology

In 2023, a very exciting new event format of CCoA was held: the Morocco 4.0: Talents & Technology. The event was organized in February in collaboration with the German Chamber of Commerce and Industry in Morocco (AHK Morocco), Deutsche Messe Technology Academy and INOYAD Technologies. Over 100 participants from companies, vocational schools, and universities attended the Makeathon, Employer Branding Workshop, Talent to Job Matchmaking, CV Check and the Industry Forum that took place during the event.

The Makeathon was the biggest part of the event. Over two days, participants worked in mixed teams of students, professionals and academics on collaborative software and hardware development challenges in the fields of robotics, artificial intelligence and 3D printing.

Each team was supervised by experienced mentors from INOYAD Technologies, UM6P, P3, HUCON AG, and Phoenix Contact. Especially students gained valuable skills through the challenges, both in terms of technology and team work.

In the AI challenge, teams had to design a software-based optical quality inspection using a machine learning library. This included image data capture, labeling of quality defects in the images, training and use of the model, and identification of quality defects on sample objects. Teams of the 3D-printing challenge had to develop a solution to a real problem with focus on Morocco. Besides designing and constructing a model and printing it, participants of this challenge also learned how to set up, commission and adjust a 3D printer. The robotics teams had to set up and commission a mobile



robot and complete a navigation through a parkour autonomously. Here, participants familiarized themselves with LIDAR as well as the robot operating system.

At the Employer Branding Workshop, recruiting experts from SAPHIR Deutschland shared their experiences, knowledge, best practices and challenges related to next-generation recruitment and candidate journey with Moroccan companies. In addition, the Talent to Job Matchmaking, introduced Moroccan candidates to Moroccan companies who are looking for young Industry 4.0 talents. At the same time, young talents had the opportunity to improve their CVs through a personalized CV check by recruitment specialists.



“At the Makeathon, we worked on the robotics challenge. We worked with a high level of team spirit. Of course, we separated the roles, but when someone was getting stuck, we all focused on solving the problem before moving on to the next steps. On the technical side, it was a real challenge given the tight deadline to solve a solution in two days when we had to work on several aspects. We had to work harder. Finally, the mentors were also very supportive to us, we learned a lot from their experiences and feedback.”

Farkh Ayoub, Electrician Maintenance at
Univers Acier



The Industry Forum focused on Industry 4.0 technology and the future of workforce for a competitive Moroccan industry. After warm welcoming notes from the Moroccan Ministry of Industry and Trade, GIZ Morocco and AHK Morocco, Walid Belahmer from SAP North Africa presented the improvement of enterprise performance in Morocco from the technology perspective. A panel with experts from Phoenix Contact Morocco, Tectag Group, Beyond 4.0 and i-rekruit focused on the future of Industry 4.0 technologies in Morocco and the young talents' contribution to this development. A lively discussion between panelists and students evolved around expectations employers and the young generation as professionals have towards each other. At the same time, the panelists also agreed that it is the young generation's own drive to learn English that helps Morocco to attract international business.



"I participated in the PLCnext training and now in the Makeathon. For the PLCnext training, I learned a lot because I work in a company that uses PLCs. Especially with the PLCnext training, it became easier for me to read the different computer languages and to understand different systems and PC control. For the Makeathon, we had a unique experience. It gave us a clear idea about the future and innovative projects. Apart from the technical part, the Makeathon allowed us to develop soft skills, such as teamwork, time management and stress management. It showed us that the English language has become important in the professional world compared to the French language, where we can exchange with many other professionals around the world."

Lina Mesbahy and Mohammed Sghiouri,
ESNAM Casablanca





Winners of AI (upper image) and Robotics (lower image)

A woman in a black jacket and glasses stands at a podium, presenting to a group of students in a modern training lab. The students are seated at long tables equipped with laptops and PLC hardware. A large screen in the background displays a presentation slide. The room has large windows on the left side, offering a view of the outdoors.

PLCnext Training for Professional Engineers and Technicians

PLCnext Training for Professional Engineers and Technicians

In addition to qualifying Moroccan educators and students in automation technology, CCoA also offered PLCnext training to professional engineers and technicians. During 3 days of training, participants were introduced to several functionalities of the PLCnext technology in the context of a project applicable to the Moroccan industry and learned how to work autonomously on the PLCnext Engineer software and its environment within the framework of the PLCnext technology. The goal of the trainings was to enable the participants to carry out automation projects for their companies.

Whilst the training content and project was developed by German automation experts, the trainings in Morocco were conducted by Moroccan educators who were qualified in automation technology in Module 1. Through this approach, the sustainability of knowledge transfer through the Train-the-Trainer approach is not only proven in higher education but also professional education. The qualification of women is a fundamental part of the success of the CCoA project in Morocco. For this reason, CCoA offered a PLCnext training exclusively for women.





“PLCnext is an open control platform developed by Phoenix Contact for industrial automation. It is designed to offer flexibility, powerfully and high degree of openness and customization for industrial automation applications.

This training process has allowed me to understand the integration of different programming languages, software tools, and technologies that combines a powerful hardware platform with an open software architecture that allows developers to use various programming languages and software tools, including C++, C#, Python, and JavaScript, to create custom applications and add new functionality to the control system.

The company that I work for operate in the industrial automation space. This training is highly relevant, valuable and will help me to optimize our specific applications for efficiency, productivity, and reliability.

I recommend working with PLCnext technology. Because it is a highly versatile and capable platform for industrial automation applications, and it can provide significant benefits to companies operating in this space. PLCnext is generous in giving developers the ability to customize and optimize their automation solutions to meet specific needs and requirements.”

Norimane Degga, Maintenance Manager, Dansk Solenergi Futur





“The quality of the training was excellent, with clear instructions and practical exercises to reinforce my skills using the resources provided (the kit on which we practiced the different languages and having tested several types of connection). The PLCnext training allowed me to discover and master innovative and powerful programming software. I learned how to use the key features. In summary, the PLCnext training has been a very enriching experience for me. I acquired new skills in programming and I was able to use them in practical projects in the context of Industry 4.0.”

Laila Tachfine, Electronic and telecommunication Engineer, Les Ateliers AM



“The CCoA training in collaboration with Phoenix Contact was really beneficial for me. I was able to discover and learn new knowledge, especially in automation and industry 4.0 (the use of PLCs and new technologies such as “Profinet, IO-link, supervision, OPC UA ...”). In fact, this training also allowed me to find a job for a position in “technical support in automation” and even to excel in this. I would like to thank the team of Phoenix Contact and CCoA for this training.”

Hamza Assouna, Technical Support in Automation, Sofimed Maroc



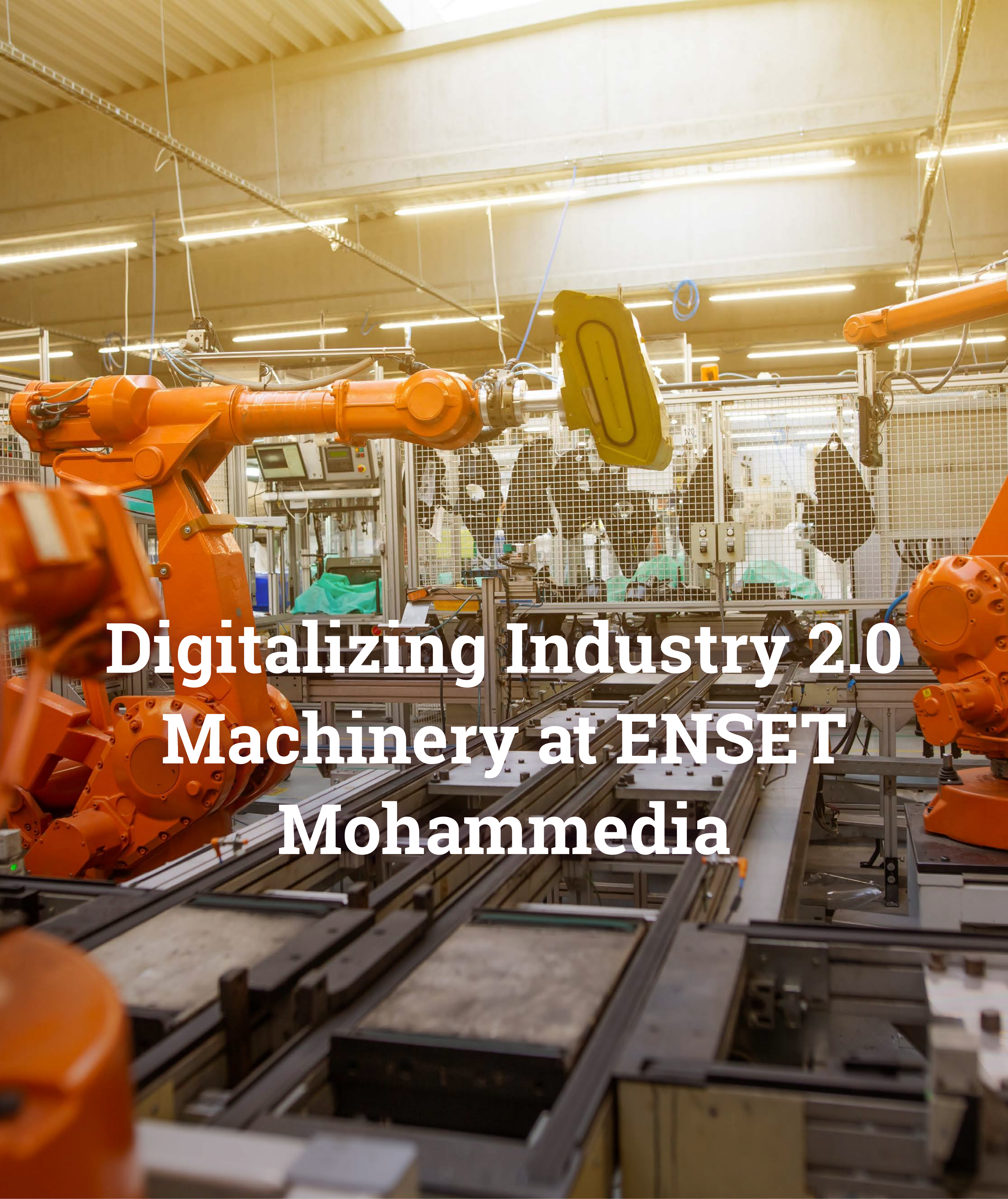
“My experience with the PLCnext training was mesmerizing and so valuable in terms of knowledge, sessions conduction, mentoring and expertise.

This training is definitely relevant for my professional career and my work environment, I got to know and familiarize myself with PLCNext softwares, Hardware platform, I was truly surprised how simple yet flexible, Phoenix Contact technology is, to create a Control command system for production plants process; the cherry on top of all this was to practice and apply it to a 4.0 Industry context.

I appreciated each moment of this training sessions, I thank and salute all the members involved, who successfully conducted this rewarding and enriching experience, I mention Mrs Aicha ISSER, Mr EL MOURAKI MEHDI and last but not least Mr Amine JDID who organised and managed wonderfully this event till the last moment of it. You have all my gratitude and will be honored for a future collaboration in forthcoming projects.”

Yousra Aarab, Electrical and Automation engineer, CA2E Maroc





Digitalizing Industry 2.0 Machinery at ENSET Mohammedia

Digitalizing Industry 2.0 Machinery at ENSET Mohammedia

ENSET Mohammedia and Director Prof. Dr. Omar Bouattane were one of the first CCoA partners in Morocco, and trained 129 students on PLCnext technology.

In March 2023, they started a project to transform conventional machine tools into Computerized Numerical Control (CNC) machines with the use of PLCnext. 19 professors of electrical engineering, mechanical engineering, and mathematics and computer science are carrying out the project. The project is a collaborative project between the institutions of the University Hassan II Casablanca (UH2C), Moroccan and foreign universities, and industrial parties in Morocco. The project aims at modernizing Industry 2.0 machine parks with automation technology to make them fit for Industry 4.0.

This project is of central importance to the Moroccan industry: rather than investing in Industry 4.0 machines, companies can upgrade their existing machine park at a much lower cost. This also makes the project importance in terms of sustainability. The project is of relevance to several industries, such as automotive, aerospace, urban and rail transport, electronics, food, and textile, which create a strong demand for new profiles in industrial robotics. The project is composed of three parts: the mechanical part, the electrical part, and the automation part. The PLCnext platforms provided by CCoA play a pivotal role in the automation part of the project. The users will be able to implement a functional diagram on the PLCnext technology and test it on the real object of the machine to be transformed.



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CCoA Factsheet

Module 1	Total	Female
People Trained	1025	362
Educators (Train-the-Trainer)	70	20
University Educators	59	14
Vocational School Educators	11	6
Employees	38	6
Students	877	317
Under 25	846	
PLCnext Trainings	40	19
Engineers	30	19
Technicians	10	
Institutions		
Universities	19	
Vocational School	4	
Private Companies	45	
Projects		
Final Year Projects	103	
Moroccan based Organizations	26	
German and Int. Companies	5	
Employment	Total	Female
Job Creation	276	88
Under 25	273	

Module 2	Total
Seminars	9
Speakers/Partners	32
Participation	710
Educational Institutions	28
Companies	101
Morocco 4.0: Talents & Technology	Total
Number of participants	132
Makeathon	80
Private companies	22
Educational institutions	11
CCoA Network	Total
CCoA Community	729
LinkedIn	2607
Newsletter	2034
Private companies	Total
All companies reached	216
Moroccan	166
European	39
Others	11

*All data as of 01.06.2023

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Competence Center on Automation (CCoA)

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CCoA is led by Steinbeis University in a joint effort of the German Electro and Digital Industry Association (ZVEI) and the German Chamber of Commerce in Morocco (AHK Morocco), together with Phoenix Contact Group and Deutsche Messe Technology Academy (DMTA).

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