The 7th International Conference ECAI 2015 "Electronics, Computers and Artificial Intelligence ", 25 - 27 June 2015

Teaching electric motors' starting methods in Lifelong Learning Programs

Robert BELOIU[1]

[1]University of Pitesti, Str. Targul din Vale Nr.1, 110040, Pitesti, Romania

Abstract

In this paper is presented a way of developing and encouraging mobilities under the Lifelong Learning European Educational Programs. The article makes a review of the actual situation for mobilities in Europe and Romania. Following this presentation, it is described a method of teaching the starting methods for an induction motor developed at the University of Pitesti. This method was developed during a Leonardo da Vinci Transfer of Innovation project in partnership with other six European partners. The methodology focuses on the starting methods of the induction machine.

Introduction

•The internationalization affects all aspects of life: commerce, work force mobility, capital, industry, etc. Higher education makes no exception[1]. This refers to both students and teachers involved in formal and informal adult education processes.
•The participants in international educational programs are better prepared to face a globalized world and its challenges [2].
•The companies in the most developed countries and the society in general (USA, Canada, Australia, China, UK, Germany, etc.) give much credit to an international educational experience [1][3].

Romania' Mobilities

Romania has a very low number of mobile students in tertiary education (figure 4).
•One reason is related to financial difficulties that students taking a mobility face in a different country.
•Another reason is due to a very rigid attitude from the teachers towards results' validation and acceptance of the abroad academic results [6][7].
•Another reason for the very low percentage of mobile university students is their mentality.
•In Romania, the participation rate in this program is very low comparing to other European countries.

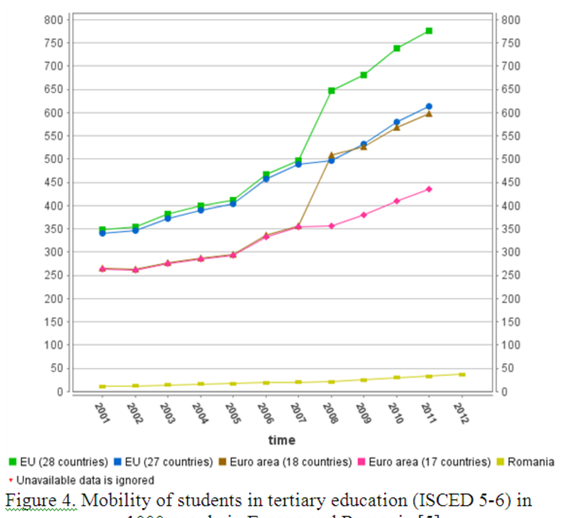


Figure 4. Mobility of students in tertiary education (ISCED 5-6) in 1000 people in Europe and Romania [5]

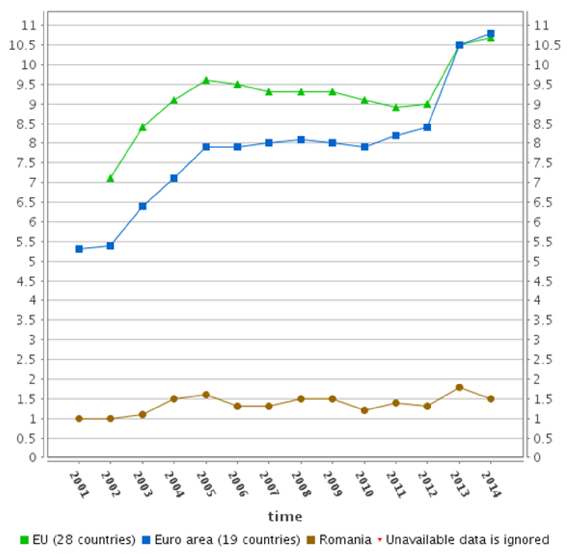
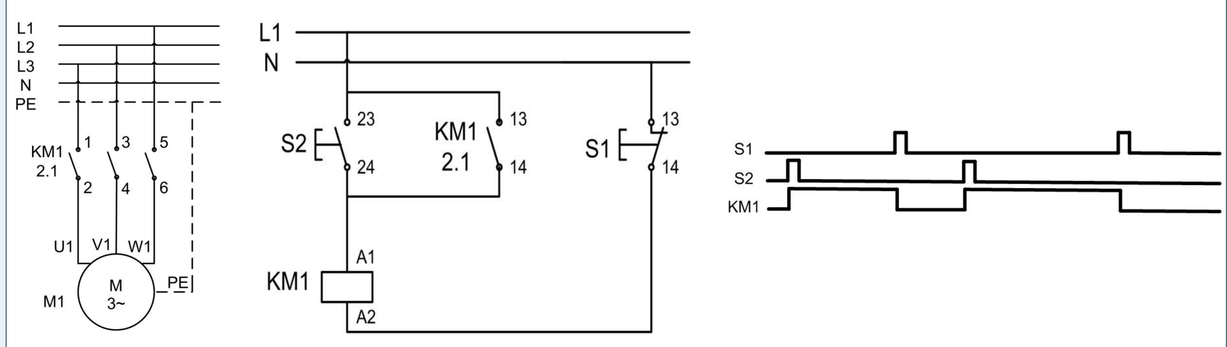


Figure 5. Lifelong learning percentage of people of 25 – 64 years old [5]

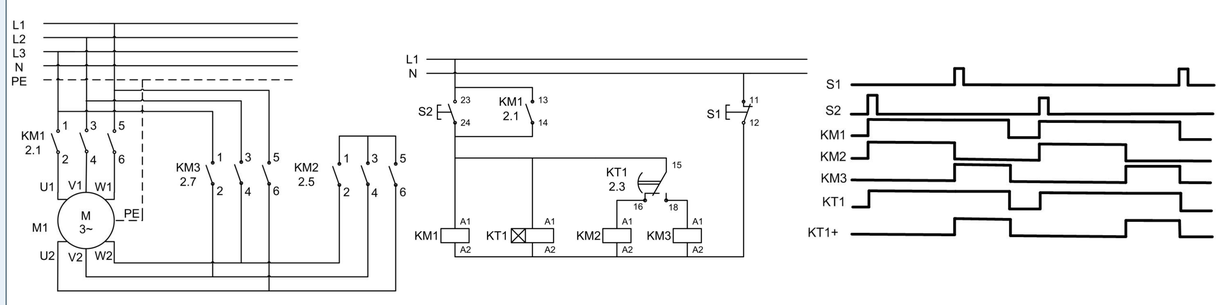
Methodology Development

•The project is developed by a consortium of seven Educational Institutions from different European areas: Spain, France, Finland, UK, Romania, Turkey and Portugal.
•The main idea of the project is to develop an educational manual that allows the students to work independently of the teacher[10]. That means the teacher is only an assistant to the student while the later performs application classes.
•Using the developed methodology, the student can have a concrete idea of what he/she is going to study abroad and prepare the lessons before the mobility.

Starting the Induction Machine



KM1 = (S2 **AND** (**NOT** S1)) **OR** (KM1 **AND** (**NOT** S1))



KM1 = (S2 **AND** (**NOT** S1)) **OR** (KM1 **AND** (**NOT** S1))
KM2 = (**NOT** KT1+) **AND** ((KM1 **AND** (**NOT** S1)) **OR** (S2 **AND** (**NOT** S1)))
KM3 = KT1+ **AND** ((KM1 **AND** (**NOT** S1)) **OR** (S2 **AND** (**NOT** S1)))
KT1 = (KM1 **AND** (**NOT** S1)) **OR** (S2 **AND** (**NOT** S1))

Learning Outcomes of the ProjectX

•Learning Outcome 1: Analyze the electric schematic for starting an induction machine
•Learning Outcome 2: Perform electrical installations and electrical maintenance for industrial premises
•Learning Outcome 3: Install programmable automated systems
•Learning Outcome 4: Write simple PLC program for sequential control systems

Conclusion

The novelty of this approach is that this material is prepared beforehand the mobility between all the partners. If the students and teachers have access to the material that is going to be used abroad, some of their fears could be solved before the actual mobility. By overcoming some of the fears, it is the hope of the authors that the number of Erasmus+ mobilities will increase to and from Romania.
Erasmus+ mobilities for both teachers and students bring many personal, professional and institutional benefits in many ways. By encouraging mobilities to and from abroad will bring improvement in the Romanian educational system

Acknowledgements

This paper is part of the project "One teacher and one student working with ProjectX", project code 2013-1-ES1-LEO01-66485, acronym "One2one", funded with support from the European Commission, through Leonardo da Vinci, Transfer of Innovation program.

Disclaimer

References

•One2one - One teacher and one student working with ProjectX, http://projectxone2one.eu/, accessed May 2015 .
•I. Bostan, R. Beloiu, and N. Bizon, "Learning Digital Frequency Dividers Through Practical Laboratory Activities," Procedia - Soc. Behav. Sci., vol. 180, pp. 1014–1021, May 2015.
•B.-A. Enache, L.-M. Constantinescu, and E. Lefter, "Modeling aspects of an electric starter system for an internal combustion engine," 2014, pp. 39–42.
•M. Iorgulescu and C. Savulescu, "Aspects of learning techniques in power system," 2013, pp. 1–4.
•R. Beloiu, "Teaching Induction Machine Laboratory Using ProjectX," Procedia - Soc. Behav. Sci., vol. 182, pp. 349–359, May 2015.
•"One2one - One teacher and one student working with ProjectX. Catalogue of ProjectX", in press, accessed May 2015 .

Contact Information

University of Pitesti - Faculty of Computers, Electronics and Electrical Engineering, **www.upit.ro**
robertbeloiu@gmail.com; robertbeloiu@yahoo.com; robert.beloiu@upit.ro

The 6th International Conference EduWorld 2014 "Education Facing Contemporary World Issues", 7th - 9th November 2014

Learning digital frequency dividers through practical laboratory activities

Ionel BOSTAN[1], Robert BELOIU[1], Nicu BIZON[1]

[1]University of Pitesti, Str. Targul din Vale Nr.1, 110040, Pitesti, Romania

Abstract

This paper present a group of useful practical activities in electronics vocational education for teaching digital frequency dividers by completing three successive stages: simulate electronic circuits with dedicated software; implement and test circuits on breadboard using general purpose logic integrated circuits; implement logic circuits using reconfigurable circuits. At the end, students will be able to implement other projects with the same level of complexity; they will have a better understanding of sequential logic circuits and good skills in working with reconfigurable circuits and handling laboratory equipment, which are essential requirements for a well-trained technician in electronic field.

Introduction

•To increase the flexibility, the quality, efficiency and attractiveness of Vocational Education and Training (VET), the Bruges Communiqué establish eleven strategic objectives for the period 2011-2020.

•Project "*one2one - One Teacher and One Students working with ProjectX* ",, aims to develop practical activities that can be done in any VET school, using a tool that was called ***ProjectX***.

•***ProjectX*** is "a methodological guide for the student to carry out a concrete activity, one to one with a teacher, in which theory and practice are both perfectly integrated and is related to the real workplace**. Each ProjectX will be developed on the basis of Learning Outcomes, which means we will also create a tool based in the ECVET credit system that will allow mobility of students"** (ProjectX, 2014).

Project description (1/2)

Aims of our *ProjectX:*

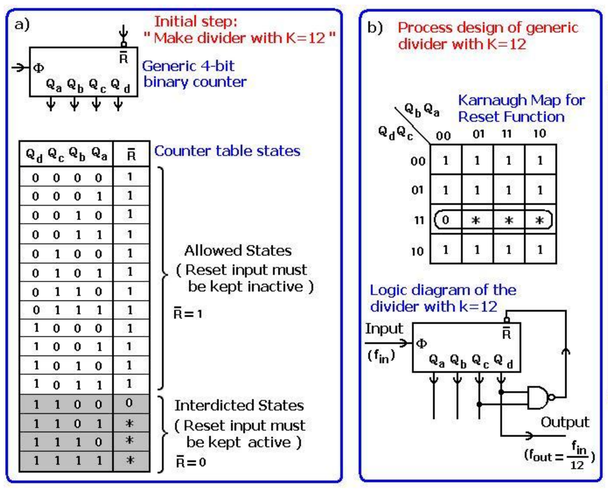
- **study and implementation of frequency dividers** taking into account that these circuits are basic blocks in almost any modern digital equipment, from traffic lights to computers;
- **use alternative ways to implement any logic circuit**
  - standard way - using general purpose logic integrated circuits ;
  - modern way **-** based on reconfigurable logic IC such as FPGA
- **cover VET curricula for medium level qualifications.**

Step 1: Previous theoretical knowledge about flip-flops and counters:

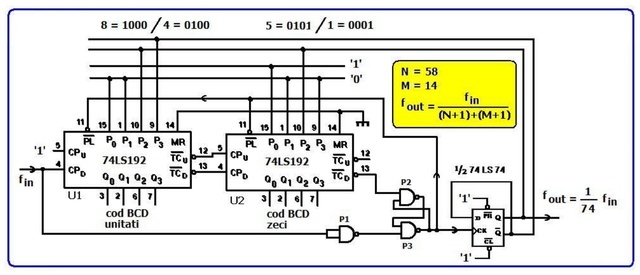
- ensured by well selected tutorials and exercises;
- all support materials are focused more on how to use these circuits and less on how they are made inside.

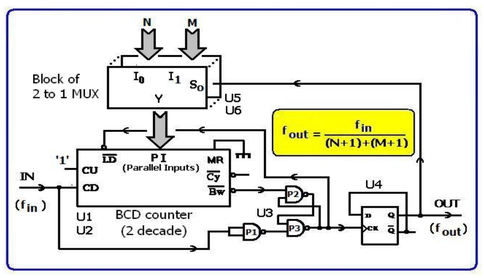
Step 2: Frequency dividers design techniques: we selected two types of representative dividers:

- **frequency dividers with fixed dividing factor, implemented with asynchronous counters**



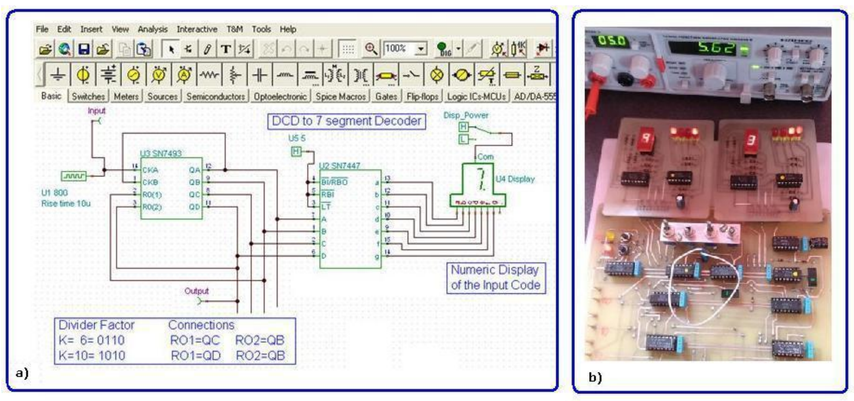
- **programmable frequency dividers implemented with synchronous counters**





Project description (2/2)

Step 3: Simulation and implementation with general purpose logic IC



Step 4: Implementation with FPGA

To implement a logic circuit in FPGA students must perform the following steps: description of the logic function; compile the logic function to obtain configuration file; circuit configuration; testing the application; in case of mistake students must fix the logic function, re-compile and re-download it.

Learning outcomes of the projects

To be easily integrated in VET system of different countries, each *ProjectX* must present a list of skills and abilities acquired after project completion.

If these learning outcomes are attractive and are in compliance with the requirements for a particular qualification, we have a chance to increase the degree of mobility in VET systems.

Table 3. Skills related to implementation of logic circuit with FPGA .

Circuit design with FPGA	*Testing circuits implemented in FPGA*
– make new project, add new sources, draw the schematic of the divider; *– make constrains file (specify the input/output FPGA pins);* *– generate configuration file;*	*− download the configuration file into FPGA;* *− make connection to the signal generator and power supply;* *− make tests to verify the functionality of the circuit;* *−use oscilloscope to display the input/output electrical signals.*

Conclusion

All these practical activities are designed to bring the following benefits to students who completed this project:

- a better understanding of sequential logic circuits:
- design different type of frequency dividers based on counters;
- use computer programs to simulate any small/medium digital circuit;
- use breadboard and general purpose logic IC to implement and test any small/medium logic circuit;
- use state of the art logic IC such as FPGA to implement logic circuit;
- improve personal skills in handling laboratory equipment.

Acknowledgements

This paper is part of the project "One teacher and one student working with ProjectX", project code 2013-1-ES1-LEO01-66485, acronym "One2one", funded with support from the European Commission, through Leonardo da Vinci, Transfer of Innovation program.

Disclaimer

References

Bruges Communiqué (2011). Supporting vocational education and training in Europe: the Bruges Communiqué, ProjectX (2014). Guidelines for making ProjectX, *Lifelong Learning Programm "One teacher and one student working with ProjectX"*, project code 2013-1-ES1-LEO01-66485, acronym "One2one", http://projectxone2one.eu. Floyd, T.(2006). *Digital Fundamentals* (9th edition), Pearson Education International, ISBN 0-13-197255-3.

Contact Information

University of Pitesti - Faculty of Computers, Electronics and Electrical Engineering, **www.upit.ro**

ionel.bostan@upit.ro

The 7th International Conference "Electronics, Computers and Artificial Intelligence", ECAI 2015, 25th - 27th June 2015

FPGA Implementation of Frequency Dividers in Vocational Education

Ionel BOSTAN[1], Guillermo FERRANDO[2], Carlos HOJOS[2]

[1]University of Pitesti, St. Targul din Vale Nr.1, 110040, Pitesti, Romania

[2]XABEC Professional Training Center , St. Arquitecto Rodríguez, 54 – 56, Valencia, Spain

Abstract

ProjectX *is "a methodological guide for the student to carry out a concrete activity, one to one with a teacher, in which theory and practice are both perfectly integrated and is related to the real workplace".*

This paper present a part of one ProjectX for teaching digital frequency dividers in VET school, by completing three successive stages: simulate electronic circuits with dedicated software; implement and test circuits on breadboard using general purpose logic integrated circuits; implement and test logic circuits using FPGA.

Introduction

A long period of time general and higher education played a major role in the European education and vocational education and training (VET) only a minor role – the thinking being that it offered less good job and even less promotion opportunities.

The growing importance of VET it is recognized in various documents elaborated by European Centre for the Development of Vocational Training.

Project "*one2one - One Teacher and One Students working with ProjectX*", developed under LLP, aims to develop practical activities that can be done in any VET school, using a tool that was called *ProjectX.*

Each *ProjectX* was developed on the basis of Learning Outcomes and ECVET credit system in order to increase the mobility of students and teachers between different institutions.

Project description (1/2)

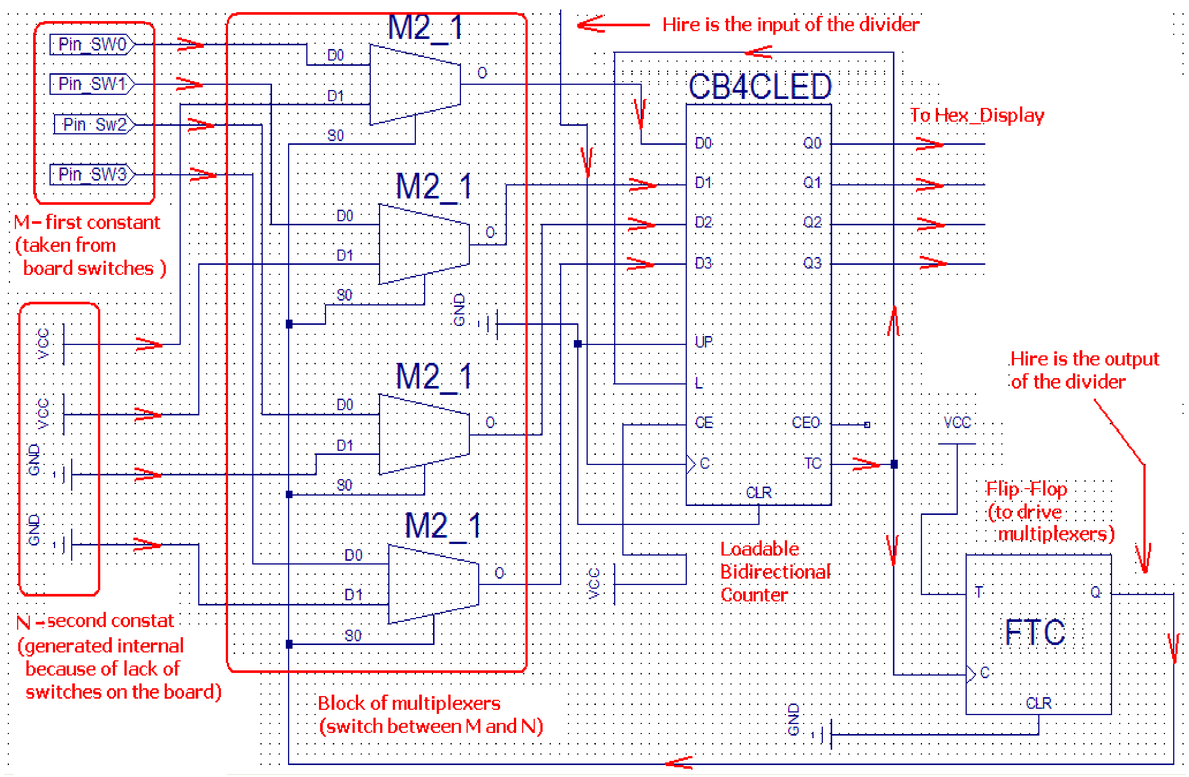
Aims of the ProjectX "Implementation of digital frequency dividers"

- **study and implementation of frequency dividers** taking into account that these circuits are basic blocks in almost any modern digital equipment;
- **use alternative ways to implement any logic circuit**
  - standard way - using general purpose logic integrated circuits ;
  - modern way **-** based on reconfigurable logic IC such as FPGA
- **cover VET curricula for medium level qualifications.**

Applayed ProjectX in Teaching Frequency Dividers

After an initial theoretical documentation regarding flip-flops, counters and frequency dividers implementation techniques, each student are going to perform three groups of practical activities:

- **simulate** different counters and frequency divider using dedicated software programs;
- **implement** and test different counters and frequency divider, **on breadboard**, using general purpose logic integrated circuits;
- **implement** and test different counters and frequency divider using modern digital circuits such as **FPGA**.



Project description (2/2)

Working with FPGA is not an easy task but is the most attractive and flexible modality of implement digital circuits. Generally speaking, for each FPGA application it is mandatory to make a project in which to specify the target circuit, its logic function and how external devices are connected to the FPGA. To make things easier, all applications will start from a *Project_Template* in which the student will place their application in well delimited area. In this template there are already implemented some useful tools in order to access the resources of the board or in order to see the state of the counter:

- a programmable signal generator;
- one BCD to 7segment decoder in order to display the state of the counter in decimal format,
- one driver in order to display the state of the counter in binary format on *Basys 2* LED's.

All experiments will be implemented in *ISE Project Navigator* software and will be tested on *Basys2* board.

Learning outcomes of the projects

To be easily integrated in VET system of different countries, each *ProjectX* must present a list of skills and abilities acquired after project completion.

If these learning outcomes are attractive and are in compliance with the requirements for a particular qualification, we have a chance to increase the degree of mobility in VET systems.

Circuit design with FPGA	*Testing circuits implemented in FPGA*
– make new project, add new sources, draw the schematic of the divider; *– make constrains file (specify the input/output FPGA pins);* *– generate configuration file;*	*– download the configuration file into FPGA;* *– make connection to the signal generator and power supply;* *– make tests to verify the functionality of the circuit;* *–use oscilloscope to display the input/output electrical signals.*

Conclusion

Students who tested this *ProjectX*, at the end of all practical activities were able to simulate, design and implement counters and frequency dividers or other logic circuits with same complexity level. They learn to implement and test logic circuits in two different technologies:

- using general purpose logic IC;
- using most recently logic IC such as FPGA.

A good understanding of these circuits and ability to work with FPGA as well as working with general purpose logic IC are essential skills for a well-trained technician in electronic field.

Acknowledgements

This paper is part of the project "One teacher and one student working with ProjectX", project code 2013-1-ES1-LEO01-66485, acronym "One2one", funded with support from the European Commission, through Leonardo da Vinci, Transfer of Innovation program.

Disclaimer

References

[1] CEDEFOP; [2] Bruges Communiqué (2011); [3] ProjectX (2014). Guidelines for making ProjectX, *Lifelong Learning Programm "One teacher and one student working with ProjectX"*, project code 2013-1-ES1-LEO01-66485, acronym "One2one", http://projectxone2one.eu.; [4] I. Bostan, R. Beloiu, and N. Bizon, "Learning Digital Frequency Dividers Through Practical Laboratory Activities", Procedia - Social and Behavioral Sciences, vol. 180, 5 May 2015, pp. 1014-1021;

Contact Information

University of Pitesti - Faculty of Computers, Electronics and Electrical Engineering, **www.upit.ro**

ionel.bostan@upit.ro

4th WORLD CONFERENCE ON EDUCATIONAL TECHNOLOGY RESEARCHES

Teaching induction machine laboratory using ProjectX

Robert BELOIU[a]

[a]University of Pitesti, Str. Targul din Vale Nr.1, 110040, Pitesti, Romania

Abstract

In electrical engineering computer simulation tends to replace almost entirely the classic experimental laboratories for different reasons: easier to be used by students and teachers, wide possibility of experiments, possibility of seeing a very quick response to fault situations, etc. In this context, the University of Pitesti, from Romania, enrolled in the Leonardo da Vinci Transfer of Innovation 'One Teacher and One Student working with ProjectX', along with other six European VET educational institutions in order to develop a practical methodology that could apply in all of them. The purpose of the project is to create a common platform that has the purpose to help teachers work especially with students with different study paths due to their particularities.

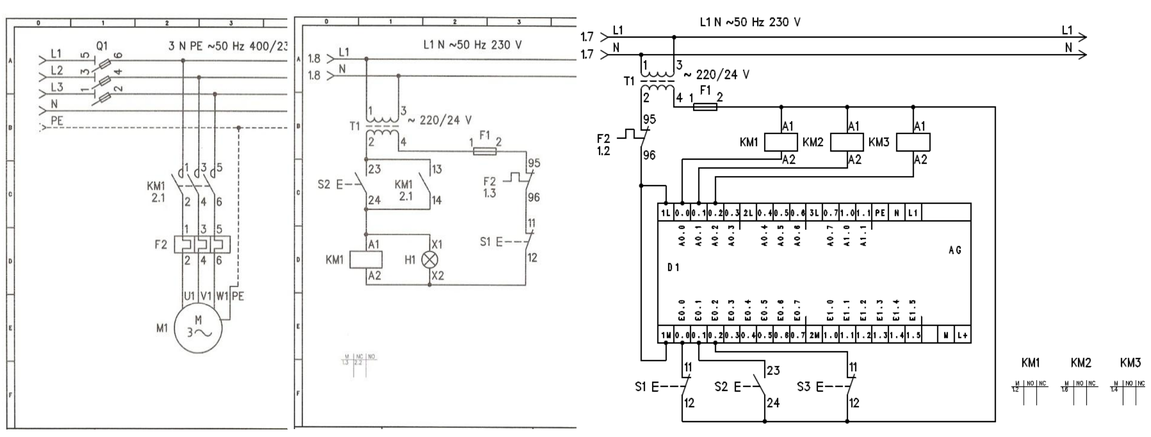
Introduction

•Technical universities loose contact with daily activity required in regular engineering jobs. Computer simulation is used in almost every field of education, and engineering education is not an exception.
•The University of Pitesti enrolled in the Leonardo da Vinci Transfer of Innovation 'One Teacher and One Student working with **ProjectX**', along with other six European VET educational institutions in order to develop a practical methodology that could be applied in all of them.
•The participant institutions are from six European countries: ES, RO, FI, FR, UK and TR.

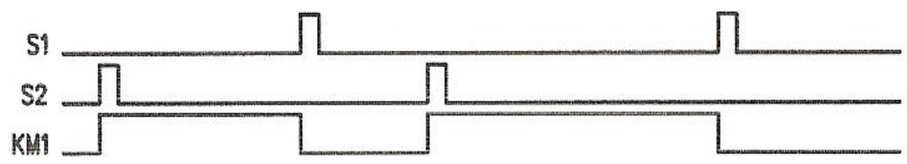
The induction machine

•The induction machine is the most used electric machine in industry.
•Induction machines could be found in very simple applications and very advanced applications.
•It is very likely that maintenance specialists will encounter it in their working experience.
•These professionals have to have a common base regarding the use of this machine: electric connection to the voltage supply, basic functionality principles, ways of starting and braking, etc.

ProjectX – starting the induction machine



KM1 = (S2 **AND (NOT S1)) OR (KM1 AND (NOT S1))**



Learning outcomes of the projects

Learning outcomes of the practice with ProjectX

•Knowledge

•Skills

•Competences

Learning Outcome 1	**Analyze the electric schematic for starting an induction machine**
Learning Outcome 2	**Perform electrical installations and electrical maintenance for industrial premises**
Learning Outcome 3	**Install programmable automated systems**
Learning Outcome 4	**Write simple PLC program for sequential control systems**

At the end of using this ProjectX, the students will have more knowledge about implementing an electrical schematic to start induction machines in different ways, specific skills and competences.

Conclusion

•This paper presented a way of teaching the starting of the induction machine in different ways: both classic as advance methods.

• The fact that this method is developed at the same time in different educational institutions in Europe is setting basis for student and teacher exchange.

The students will be able to:
•Read technical schematic
•Implement an electric schematic using classic apparatus and PLC
•Develop self-esteem in students as they have independence in laboratory practice

Acknowledgements

This paper is part of the project "One teacher and one student working with ProjectX", project code 2013-1-ES1-LEO01-66485, acronym "One2one", funded with support from the European Commission, through Leonardo da Vinci, Transfer of Innovation program.

Disclaimer

References

Bostan, I., Beloiu, R., Bizon, N., 2014. Learning digital frequency dividers through practical laboratory activities. 6th Int. Conf. Edu World 2014 „EDUCATION FACING Contemp. WORLD ISSUES" in press.
Chiţiba, C.A., 2012. Lifelong Learning Challenges and Opportunities for Traditional Universities. Procedia - Soc. Behav. Sci. 46, 1943–1947. doi:10.1016/j.sbspro.2012.05.408
"Discover Magazine." http://discovermagazine.com/topics/technology, accessed 18.09.2014.
Hasni, M., Mancer, Z., Mekhtoub, S., bacha, S., 2012. Parametric Identification of the Doubly Fed Induction Machine. Energy Procedia 18, 177–186. doi:10.1016/j.egypro.2012.05.029
Hursen, C., 2014. Are the Teachers Lifelong Learners? Procedia - Soc. Behav. Sci. 116, 5036–5040. doi:10.1016/j.sbspro.2014.01.1069
Iorgulescu, M., Savulescu, C., 2013. Aspects of learning techniques in power system. IEEE, pp. 1–4. doi:10.1109/ECAI.2013.6636197
"One Teacher and One Students working with ProjectX." http://projectxone2one.eu/wp-content/uploads/2014/06/LIS-06-Guidelines-For-making-ProjectX.pdf, accessed on 18.09.2014.
Renken, M.D., Nunez, N., 2013. Computer simulations and clear observations do not guarantee conceptual understanding. Learn. Instr. 23, 10–23. doi:10.1016/j.learninstruc.2012.08.006
Temiz, İ., Akuner, C., 2009. Comparison of traditional education to computer aided education: simulation of three-phase rotating area in an induction machine. Procedia - Soc. Behav. Sci. 1, 1825–1833. doi:10.1016/j.sbspro.2009.01.323
Zacharia, Z.C., Olympiou, G., 2011. Physical versus virtual manipulative experimentation in physics learning. Learn. Instr. 21, 317–331. doi:10.1016/j.learninstruc.2010.03.001

Contact Information

University of Pitesti - Faculty of Computers, Electronics and Electrical Engineering, **www.upit.ro**
robertbeloiu@yahoo.com

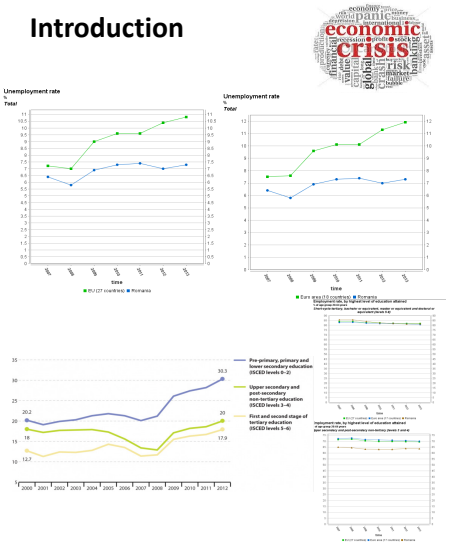
The 6th International Conference EduWorld 2014 "Education Facing Contemporary World Issues", 7th - 9th November 2014

Internationalization of educational programs through European projects

R. Beloiu, I. Bostan, M. Iorgulescu

University of Pitesti, Targu din Vale, nr. 1, Pitesti, 110040, Romania

Introduction

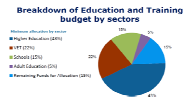


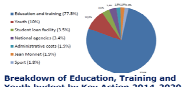
- Companies prefer to hire better educated people
- In the near future, it is estimated that there will be an increase with almost 6% in the jobs, that require high level qualification.

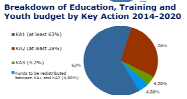
Internationalization of Romanian education system

Values of the European Union:

- Mobility of work-force and of its citizens
- Mobility and cooperation of youth and people involved in educational system





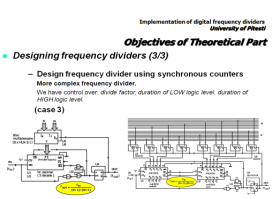


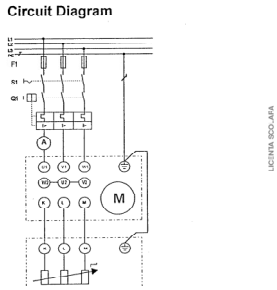
One teacher and one student working with ProjectX

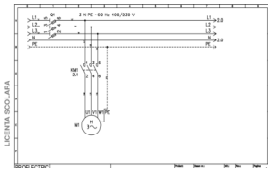
"ProjectX", a methodological guide for the student to carry out a concrete activity, one to one with the teacher, in which theory and practice are both perfectly integrated and is related to the real workplace.

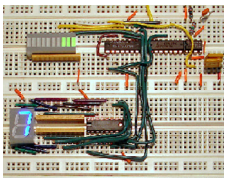
- In the project each member has to implement three applications that can be done in its school with its own resources.

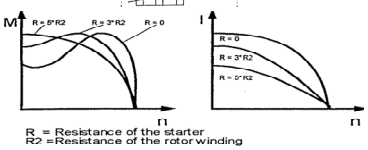
For this project the University of Pitesti presents three themes:











Conclusions

- International mobility brings challenges as far as languages and professional skills.
- Various European institutions decided to develop a common educational. A common methodology for teaching certain area is definitely a way to encourage and stimulate mobility at all levels of education.
- The University of Pitesti team is exposed to the challenge to adjust some laboratory classes to VET philosophy
- A result of the project is that it opens future cooperation between the participant institutions in educational programs, such as Erasmus+.
- After finishing this project, the team of teachers could also share their experience with other colleagues and students.
- It is expected that the application courses to become more practical and more industry related.

Acknowledgments

The present paper is part of the project "One teacher and one student working with ProjectX", project code 2013-1-ES1-LEO01-66485, acronym "One2one", funded with support from the European Commission, through Leonardo da Vinci, Transfer of Innovation program.

ECAI 2015 - International Conference – 7th Edition Electronics, Computers and Artificial Intelligence, 25 June -27 June, 2015, Bucharest, ROMÂNIA

Electrical Power Analysis Learning And Implementation In One2One Project

Luminita Mirela CONSTANTINESCU[1], Yannick VILLENEUVE[2]
[1]University of Pitesti, 1 Targu din Vale, Arges, 110040, Pitesti - Romania
[2]Lycée NEWTON ENREA, 1 place Jules Verne, 92110, CLICHY, Paris - France

Abstract

This paper presents a didactical project for vocational education in electrical field under the European Longlife Learning Programme - Transfer of innovation - with the title "One2One - One Teacher and One Student working with ProjectX ". The ProjectX is a methodological guide for the student to carry out a concrete activity, one to one with the teacher, in which theory and practice are both perfectly integrated and is related to the real workplace. In the theoretical part, students will learn about the key elements of an electrical installation that refers to: the main types of loads, the electrical system capacity, the cables choice, checking the protection of electrical equipment, protection of persons, power factor and harmonics. They will also knew the parameters for estimating main characteristics of electrical networks. After learning and testing, the students will perform the practice that has as main objective the achievement of energy assessments. At the end of this ProjectX, students will be able to realise a preventive or corrective maintenance for a best energy efficiency, with high technical and economic impacts. The Project developed by France partner was evaluated by Romania partner, in order to improve its quality and transferability. In this conditions the project facilitates the exchange of ERASMUS mobility for students and teachers.

Introduction

- A **ProjectX** is a tool used to allow teacher's individual attention to each singular student, and respect their own personal learning rhythms.
- Because a bad power quality can cause technological damage (defects and deterioration of product quality, reduced productivity, irregularity of the technological process) and Electromagnetic damage (increase in energy losses, damage to electrical equipment, disruptions in automation, communication), we have to take it into account.
- The student will have to estimate the main characteristics of the electricity network by using a power quality tool.
- **With this assessment, preventive or corrective maintenance could be done to reach the best energy efficiency.**

Project description

In the frame of ***One2One*** was design and promote one **ProjectX** related to the electrical power analysis.
This section describes the main theoretical and practical aspects related to the study of the electricity network and make an energy assessment.

A. Theoretical Knowledge

- Study the types of Loads and verify electrical system capacity;
- Cable choice;
- Checking the protection of electrical equipment;
- Protection of persons;
- Power factor;
- Harmonics.

B. Practice

The objective of the practice is to make an energy assessment.

- ❑ To discover the electrical blueprint with its characteristics;
- ❑ To check the protection of persons;
- ❑ To check the protection of goods;
- ❑ To prepare the audit of quantity and quality electrical energy;
- ❑ To do the energy measurement;
- ❑ To conclude about the energy assessment.

Learning outcomes of the project

To be easily integrated in VET system of different European countries, in this ProjectX were presented, besides detailed description of theoretical and practical activities, a list of knowledge, skills and competences acquired after project completion for some learning outcomes, as:

A. Compare an electrical installation to the IEC international standards;
B. Assess the electric safety and availability of an electrical installation;
C. Generate an electrical audit of a 3 phase power supply.

The tested of the ProjectX

This ProjectX was tested "One2One" by students and teachers of Electrical Engineering of University of Pitesti - Romanian partner project.

The students make an energy assessment. They are quantify energy consumption for each machine in the school laboratory. They check quality of service compliance and validate incoming power quality at the service entrance. They validated the protection device. Students have followed all the steps provided in the Guide - Practice and completed the work practice.

After an internal assessment, the conclusions of students and teachers are:

- ✓ The presentation of the project is clear for what it's contains. The short presentation of the project is good and necessary in the electricity networks to reach the best efficiency. The connection between the title and content is ensured by questions that rise the curiosity to scroll through the project.
- ✓ The theoretical knowledge is very complex, but is presented gradual, logically and very complete. The references are very good and updated material for study.
- ✓ The questions of the tests are very clear, the answers are easy to find in theory, after study.
- ✓ The practice is very clear and interesting activity.

Conclusions

- ➢ In this paper were presented a series of theoretical and practical activities useful for VET, in order to improve general knowledge about electrical power analysis.
- ➢ The project has a logical structure, a gradual introduction of elements of electrical components that takes into account its compound, protection of Compounds equipment, but also personnel protection serves. It highlights the parameters required to estimate the main characteristics of a grid.
- ➢ The project can be approached by students from vocational school. The students at UPIT encountered in their curriculum many similarities with the projects' content. By completing the project they will be able to achieve a preventive or corrective maintenance for increased energy efficiency, increased technical and economic impact.
- ➢ **The project is very complex, excellent and facilitates the exchange of ERASMUS mobility for students and teachers in a high grade of quality, in accord with the European Strategy 2020.**

Acknowledgements

This paper is part of the project "One teacher and one student working with ProjectX", project code 2013-1-ES1-LEO01-66485, acronym "One2One", funded with support from the European Commission, through Leonardo da Vinci, Transfer of Innovation program.

Disclaimer

References

ProjectX, "Guidelines for making ProjectX", Lifelong Learning Programm "One teacher and one student working with ProjectX", project code 2013-1-ES1-LEO01-66485, acronym "One2one", http://projectxone2one.eu; InnMain, http://www.innmain.eu/; I. Bostan, R. Beloiu, and N. Bizon, "Learning Digital Frequency Dividers Through Practical Laboratory Activities", Procedia - Social and Behavioral Sciences, 5 May 2015; Schneider Electric, "Electrical Installation guide 2015"; Henk de Swardt, "Star Delta Starting and Dual Voltage Motors Explained" 10/2007.

Contact Information

University of Pitesti - Faculty of Computers, Electronics and Electrical Engineering, **www.upit.ro**
luminita.constantinescu@upit.ro