Complementary Training Programme for Electrical and Computer Engineering Students Through an Industrial-Academic Collaboration
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Challenges to Electrical and Computer Engineering Education

• Due to the fast technological progress, companies are facing a degree of technological complexity that requires more specialised engineers

• Universities tend to constantly revise the education of science, technology, engineering and mathematics (STEM) fields
  - Update academic curricula
  - Provide real experiences
  - Incentive research

• Main problem faced by Brazilian universities:
  - bureaucracy
Extra-Curricular Programmes

- Universities pursue for partnerships with industry in order to invest in co-operative education programmes
  - importance of work experience during college

- Electronic and Information Research Centre - CETELI
  - an alternative to a close convergence between industry and academia
  - promote research, technological progress, and human resource training in Amazônia
  - Partnerships: Nokia Institute of Technology (INdT) and Samsung Electronics
Objectives

**Improve the academic experience of electrical and computer engineering students**

- Establish an industrial-academic cooperation between CETELI, Federal University of Amazonas (UFAM) and Samsung
  - meet the demand for trained human resources according to the (current) market interests and company needs;

- Propose a co-operative education programme
  - present its educational structure from the theoretical and practical perspective;
Industrial-Academic Collaboration

- We have faced three major challenges to accomplish a partnership agreement between CETELI, UFAM, and Samsung:

  I. The identification of the primary goals of each partner and the establishment of a common ground in the partnership;

  II. Overcome the bureaucracy in the Federal Institution of Higher Education (IFES), in order to establish the partnership with a private company;

  III. Establish contracts on intellectual property (IP) ownership and confidentiality, which are of paramount importance for the company representatives;
Industrial-Academic Collaboration (solutions)

I. As a result, the chosen R&D fields included software development activities related to mobile devices, digital TV, and industrial automation;

II. The excessive bureaucracy of the project's approval process was attenuated by a continuous follow-up of its legal procedure at UFAM;

III. The official project proposal has established a three-years cooperation plan;

- UFAM accepted the minor percentual portion of the joint ownership of IP, due to the fact it is the major beneficiary of this project, once it receives the majority of incomes and infrastructure.
Complementary Training Programme

• Inspired by co-operative systems of education, the goal of this collaboration is to implement a continuing-education model named as **Complementary Training Programme** (CTP):
  - Mobile devices applications development.
  - Digital TV applications development.
  - Emerging technologies for industrial automation systems.

• Delivers a work experience, where the undergraduate students work on a project from scratch;

• Inclusion of graduate engineering students from the **Postgraduate Programme in Electrical Engineering** (PPGEE);
Planning
- Electronic and Information Research Centre
- Project Leaders
- Postgraduate Programme in Electrical Engineering
- Graduate Students (Tutors)
- Extracurricular Courses Plan

Learning
- Project Leaders
- B.Sc. Electrical and Computer Engineering
- Undergraduate Students
- Extracurricular Courses Execution

Developing
- Brainstorming Session
- R&D Project Ideas
- Group of Undergraduate Students
- R&D Project Execution

Endorsing
- Undergraduate Students
- Final Presentations
- CETELI & Samsung Workshop of Innovative Technology
- Researcher Keynote Speech
- Disclosure for Academic Community
- Award for the Best Projects
Planning

(i) Elect professors

(ii) Select postgraduate students to be tutors

(iii) Prepare extracurricular courses plan
(i) Select undergraduate students

(ii) Execution of the extracurricular courses (4 months)

(iii) Undergraduate students must achieve at least 7.0 grade and 75% of attendance by the end of each course
Developing

(i) Select ideas for projects
   - originality, innovation, and feasibility

(ii) Create teams to work in each idea

(iii) Execution of the project idea (4 months)
Endorsing

(i) Team presentations for a stable and tested version of the proposed product

(ii) CETELI & Samsung Workshop of Innovative Technology

(iii) Award for the best R&D project in each research area
Outcomes

- Outcomes in numbers, after 3 years of partnership between CETELI, UFAM and Samsung:
  - 13 mobile applications;
  - 5 digital TV applications;
  - 4 industrial automation applications;
  - 8 master degree dissertations;
  - 25 scientific publications in top conferences and journals.
Mobile devices applications development

- In mobile devices area, **60** undergraduate students were trained.
Digital TV applications development

- In digital TV area, **28** undergraduate students were trained.

Motivated by the World Cup held in Brazil in 2014, undergraduate students have developed 2 digital TV applications for the soccer fans: **Copa DTV** and **GoSoccer**
Emerging technologies for industrial automation systems

• In industrial automation area, **30** undergraduate students were trained.

• The students were split into 3 classes and each one was responsible for one of the following development areas:
  - Programmable Logic Controller (PLC) Programming;
  - Mobile Robotics Programming;
  - Industrial Robotics Programming.

The robot arm **Melfa RV-2SDB**, which was programmed to manage the production line outcomes
Scientific publications

- During this partnership:
  - 23 articles were published (16 international and 7 national conferences)
  - 2 journal papers
  - 2 journal submissions under review.

- An increase of 37% in CETELI's scientific production:
  - 29% more conference participation;
  - 43% more journal publications.
Infrastructure

• **CETELI II** comprises 1,184m² of area and is fully equipped with
  - classrooms for the PPGEE
  - staff rooms
  - meeting rooms
  - stockrooms
  - well-equipped laboratories with brand new technologies
Conclusion and Future Work

• UFAM, CETELI and Samsung accomplished an industrial-academic collaboration
  - an outstanding investment to the professional training of human resources in innovative technological areas (over US$ 5 million).

• Wide dissemination of the R&D projects held by CETELI and UFAM
  - endorses the work quality produced in the university and its professionals.

• This partnership presented outstanding results, when compared to other investments in research and development of new technologies implemented at UFAM.

• From now on, CETELI is spotted as highlight technology centre in the Industrial Pole of Manaus (Brazil).
“Learning is not a spectator sport.”

–D. Blocher