

Electrical engineering education in Uruguay. Some experiences.

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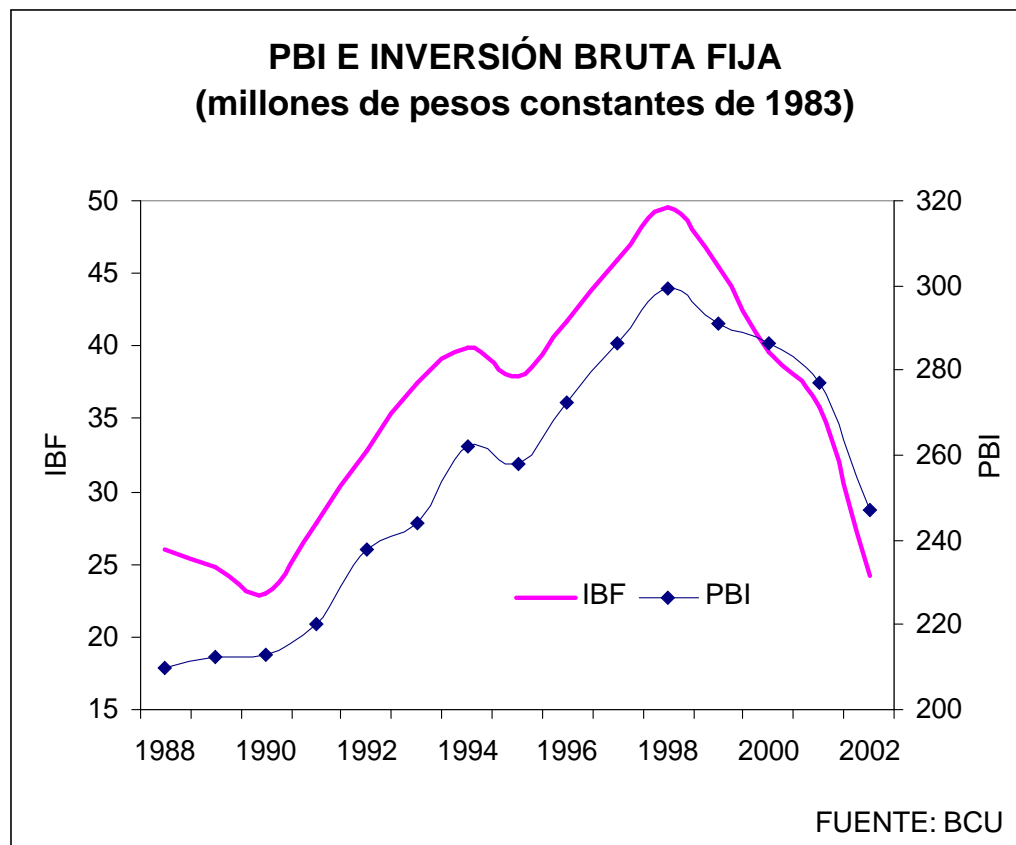
ICEE 2004

Where?

- **Montevideo, Uruguay.**
- **GNP per capita.**
 - **2002: approx. 5600 dollars.**
 - **2004: approx. 4000 dollars**



The context



Who?

- **Universidad de la República (80000 students)**
 - **Facultad de Ingeniería (6000 students)**
 - **Instituto de Ingeniería Eléctrica**
- **State University:**
 - **Free and non limited student admission**
 - **Autonomous**
 - **Governed by faculty, students and alumni.**

Instituto de Ingeniería Eléctrica

- **Faculty: 100.**
- **Students: 200 in 3rd year.**
- **Around 50 engineers each year.**
- **Around 45 courses each year.**

Electrical Engineering career

- **A general title on electrical engineering with profiles:**
 - **Control & Industrial electronics.**
 - **Power Systems**
 - **Telecommunications.**
- **Credit-based curriculum: each student builds his personal profile that must be approved by a committee.**

Context

- **Massiveness:**
 - **Around 300 freshmen students choose EE each year.**
 - **Growth of 25% in the number of graduate electrical engineers in 3 years.**
- **Strong budget limitations.**

Characteristics of our curriculum

- **Strong tradition on math and physics gives the students a solid basic education in the first 2 years.**
- **Courses are given by experimented professors with research and/or professional experience.**

What kind of engineers we need?

- **The engineers in Uruguay must be active actors of social and economic change,**
- **They must be able to use the most modern technology to solve real problems that affect the economy of a third world country like Uruguay**

Challenges

- **We perceive that the curriculum need some improvements:**
 - **Develop team work skills**
 - **Stimulate the creativity**
 - **Stimulate the multidisciplinary approach to the solving of engineering problems.**
 - **Active teaching of project management.**

Actions

- **Introduce more active learning in the curriculum.**
- **Some examples:**
 - **Studio of Art and Programming (TAP).**
 - **Internships.**
 - **Project workshop (Taller de Proyecto).**
 - **Final Project.**

Studio of Art and Programming

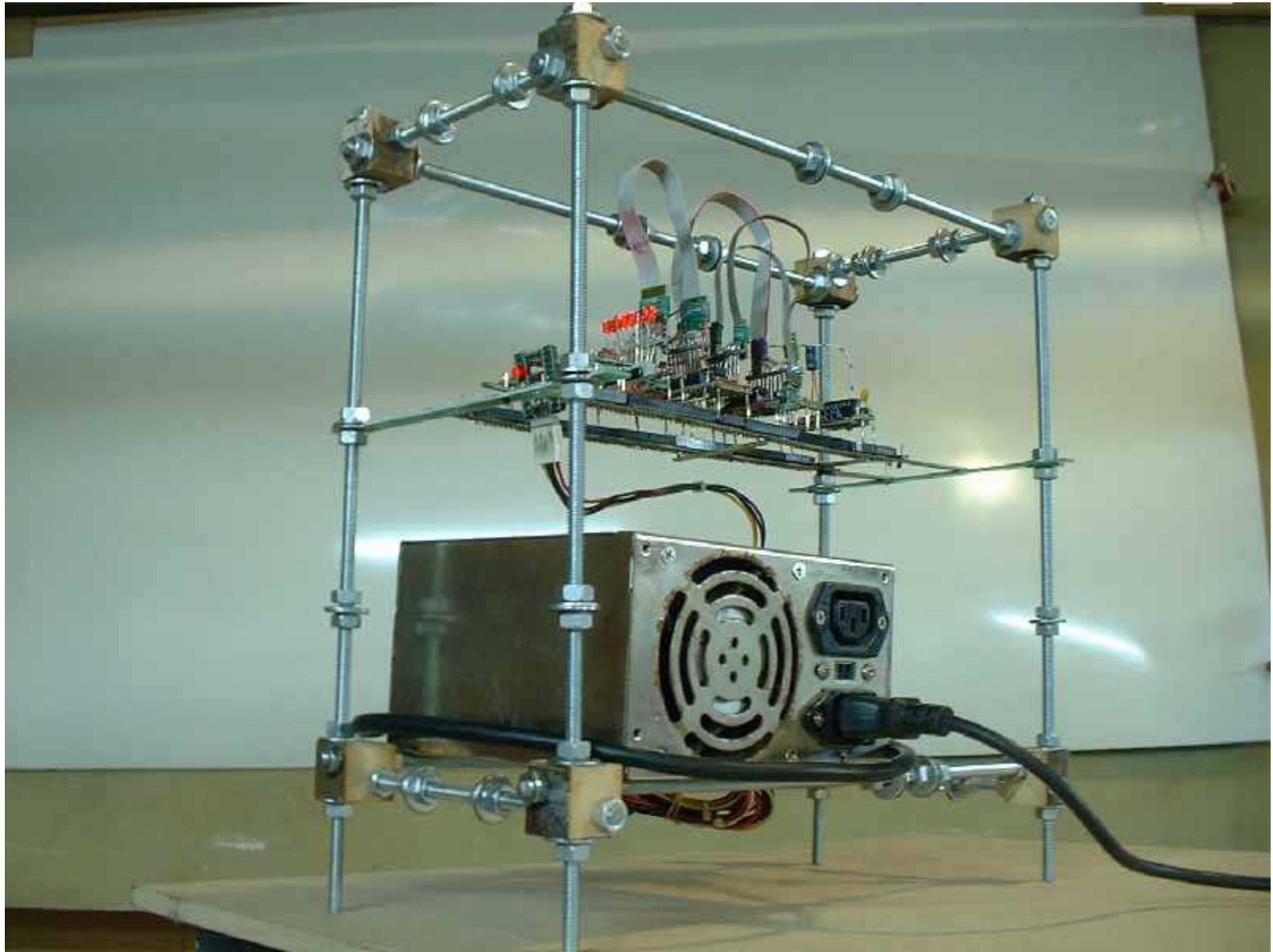
- 100 to 150 undergraduate students from EE, CS, arts, music, architecture and other disciplines work together for a semester in an effort to approximate digital technology with an holistic vision.

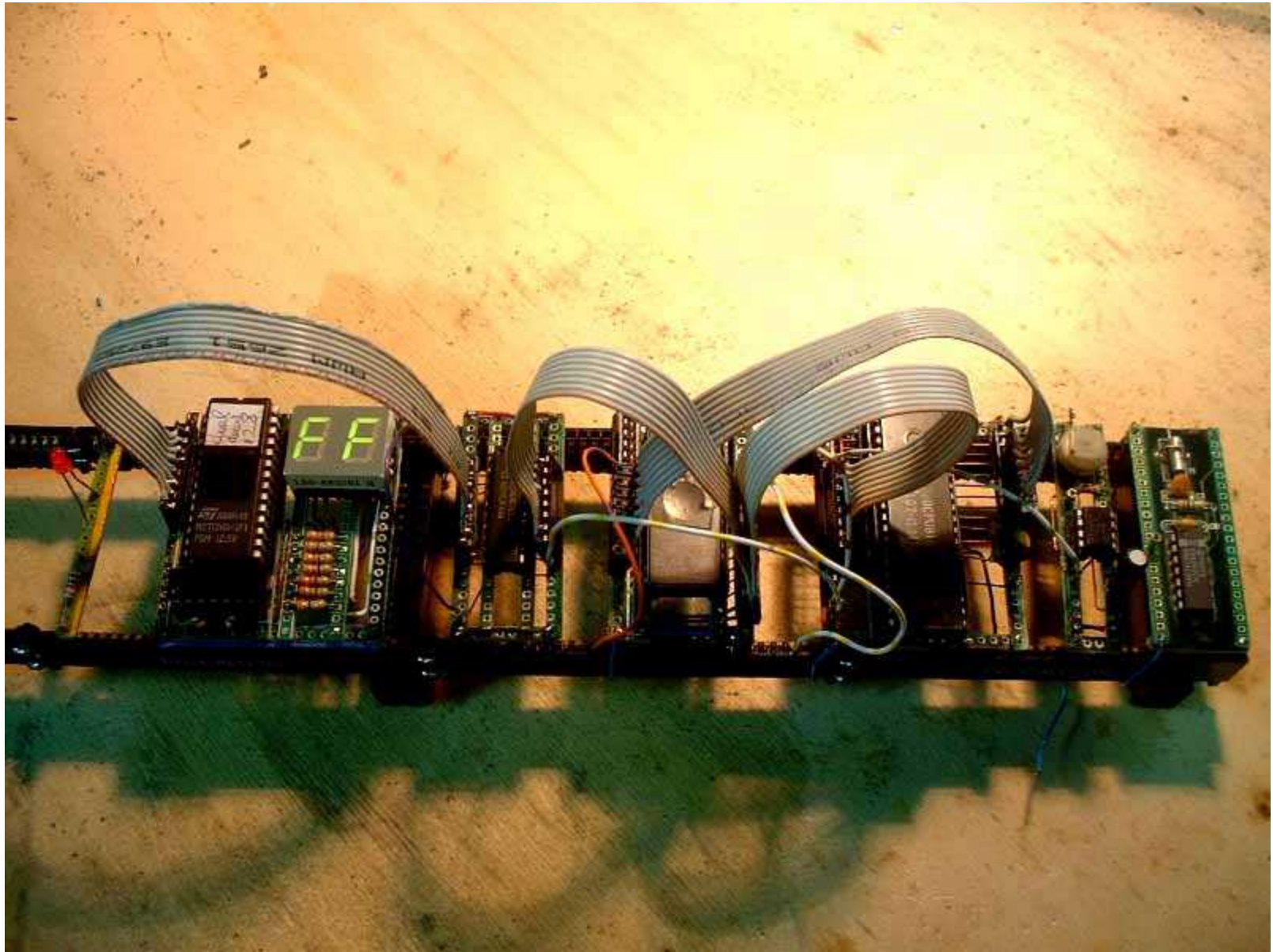




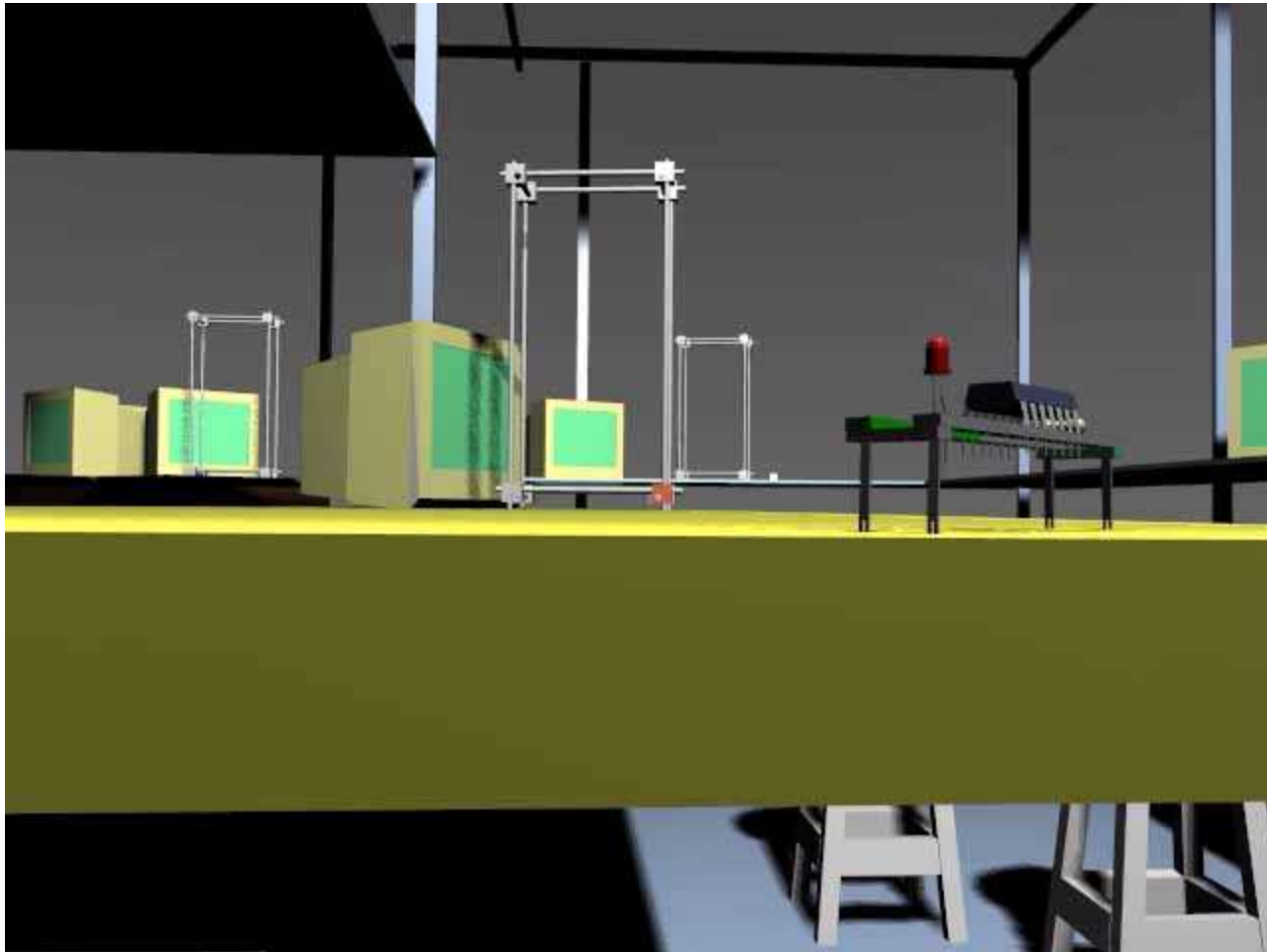
TAP

- The students from so different backgrounds work together for a semester, develop a “common” language and work with digital refuse in order to put the knowledge on scene.





Bits and atoms



TAP

- **The feedback from the students is very good.**
- **Each year we have more students interested in TAP.**
- **We want to reproduce the experience in other universities.**
- **Maybe exchange some students?**

Project workshop

- <http://iie.fing.edu.uy/ense/assign/tapro/>
- 4th year students.
- **Objectives:**
 - Develop team-work skills
 - Stimulate creativity
 - Integrate knowledge

Credits: PUCP, Perú

Methodology

- **The same project is proposed to several teams, each formed by 5-6 students.**
- **We stimulate the intra-team cooperation and inter-team competition**
- **Strong restrictions:**
 - technical,
 - timing (1 ½ semester)
 - budgetary (U\$S 100)

Methodology

- **The problems are in general useless (in order to avoid standard solutions...)**
- **Each team must patent its own solution in order to promote different approaches and thus, creativity.**
- **Professors does not suggest technical solutions**

Experiences

- **2002: 4 students.**
 - **Farolero: a mobile device that detects and turns off a set of lights on a surface.**
- **2003: 12 students.**
 - **The automatic goal : a rigid, convex autonomous mobile device able to detect a goal, to dribble obstacles and to introduce itself in the goal.**
- **2004: 18 students**
 - **The kiss to the Princess: an autonomous device mounted on an hammock which must be able to gracefully touch a light object (the Princess).**

Samples



Final Project

- **A complete engineering project for the students.**
- **A real problem, proposed by the industry or the research groups or the students.**
- **Teams of 3 students.**
- **Duration: 2 semesters, maximum 3.**
- **Public presentation at the end.**

Final Project

- **An initial short course on project management**
- **The students must develop a project plan**
- **The plan is approved by their tutor**
- **All the project must be managed with a management methodology.**

Final Project

- **Final Projects per year: 20 - 25**
- **Students per year: 60 – 75.**
- **Projects by area last 3 years (# students):**
 - **Control** 4 (12)
 - **Electronics** 11 (33)
 - **Telecom** 25 (75)
 - **Biomedical** 2 (6)
 - **Image Processing** 6 (21)
 - **Power systems** 9 (27)

Final Projects

- **Annual public exhibition and contest, open to the community.**
- **Some examples:**
 - **Detection of Colored Fibers on Wool Tops.**
 - **Sulla**
 - **Network simulator for performance evaluation.**
 - **<http://iie.fing.edu.uy/ense/assign/proy97/>**

Thanks

- **<http://iie.fing.edu.uy>**

Calidad de la enseñanza

- Nuevas asignaturas: “Desarrollo de SW para Ing. Eléctrica”, nuevo Proyecto, Antenas y Propagación.
- Laboratorios.
- Pasantías obligatorias.
- Plan 97: de carrera de exámenes a carrera de cursos (evaluación continua).

Calidad académica

- Meta: En pocos años todos los docentes deben tener título Posgrado.
- Hoy hay más de 20 docentes realizando posgrados, 6 en el extranjero.

Grupos de Trabajo

- Realizan investigación, enseñanza y extensión en un área.
- Son apuestas a largo plazo.
- Microelectrónica, Electrónica Aplicada, Ing. Biomédica, Imágenes, Control, Codificación, Redes, RF, Energías renovables, Economía de la energía, iluminación, etc.

Vinculación con el medio

- Inicio del ciclo técnico: Pasantías
- Pichón de ingeniero: Proyectos de Fin de Carrera (gestión, multidisciplinarios)
- Posgrado:
 - Becas de Posgrado,
 - Proyectos conjuntos,
 - Formación Continua.