

# **COOPERATION FRAMEWORK WITH A HOSPITAL AS A DESIGN-BUILD PROJECTS SOURCE**

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## **ABSTRACT**

The new framework that Telecom-BCN (UPC, Barcelona) has established with Bellvitge General Hospital and Bellvitge Biomedical Research Institute (IDIBELL) is described. The aim is to generate ideas or concepts that are suitable as topic for design-build projects under the CDIO approach. The issues about intellectual property (IP) management and about balance between analytical design and human-centered design are discussed.

## **KEYWORDS**

Design-Build Project, Intellectual Property, Stakeholders, Standards: 2, 5

## **INTRODUCTION**

Cooperation between hospital research and engineering departments is usual, especially with biomedical engineering departments. What is described here is a framework that Telecom-BCN (UPC, Barcelona) has built together with Bellvitge General Hospital and Bellvitge Biomedical Research Institute (IDIBELL). The initial aim of the cooperation agreement was to find ideas or concepts that could be suitable as project topics for design-build projects under the CDIO approach. These concepts should be complex and original enough to constitute the challenge for our Advanced Engineering Project (Bragos, 2012), which takes place along a semester in third or fourth year (depending on the degree), involving 8-12 students per team and accounting 12 ECTS credits. The topic should have a potential impact to motivate the students but on the other hand, it should not compromise the publicability or patentability of running research lines of the hospital.

The cooperation started through a contact between Telecom-BCN Engineering School management, the Hospital management and the Institute of Research associated to the Hospital to define the framework. A global agreement was written, approved and signed by the legal representatives of the institutions, including IP and confidentiality clauses. After a few meetings and brainstorming sessions, three topics for student team projects were identified. One of them has been implemented the fall semester of year 2014-2015. Additionally, and as a result of the contact, two additional potential research projects are being explored between both institutions and a first patent is being written. The three institutions perform periodic meetings to review the state of the current projects and to look for new ones.

The first hospital department that was identified as a project specifier was Anesthesiology (Dr. Tomás Domingo). The project topic will not be described in detail because is included in the confidentiality clauses. It is about augmenting the value of echography images in some pain-relief procedures. Two teams of 10 students were competing for the best solution along the fall semester. They were from the electronics and audiovisual systems degrees, because the technological solutions of the project were based in the use of sensors and image processing. Dr. Domingo gave a presentation to the students and a demonstration of the use of the echography images in that specific application. Then the students wrote the Requirements and Specifications document, made a Project Plan and started to implement the work packages. They visited in turns the hospital to know about the real procedures and the associated needs. They had a Critical Design review in the 8th week and presented the final results in the 14th week, just before Christmas. A public presentation was made in the Hospital in January. Fujifilm-Sonosite Company left an ultrasound imaging system to the School for the whole semester thanks to the intercession of Dr. Domingo. Figure 1 shows different moments of the project development.



Figure 1. From left to right: Dr. Domingo giving a practical lecture about the use of the echography system in our lab and displaying the procedure to be performed before entering the operations theater with the students at the Hospital. The students giving the final presentation to Hospital managers and doctors in the Hospital auditorium.

Up to now, what has been described is not really innovative. Other authors Surgenor (2005), Thomson (2012) among others, have described similar or more advanced frameworks. In our case, only 1/3 of the capstone project topics are specified by external stakeholders so this approach has been a clear improvement. Nevertheless, there are two aspects that have arisen during this project that we think that can be of interest of CDIO community and that we would like to describe in this Work-in-Progress paper: the intellectual property management and the balance between analytical design and human-centered design.

## IP MANAGEMENT

One of the major issues in the agreement between the institutions has been the management of the IP and confidentiality issues because of the requirement of confidentiality from the hospital side to keep the possible patentability of the product on the one hand, and the rights that the University acknowledges to the students about the work they do in their projects on the other hand. The tradeoff solution we have found and that will be used as a model for the next projects is the following: the main idea about the possible solution, developed between the doctors and the lecturers is written in the project statement. If the result of the student's work is a mere implementation of this idea, the IP remains in the Hospital and University side, according to the agreement document. If the students create a new solution, it belongs to them and the university and hospital can use it for research and teaching purposes. The students that enroll in this project know these rules and sign a document adhering to the confidentiality and IP clauses of the agreement. The document the students sign include the confidentiality clauses of the agreements and the university regulations about IP (as annexes) and the following paragraphs:

"In order to protect the rights of the possible development of the initial concept and also the rights of possible original contributions made by the students that, being part of the project, go beyond the definition declared in the initial statement, the participants in the project sign this document of adherence to the clauses of confidentiality and intellectual property rights of the agreements between the UPC and the IDIBELL (attached documents 1 and 2). Intellectual property rights of the developments made in the UPC are regulated by article 2 of the document "CG 10/10 2008, regulations on intellectual property rights in the UPC", of which an excerpt is attached (Document 3). Concisely, it is considered that the intellectual property of the developments in which the student's participation is a mere implementation of the idea described in the statement of the project and are carried out under the supervision of the teaching staff, corresponds to the UPC-IDIBELL Consortium. On the other hand, the possible original contributions made by the students, individually or collectively, exceeding clearly the scope of the initial statement and which are carried out independently by students, would be covered by paragraph 3 "of the inventions of the students not directed by professors of the UPC", and their ownership corresponds to the student or students, keeping UPC and IDIBELL the right of using them for teaching or research activities. In this case, a co-ownership agreement could also be negotiated in order to facilitate the protection and development of the idea.

The statement of the initial idea is the following:

- Need: ...
- Solution proposal: ...
- Foreseen Applications: ...

As a student of the Advanced Engineering Project subject and therefore forming part of the UPC, I adhere to the above mentioned terms of the documents 1: framework agreement UPC-HUB-IDIBELL and 2: specific agreement UPC-HUB-IDIBELL

Name, date and signature:"

## **ANALYTICAL DESIGN VS DESIGN-THINKING APPROACH**

The capstone projects at Telecom-BCN usually emphasize the Design, Implementation and Operation aspects, while the Conceiving aspects have less weight. Usually the main idea is given to students in the form of generic requirements, which they transform into specifications after studying the problem. The solution they develop to fulfill the requirements and specifications is expected to have an advanced technological level. In this case, the technological solution mainly had to employ image processing techniques to generate value-added virtual images that helped the doctor while performing a specific pain relief procedure. It happened that both teams developed a correct but not outstanding solution in this sense but also happened that, from the observation of the way the doctor managed the echography probe in the operations theater both teams proposed modifications in the probe shape and function and in the way of managing it. Basically, the doctor would need a third hand to operate with the probe, a needle and the echography system controls. They proposed three different solutions and implemented two of them with a 3D-printed mechanical design and a low-resolution prototype of the associated electronics. These added components were not developed with the same depth than the image processing part of the project, but allowed the teams providing a proof of concept which had a higher value for the user than the initially intended solution.

This drives us to consider a tradeoff between the Design Thinking approach and the Analytical Design approach, with which we are more used. We only give more weight to the conceiving phases (needfinding, ideation) in projects where engineering students work together with design students and business students, but up to now we considered that the time needed to perform correctly these phases in purely engineering projects makes difficult arriving to relevant technological solutions. The experience gained with this project is pushing us to (slightly) reconsider our approach.

## **CONCLUSIONS**

This is definitively a work-in-progress on its several aspects. The framework built through the agreement between our engineering school and the hospital has allowed developing a project and two more projects are now being prepared to perform, at least one of them, in the following fall semester. Given that we change the project topics every semester, the continuation of the project about echography and pain relief could be done through one or two degree thesis performed by students belonging to the teams or through a research project.

The solution developed to protect the IP of University, Hospital and students has allowed avoiding any blocking of the project for IP protection reasons but we should observe how this issue is developed along several projects.

The dilemma about the weight of the more creative phases of design versus the complexity and depth of technological solutions just appeared in our institution. Most faculty considers capstone projects as platforms to run in depth in advanced technological solutions integration while providing opportunities to develop personal, interpersonal and professional skills. For the external stakeholders, however, the solutions could be more relevant if the needfinding and ideation phases have been more intense, even if the price is a proof of concept with less resolution. Probably this topic deserves a debate into the CDIO community.

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## BIOGRAPHICAL INFORMATION

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