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## MediSuite + iPlate Integration



### Abstract

Force plate or pressure plate analysis came as an innovative tool to biomechanics and sport medicine. This allows engineers, scientists and doctors to virtually reconstruct the way a person steps while running or walking using a measuring system and a computer. With this information they can calculate and analyze a whole set of variables and factors that characterize the step. Then they are able to make corrections and/or optimizations, designing appropriate shoes and insoles for the patient.

The idea is to study and understand all the hardware and software implications of this process and all the components involved, and then propose an alternative solution. This solution should have at least similar performance to existing systems. It should increase the accuracy and/or the sampling frequency to obtain better results. By the end, there should be a working prototype of a pressure measuring system and a mathematical model to govern it. The costs of the system have to be lower than most of the systems in the market.

# Keynote

Part of the fun of engineering is that it's an exploratory, creative process, which demands its engineers adjust their thinking to meet a project's changing requirements.

This is sometimes due to that the basic technology is leading-edge and is not fully understood, so engineers discover new things during the design process. Frequently the initial goals or objectives were unclear at the beginning and are clarified as the design progresses. But especially because engineering design is as much art as science, there can be an infinite number of possible solutions, or possible variations of one solution. A good engineer should be always open to changes and new approaches.

## Scope of Work

The information and documents of the project are private and confidential. The research will be made at Ilimitada's headquarters in Medellin. The project should be developed during the first semester of 2010 and will be documented in English. The results of this project are the first approach to the solution.

## Proposed Work

The systems that are available today offer different solutions for the pressure measuring problem. There are all kinds of alternatives with different features, but there are some problems with them too. The first one which is the one that affects the most is that the access to this kind of technologies is not very easy in our country for two reasons: one is that this technology is available in Europe and USA mostly and is a hassle to bring it in; then the second one is the price. Most of these systems are wicked expensive for what they do and for what they could be used here. So in this line, we see the need of having this kind of technologies inside our country, one to make it available and two to impulse work on our industry.

This argument in one hand and on the other hand these facts. The student wants a challenging project for the thesis, and Ilimitada is already working on some software tools and

suits for biomechanics and orthopedics; they have done a nice prototype using one of the systems in the market (Medilogic's). And finally there are other needs, because the company wants a system there all the time to do testing for as long as they want with good performance, and the sampling frequency and resolution of the information that comes from that device is not very appropriate and the results are not as accurate as desired.

So the idea is clear now, and the requirements for the system are listed further down in this document. Now to describe the problem and the resulting benefit to the organization if the problem is solved. The main objective of the project is basically solve those needs and wants already explained, creating an alternative system that may use a different technology or innovative process to do pressure measurements in real time if wanted. The system should have an accessible price for doctors and companies in our country.

By the end of the project I would like to have a working prototype of an alternative pressure measuring system that can interact with the MediSuite software. The price of the system could not exceed those from the solutions in the market. I hope to come up with an accurate model to rule the system and the way the information is processed.

## Needs and Wants

These requirements are analyzed and prioritized to make them a guide for the design process and development.

### Key Features

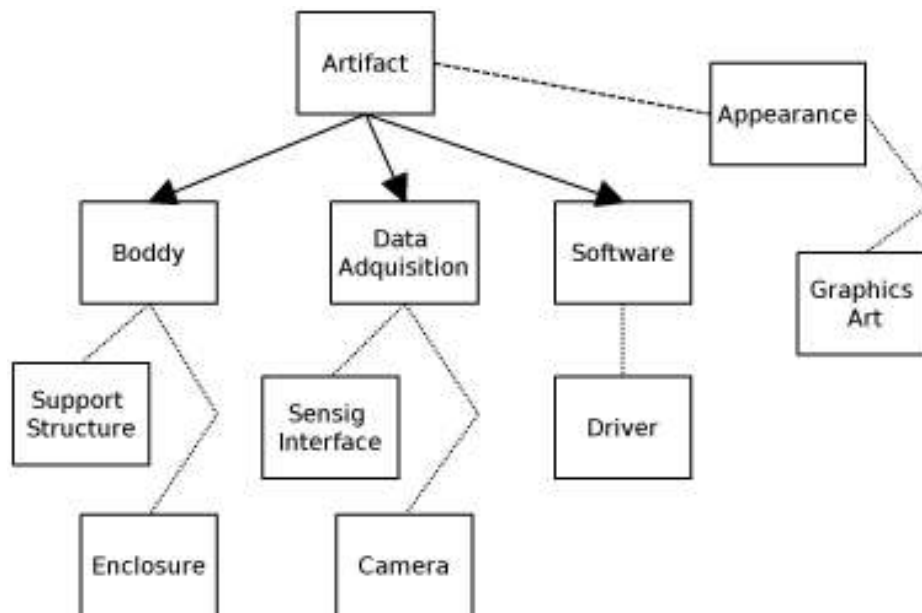
- A low-cost pressure measurement system that works in real time
- Develop an intuitive desktop software
- Integrate the iPlate with MediSuite
- Real-time low-cost measurements
- Accurate results
- The system should be scalable

### Target Groups

- Orthopedics and Physiotherapy
- Medics, doctors
- Retailers
- Footwear Industry

## The System

The system is then divided in four main subsystems and distinct areas (see figure 1): sensor technology, data acquisition hardware, display and analysis-processing software, and materials technology. In the hardware area the work is made in ilimitada, they have already had some good innovations, so this project focuses especially in the other three. The materials depend a lot of the technology used and the design of the system, so is crucial to identify the technology to use for the sensors and the way the data is going a be acquired and transmitted to the computer. To do so a lot of research and study is needed by those involved in the project. The software is then the center of focus here, to acquire, manipulate and present the data.



*Figure 1: System Structure Tree*

# Software Model

The software is made of different modules (see figure 2). First use the sensors to get frames that show differences in measured property (resistance) indicating differences in pressure. Then build a transfer function for the pressure with the resistance value and use different colors, a sampling of known pressure values and related colors is needed, so that there is a way to interpolate the new pressure values with the colors.

Calibration is very important, use a object with known area to contact the force plate top surface and put a known load on top of it; repeat this with several different loads.

Once all the information is collected there will be a set of load values and a set of corresponding frames. Then calculate the pressure for each case using  $p = \text{load}/\text{area}$ , where the area is constant and known for all cases. After this analyze the frame and calculate the average color and with these values build a function of pressure values and colors.

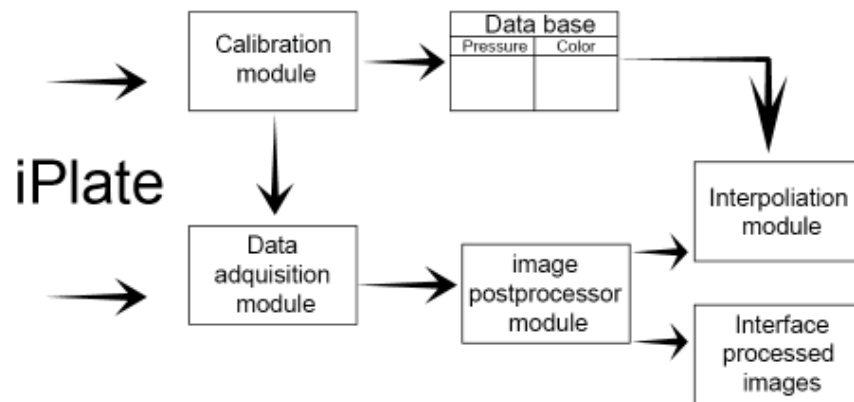


Figure 2: Diagram of the Software Structure

