Architectural Apps for Smartphones: Four Finished Cases

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1. Introduction

This paper describes the process followed for the creation of four applications for iPhone/iPad devices, which have produced an unusual R&D and are applicable to professional practice.
This process is born on two, apparently unconnected points:
1. University teaching, research and the professional practice of architecture should not be unconnected activities, but the complex reality of the world of construction means that they are seen as separate.
2. It is obvious that many technological tools such as PC tablets, smartphones… are being used by the general public in their everyday lives [1].
These are the first apps developed by the School of Architecture, where the formal and aesthetic requirements are of great importance, so the concept of a collection of apps also had to be resolved in these first apps. Hence, the seemingly simple user interface was complex to design, as it had to be the basis for future apps (yet to be designed at the time), either by the School of Architecture or other Faculties in the University.

2. Methodology

The creation process for the different apps was the following:

- Deciding on the calculation parameters demanded by the regulations.
- Comparing these values with those which, thanks to professional experience and architectural repercussions (e.g. the position of the staircases), are of immense importance for building students and professionals.
- Creating the calculation engine on an Excel spread sheet.
- Design of the graphical interface.
- For the AutoSum of points 3 and 4, the programming was carried out in Apple XCode (Objective-C).
- Several Beta versions were created and distributed among students, professors, architects, engineers and administration professionals to get feedback and improve the app before its definitive publication on the online App Store.

From the beginning, the production of two different formats was considered appropriate, one for iPhone/iPod and another for iPad, which meant two-fold programming so as to optimize the resolution on both devices.

2. UNAV-Fire

With these precedents, the aim of the project in this first app was to create a software program so that a student, lecturer or professional architect could, at any time or any place, use the tool to calculate the main fire safety parameters for a residential building (number of sectors, occupation, structure resistance and dimensions of the evacuation routes) obtaining a result which, beyond regional or national regulations, assesses the appropriateness of the proposal.

Thus, based on the Spanish norms, and with reference to the Performance Based Design so as to be applicable to any project, we have a simple software program, which returns the mentioned parameters with the input of only eight pieces of data on the building.

Fig.1. Unav-Fire App (Chinese–iPad screen version).

The following is the list of user data input:

Conditioning factors:

- Automatic extinction with/without water sprinklers
- Floor with/without direct exit to safe exterior area.

Variables:

- Area constructed.
- Area of fire sector to be calculated.
- Height of evacuation descent.
- Maximum evacuation distance.
- Number of exits per floor.
- Number of leaves in doors and passages.

The App swiftly shows the main design factors in fire protection in a residential building (outputs):

- Sector occupation.
- Resistance of structure to fire.
- Number of fire escapes per floor.
- Characteristics of emergency staircases.
- Characteristics of emergency doors and passages.
- Characteristics of emergency corridors and ramps.

Although the Spanish regulations in Basic Document CTE-DB-SI are used as its basis, the essence of the app is not to fulfil any particular regulations, but to provide a rule of thumb which, for the first sketches of the building design, would allow one to see how close the creation of a safe building was from this perspective; a tool that brings teaching and professional practice together in such a way as to be within the reach of anyone anywhere.

3. UNAV-Peltier

The App "UNAV Peltier" has a double end:

- Sharing the research of the Installations and Energy section from the School of Architecture of the Universidad de Navarra ETSAUN, an environment with HVAC of spaces with Peltier cells [2].
- To be use like a platform to spread the knowledge of this technology. For that, the programmers have created an additional software notes the automatic actualization of the Apps contents without resort to the procreation in AppleXCode from a PC.

Fig.2. Unav-Peltier App (English–iPad screen version).

The App offers, from the investigations realized in the School of Architecture, are the first approximation to estimate the number of Peltier cells should be required in spaces up to 100 m2.
For that, the user only introduces as a variable the surface of the space to be air conditioning, with a heat transfer power of 70W for each cell.

4. UNAV-Test

Fig.3. Unav-Fire App (Spanish – iPhone screen version).

This App allows students of Architecture and Engineering to improve their knowledge in the following five areas of Buildings Services:

- Fire Safety.
- Water management.
- Electricity and data telecommunications.
- HVAC.
- Other building services such us security, waste, elevators, ...

So, this App is 'only' a recompilation of questions and answers, which have been produced by the experience of students and teachers from the School of Architecture of the Universidad de Navarra.

5. UNAV-TIME

Fig.4. Unav-Fire App (Spanish–iPad screen version).

The object of this App is that users of a local can estimate in seconds the electric and HVAC cost of the space where they are.
As an evidence, the calculi's immediacy is reached simplifying, on that way is how we have to use the App: as an brief visualization of the consumption of a classroom, office or an space of a residence, that requires exactly data calculus to obtain precise data. The App goal is to know if we are talking about 1,10 or 10.000.
Data calculi are from "ASHRAE POCKET GUIDE for Air Conditioning, Heating, Ventilation, Refrigeration (SI Edition)", and in concrete terms are the following:

	Occupation	Lightning	HVAC
Classroom	2,3 m²/person	8 W/m²	130 W/m²
Office	11,6 m²/person	8 W/m²	120 W/m²
Residential	35,2 m²/person	3 W/m²	75 W/m²

Appliances	Power Consumption
Computer	0,25 kWh
Projector	0,22 kWh
Printer	0,013 kWh
Television	0,18 kWh
Coffee Machine	0,8 kWh
Audio System	0,2 kWh
Musical Equipment	0,08 kWh
Modem	0,025 kWh

With that information, the users choose a type of inhabited space, a surface, the number and type of the installation's dispositive exists. When the chronometer starts, we obtain the thermal and electric kWh and instantly accumulated on that session, assigning an economic value from the average rates of the Spanish energy market.

6.Discussion

As far as the authors know, these are the first apps of its kind produced by a School of Architecture. Thus, the doubts and problems resolved were not difficult in themselves, but were complicated because they had never been dealt with before.

The following gives a general list of the team's reflections:

- As this app is produced at a School of Architecture, another objective which is also important, is to encourage the students to be familiar with the regulation norms and thus to apply them to their future professional projects.
- As it was created at the University, a query that was repeated again and again from the start was whether the app should be free, or sold at a token price, or if enough should be charged to cover the costs, thereby earning funds for future applications.
- The aesthetics of the app, with several architects among its beta testers, was at times an additional problem, but the final result is even better than expected in two ways: the usability of the apps and the creation of the collection aesthetics needed for later apps.
- Should the app be developed for the Apple system only or also for other devices such as Android? Obviously the app promoters would have preferred the app were developed for both platforms, but it was a cash-flow issue: there wasn't enough for the two. Apple was chosen because it is more widespread in Spain in the construction field.

6.Conclusion

The final status of the apps is the following one (march 2013):

- Unav-Fire: Available on iTunes Store. Working on content´s update (0'79€).
- Unav-Peltier: Slope of up to iTunes Store (free).
- Unav-Test: Pending on distribute between Beta Testers before sending to iTunes Store (free).
- Unav-Time: Pending on distribute between Beta Testers before sending to iTunes Store (free).

With the process finished, our conclusions can be summed up as follows:

- The availability of the app in several languages has confirmed how easily it has become well known among the specialist public.
- It would be desirable that apps produced by the University as a means of spreading knowledge should be distributed free of charge.

- Apart from the usual spread of academic knowledge in indexed journals and specialized congresses, there is no doubt that apps for these devices will be important in the future, and their implementation will have to be resolved, as evidently they cannot be patented nor are they controlled by peer-to-peer revision, but may become very widespread among academics and professionals.
- This software was developed for iPhone and iPad devices by construction professionals (students, architects, engineers and administrative staff) in Spain. The software could also be developed for Windows, Linux or Android interfaces, which is simple as the problem is not the language programming, but the creation of the original calculation engine.

The calculations used in these Apps are based on the calculation tables of the Spanish Technical Building Code, ASHRAE Codes and on the authors experiences. However, the results of these applications must no be used as justifying calculations.

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