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Mobile and web technology to display notifications of academic events of the Universidad Francisco de Paula Santander by using the agile methodology for mobile development

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Abstract. The "Universidad Francisco de Paula Santander, Colombia" lacks a dynamic tool to give the academic community timely knowledge of events and information needs in an assertive manner and in a reasonable time. Based on the above and following the dissemination strategy designed by the "Centro de Comunicaciones y Medios Audiovisuales" to incorporate the use of technology to massify internal institutional information, is built the mobile application NotiUFPS for Android devices, which allows notifying all events that take place at the university, including the calendar of previous and academic calendar, with the compatibility of downloading information in pdf format. The application will make use of global positioning system, to send timely notifications and updated information of institutional events when the user is inside the university campus. NotiUFPS was developed using "Metodología Ágil para Dispositivos Móviles", a methodology developed by the "Grupo de Investigación en Desarrollo e Ingeniería de Software, Universidad Francisco de Paula Santander, San José de Cúcuta, Colombia", which consolidates development practices recognized as Scrum and XP.

1. Introduction
The systems engineering program of the "Universidad Francisco de Paula Santander (UFPS), San José de Cúcuta, Colombia", for some years has been applying the strategy of project-based learning (PBL) using agile methodologies [1]. Is how was the idea of apply the approach of "Metodología Ágil para Dispositivos Móviles (MADMOV)" in a classroom work entitled "NotiUFPS" of the integrator seminar III, it is a subject in which the learning process is based on the development of a project, and in which this project is part of its final evaluation. The methodology has been incorporated in other subjects that contemplate the concept of PBL, it adapts to the time that in the case of classroom projects corresponds to an academic semester (4 calendar months); time that is taken as a baseline to define the scope of the project and its deliverables.

The teachers who focus their subjects in "Aprendizaje Basado en Problemas (ABP)" have incorporated MADMOV as their methodology, which adjusts to the needs of the systems engineering program and is recognized by most of the students of the last semesters of the program who have validated it in several final projects to give solution to institutional needs. Outstanding projects are socialized in the classroom project fair, which takes place in each academic period. Within the needs of the institution identified in the classroom projects, are that the academic community is not a participant in several of the events because it lacks a tool based on technology that allows timely knowledge of these events which leads to many people know the events after

they are held.

The article presents the results of the experience in applying the MADMOV agile methodology approach in the development of software for mobile devices, providing the students of the systems engineering program of the UFPS, San José Cúcuta, Colombia, with a tool that allows the how the developer team works according to the conditions or context of the project to be developed according to the client's needs.

2. Application development for mobile

Agile methodologies are characterized mainly because they represent the antithesis of the traditional process of developing software; overlook the use of use cases, the exhaustive definition of requirements and the production of extensive documentation [2]. This may seem chaotic according to the traditional approach of software engineering, although it should not be forgotten that XP has a life cycle associated with it and is also considered a process [3,4].

The delivery of software with short times and reduced costs but without losing the quality standards makes that agile approaches are taken into account when developing small and medium projects, where requirements constantly change, in environments of uncertainty and instability of requirements [5,6] and where there is no need to have large teams, instead small teams that do not exceed in 10 the number of developers [7].

MADMOV was born as a necessity of the systems engineering program of the UFPS, San José de Cúcuta, Colombia, for the development of software as a product of projects in the classroom, the methodology consists of four phases: identification, planning, development and delivery [4] (see Figure 1).
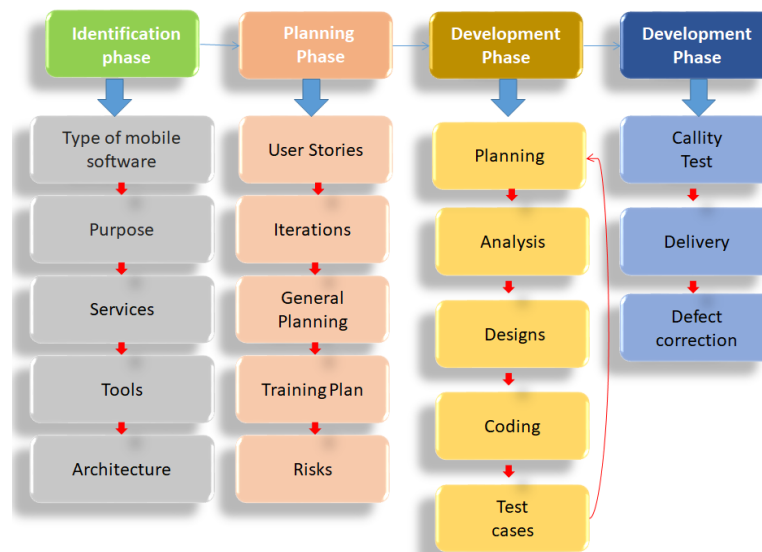

Figure 1. Structure of MADMOV [7].

- Phase: It is the first phase of the methodology where the initial contact with the client takes place. The client must be made aware that he is a fundamental part of the success of the project, therefore; he is one more member of the development team. In this phase, the type of software must be determined, the problem that will be solved with the software must be identified and defined, the services that must be implemented in the software must be identified, the tools and technologies that will be used in the development of the product must be identified and approved, and the architecture must be determined.
- Planning Phase: Consists of a set of activities aimed at clearly defining user histories, their prioritization, and the iterations to be developed, as well as calculating costs and development times. Risks related to the customer, technology and product development itself are also clearly identified.

- Development phase: The product is created, and the functional and technical tests are carried out. It includes the planning activities of the iteration to be executed, the analysis, the design and the coding required for the iteration. In the end, there are cases of evidence for the deliverables.
- Delivery phase: Quality testing, correction of defects and delivery of a product increment are performed.

MADMOV, adapts to any desktop and web environment, taking into account that its approach is iterative and light, proving to be a best practice for software development, allowing the elicitation of requirements, reducing development time, early error correction and control and monitoring of projects developed in the classroom. In the subjects that involve software development, MADMOV has been used as part of the good practices that the future professional in systems engineering should have.

Software engineering is applied in several fields of study, as can be seen in this research which allows giving answers to the needs of the university environment and which adapts to the characteristics of the Institution and the human talent available, starting from experiences and technological tools validated in the teaching-learning process.

In the "Centro de Comunicaciones y Medios Audiovisuales (CECOM)", UFPS, San José de Cúcuta, Colombia, within its dissemination strategy incorporates the use of technology to massify internal institutional information and builds the mobile application NotiUFPS for Android devices, which allows notifying all events that take place in the university, including the calendar of previous under the MADMOV approach.

3. Methodology

In the mobile application, NotiUFPS is applied the methodological approach MADMOV, developed by the "Grupo de Investigación en Desarrollo e Ingeniería de Software (GIDIS)", UFPS, San José de Cúcuta, Colombia, allowing to manage the project and supervise the development of the application, since the approach consolidates software development practices recognized as Scrum and XP.

For the development of the project, the four stages of MADMOV are proposed; identification, planning, development and delivery; based on the practical and applied development of knowledge acquired in the course of the professional career in systems engineering, these stages required to fulfill the objectives of the investigation are described next:

- Identification: at this stage, the mobile operating system most used by teachers, administrators and students of the UFPS to define the technologies, tools and development architecture of the project was identified (see Table 1).

Table 1. Technologies used in NOTIUFPS.

Technology	Justification
HTML5	Allows the creation of the structure of the web platform.
JQuery (Javascript)	Javascript with jQuery framework for the dynamic design of the calendar of events.
Bootstrap (CSS3)	Gives style to the web component.
PHP	Web programming language.
MySQL	Database management systems.
Android (Java)	Native programming language to develop the mobile application.

NotiUFPS was developed under a client/server architecture with three MVC layers (model, view and controller), considered with an adequate level of maturity and that has proven its validity over the years in all types of applications, and in multiple programming languages (see Figure 2).

The selection of the operating system for the implementation of the application was based on a survey of 200 students out of a population of 18,000 students (see Table 2), with a security level of 95%; the accuracy of 3% and the expected ratio of 5% [8].
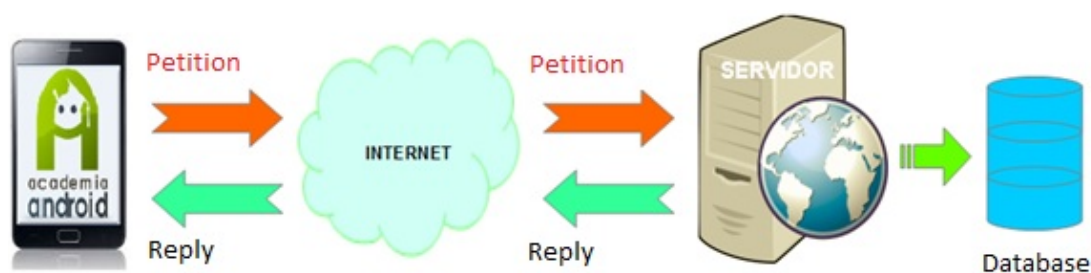
Figure 2. NotiUFPS Architecture.

Table 2. Survey results.

Operating system	Number of students
IOS	10
Android	190

In the phase of elicitation of requirements with the users of the CECOM, UFPS, San José de Cúcuta, Colombia, is identified the need for a web and mobile application to manage the events scheduled at the University, as well as the calendars of previous and academic activities, which can meet the expectation of the student population, young people born in a digital generation, hyperconnected, in this way the premise given by [9] of involving the client and users as part of the team, taking the role of product owner, is maintained.

- Planning: At this stage, the requirements identified by the stakeholders, in this case, the CECOM, UFPS office, are generally tendered, characterized by certain uncertainty and the scarce CECOM, UFPS, definition of the requirements, a predominant characteristic in experimental and novel projects; this instability is adopted as a premise and, through techniques, development priorities are gradually established and the understanding times of the new technologies are contemplated without negatively affecting the quality of the architecture, maintaining the continuous flow of value for CECOM, UFPS, without interruptions as proposed by [10].

- Development: Starting from the general idea of NOTIUFPS we estimate the development effort of the user stories, with brief descriptions of the needs of the Communications Center to benefit the development of NotiUFPS applications, avoiding an enormous allocation of time in the definition of software requirements, characteristic of MADMOV taking into account its agile approach.

- With the iterative development, fundamental pillar of MADMOV, in the first three iterations the NotiUFPS news administrator and the academic events such as the previous calendar were built; as the administrative functionality was made, feedback was obtained from CECOM, UFPS, collaborators and the necessary changes were made in such a way that at the end of the first three iterations a productive administration functionality was obtained that worked without problems and could be shown to the users, even if it was not the final and definitive version; in later iterations several improvements were incorporated. With the agile approach of MADMOV that promotes iterative and incremental development, during the iterations the final product of NotiUFPS was profiled and defined, see Figure 3. At the same time that deliveries were made that represented sufficient value and met the needs of the communications department called CECOM, UFPS, in the same way, the global positioning system (GPS) and notifications of institutional events were incorporated to the software for the users when they are inside the university campus.

- Delivery: The integration of all functionalities is carried out by making validations or tests of each one, the necessary changes or corrections are made, and a delivery report is drawn up with the implementation of the application [11,12].

Figure 3. Capture of the main interface of NotiUFPS.

4. Recommendations

According to the experience with MADMOV, it is expected to incorporate in the planning phase an activity to organize the development teams with this agile practice, to define the role of the facilitator leader and the developers that make up the classroom projects which usually correspond to a small number of participants and thus get an appropriate assignment of user stories for the optimization of development processes and the rapid identification of errors in the course of each iteration.

5. Conclusions

The research process concludes that Android technology is the most used by students at the UFPS in San José de Cúcuta, Colombia, which allowed the development of the mobile application under this technology. Then, it was concluded that the mobile technology developed deploys on time the academic notifications to the students of the UFPS, developed through the agile MADMOV approach and allows the application administrator to register the events with title, date and time.

The web platform allows adding to the database the previews of the professional careers of the UFPS, adding start and end date, as well as the PDF or DOC file with the dates of each of the previews of the subjects of each career.

The mobile application filters events according to pre-established preferences, make use of the GPS if the user requires it, displays the notifications in a range of action of the UFPS, and constantly checks if the user's location coincides with that of the university in order to send notifications of events. This is only valid if the user has chosen to make use of the mobile's GPS.

Likewise, the MADMOV methodology streamlines the work of the development team, being for this case the delivery of web and mobile application that meets the requirements set out in the classroom project of the subject Integrator Seminar III.

Moreover, MADMOV meets the needs of the Systems Engineering Program in the following subjects where the ABP is applied with agile methodologies since this approach is born from the best practices of agile methodologies such as SCRUM and XP.

Regarding the time established for the development of projects in the classroom, the MADMOV methodology helps the student to fulfill the objectives and scope defined in his project; it is an iterative, lightweight methodology with the necessary artifacts to support a development process at the end of an academic semester (4 months) compared to other known agile methodologies that despite its agile nature require a defined and structured team during the development phase.

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