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A mobile application to create awareness about scholar's activities

Nava-Muñoz, S.E.[1]; **Ibarra-Cuevas, D.M.**[1]; **Aceves de Alba, J.**[1]; **Ramos Blanco, A.**[1]; **Martínez-Pérez, F.E.**[1]

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ABSTRACT

Mobile computing has been more accessible to people and the development of software for this area seeks to enhance all its benefits. A stand-alone mobile application does not depend on an Internet connection for its operation, and this operation allows it to be more useful. There are some platforms that allow us to manage an agenda and therefore get notifications about what we have scheduled, but an internet connection is needed if you want to check the agenda from a mobile device. This work, in a school context, offers to users a stand-alone mobile application to create awareness about activities planned in a school calendar. The application downloads the calendar only when such calendar gets updated and later works independently. It also sends personalized notifications according to the user's profile configured on the mobile device. The application called Uni-Agenda was developed in its first version and concept tests were carried out to ensure its correct operation. The next step is to release it to a group of university students so features like performance and usability will be evaluated.

KEYWORDS: mobile computing, awareness, stand-alone, application, context-aware

[1] Facultad de Ingeniería. UASLP. San Luis Potosí, México
Autores de correspondencia:
senavam@uaslp.mx, A279236@alumnos.uaslp.mx, {jaceves, beto, eduardo.perez}@uaslp.mx

INTRODUCTION

In recent years, Software development can be found in different types of devices, smartphones included. Additionally, the use of a mobile devices by students in a university community is already widespread (Barboutov et al., 2017), not only to listen to music, use social networks or stay in touch with the family, but also to various applications of interest. Bordini & Korn (2020) propose an App as a solution about the transition from college to university in terms of combat loneliness and social isolation.

Other applications have been created to propose learning environments (Brazuelo, 2011; Khaddage, 2016; Loredo, 2018), consult academic information (Vega Olvera, 2017; e-Scholar App), as a school planner (Egenda App; rSchoolToday App; Class Timetable App), or to track study habits (Arnold et al., 2017). For a student it is very important to be informed about the dates of a school calendar, and the accomplishment of the different activities on time. In computational terms a student's profile (e.g. academic level) can be considered as a "user context" and the application that reacts to this information is called a "context-aware system". The literature reports some context-aware mobile applications, focused on providing solutions in different environments, such as health (Araujo-Lara, 2016; Kumar, 2022; Marshall, 2019) and tourism (Cheverst et al., 2017). However, a challenge as proposed in (Cheverst et al., 2017) is to offer applications that do not completely depend on an Internet connection, so that it is available to the entire community.

The purpose of this work is to develop a mobile application, as a context-aware system, that works as a school assistant, which provides information about the activities planned in a school calendar and sends personalized notifications according to the student's profile. The benefit is to keep the students aware of their school activities, which allows them to have good academic performance. The school calendar is automatically updated in the application, and two versions are proposed: the first version includes the definition of the user's profile by the own student and the second one considers that their profile will download automatically from a server in the University. The main contribution of this job is the design of the software to automatically download the calendar, the acquisition of the student´s profile (user context) and to send personalized notifications (context-aware notifications).

This work was developed in the Engineering School of the Autonomous University of San Luis Potosí, nevertheless, it is possible to develop on other academic entities. The structure of the paper is as follows: Section 2 describes the details of the design of the mobile

application; Section 3 shows the tests carried out, a plan for its use, and a future evaluation; and finally, Section 4 presents the conclusions and future work.

MATERIALS AND METHODS

The application was developed in Dart (Bracha, 2016) as an open-source programming language. Flutter (Meiller, 2021) was used, an SDK for the mobile application development. The app uses shared packages and plugins of the package supplier Pub Dev as complement library and makes the function of the platform Pub Dev available to the application. The detail of imported dependencies is found in the file pubspec.yaml, in which the name and version of the dependency is reflected.

Figure 1 represents the architecture of the application. The flow starts when the administrator of the scholar department of the University (1) uploads a plain file or records an activity in the server, (2) server that has a plain-files library, (3) such library contains the university's calendar records. Each registered activity is reflected in the activities list (4) which keeps a defined activity model format. The App initiates a connection with the server (5) using an API GET command under HTTP protocol, requestion the scholar calendar and the activities list. This information is then stored in the mobile application (6) where can be consulted by the student.

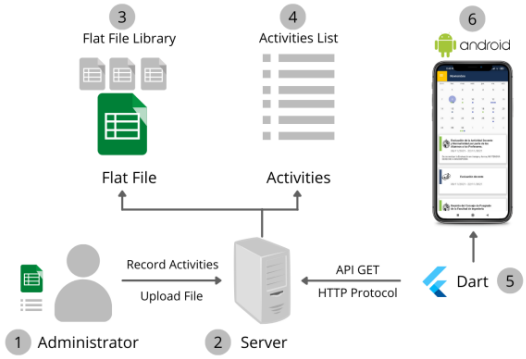


FIGURE 1.
ARCHITECTURE OF THE APP.

For the plain file library, each one of the uploaded files is given a loading date and an identifier that will be useful to recover the scholar calendar file; the purpose is for the application to identify which file is the most recent in being uploaded by the server. On the other hand, the activities list has an activity model format defined in the application with the

following fields: date of start, date of end, name, description, type of activity, academic entity, procedure, requirements, and URL.

The "type of activity" defined in the plain file allows sending custom notifications according to each user's profile. Figure 2 shows the use cases of the application, each use case as a module in the system is described below. In case of "Storage user context" is a functionality that has the purpose to storage the user context defined by the user in a database, which is retrieval by the application.

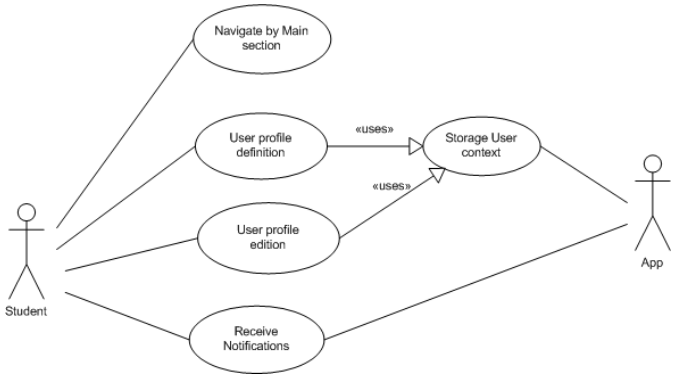


FIGURE 2.
USE CASES DIAGRAM.

Main section description

The main section includes the calendar (see Figure 3.a), it reflects each activity from the plain file through a color code, and the user may navigate to know all the belonging activities of the selected month.

In the menu bar (see Figure 3.b) it is possible to configure the calendar visualization (month or week). Additionally, it has direct access to the institutional websites, which are linked by URL launcher dependency, and allows to open a new tab in the web browser of the mobile phone.

User profile view

There is a settings screen where the student can modify the user's profile and therefore the notifications he wishes to receive. It is divided by categories that can be checked or not, also the user can activate or deactivate the option to receive notifications (See Figure 6).

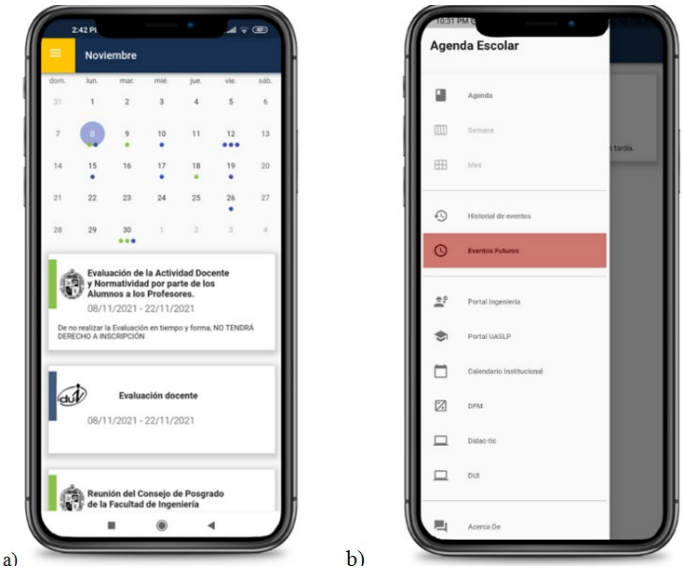


FIGURE 3.
APP VIEWS: (a), CALENDAR, (b), GENERAL OPTIONS.

User profile definition

Once the user downloads the application on a mobile device, they are asked to answer four-questions survey as part of his profile. The profile separates the user by academic level (undergraduate or postgraduate), by academic area (Agroindustrial, Ciencias de la Computación, Ciencias de la Tierra, Civil, Mecánica y Eléctrica, and Metalurgia), and also allows to establish if the Departamento de Físico Matemáticas (DFM) or Departamento Universitario de Inglés (DUI) still interest the student, see Figures 4 and 5.

After responding to the survey, a connection is established with the institutional server of the University under the HTTP protocol, allowing the reception of the scholar calendar for the current semester through a flat file. The processing of this file includes reading the information extracting from each activity: start date, end date, name, description, type of activity, academic entity, procedure, requirements, URL, academic area, notification category and academic level. Each activity is registered in the application's main calendar.

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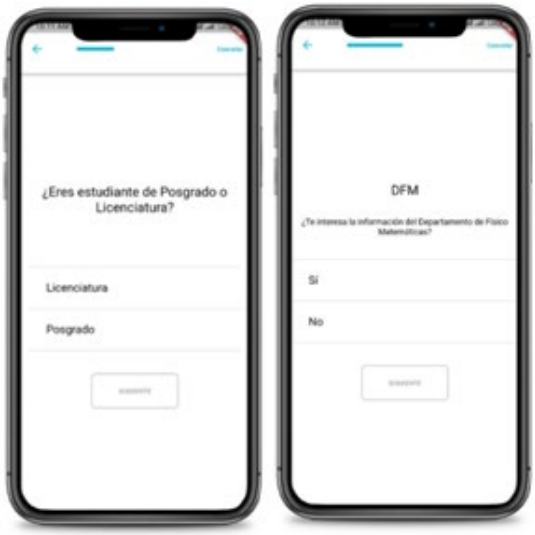


FIGURE 4.
USER PROFILE DEFINITION (ACADEMIC LEVEL AND DFM).

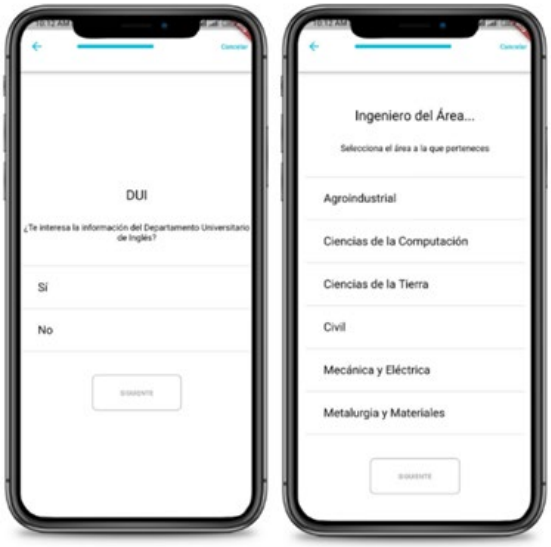


FIGURE 5.
USER PROFILE DEFINITION (DUI AND ACADEMIX AREA).

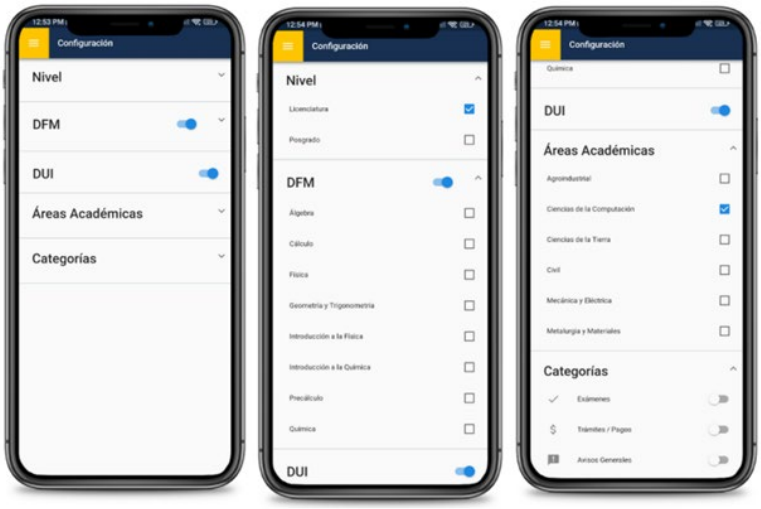


FIGURE 6.
USER PROFILE EDITION.

Notification Module

According with the Taxonomy of Notification proposed at (Nava-Muñoz et al., 2009), the content type is a "reminder", the time considers some periods, the actor is the student, and the presentation is on a mobile device. These dimensions are based on six W´s questions approach, as shown in Figure 7.

Three periods are considered for each notification:

- Before: the date before the event happens
- During: period in which the event is happening
- Last day: date of the ending of the event

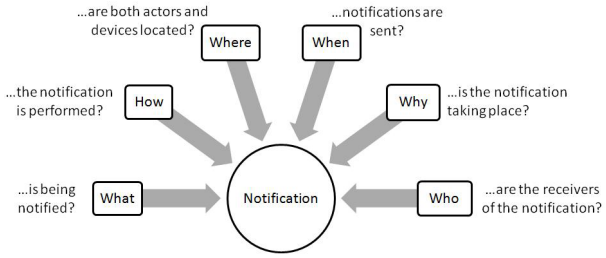


FIGURE 7.
SIX W'S QUESTION APPROACH, FROM (NAVA-MUÑOZ ET AL, 2009).

Considering these three configuration criteria: (1) user wants to be notified of a certain category, (2) the times of a notification, and (3) the categories mentioned before, the characteristics for each category:

- Exam: two notifications are created. The first notification is set one day before the exam period start date, and the second one the day the exam period starts.
- Payment Processing: The day of the start date of this processing is set.
- Notice: It is set to the start date of the notice.
- Mandatory: The first notification of this category is configured one day before the day of the event, then notifications are created based on the number of days established by the period of time for this activity, considering two-days intervals, and finally the last notification is set on the day marked as the last day for this activity (end date).
- DFM and DUI: It is configured one day before the start date of the activity.

Each of the activities are scheduled at 10:00 a.m., considering UTC time zone or the local time of the device in which the object is created. To launch a context-aware notification, the application creates an iterative process where the categories activated in the user's profile are compared with the list of activities, in the event that the current date is the same to the scheduled date, it sends a message to the user. Figure 8 shows a sequence diagram of how a notification works to a student with the categories: DUI, DFM, Ciencias de la Computación.

When the user context enabled notifications, the type of notification is queried and it gets configured. A notification is created and scheduled as shown in Figure 8. The action of scheduling a notification is different for each of the established categories, which are: exam, process payment, notice, mandatory, DFM, DUI and postgraduate.

Premilinary tests of uni-agenda app

The application was tested during one semester, with the entire calendar loaded and it was asked to users to configure user profile. The concept tests were made according to different user profiles, for example changing the academic area. For each profile, notifications waited for 15 days in order to verify its correct operation, so we could verify that each notification is associated with an active category. It was requested to users to make a log of notifications received for the verification process.

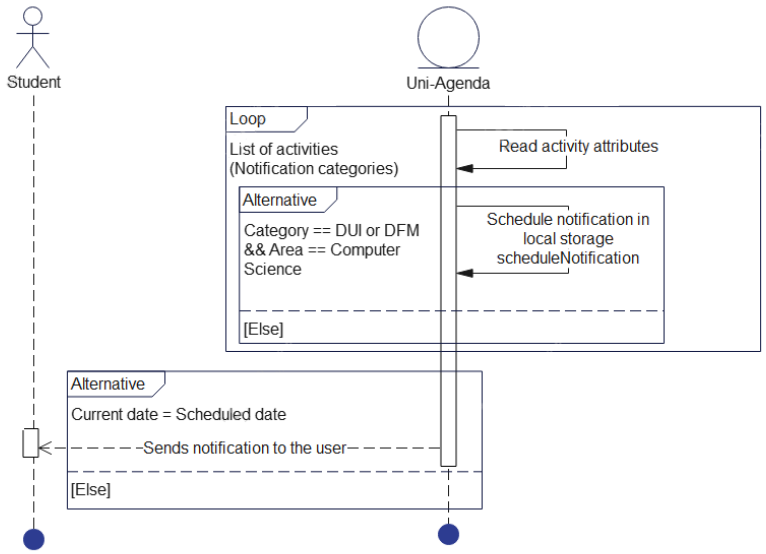


FIGURE 8.
SEQUENCE DIAGRAM ABOUT NOTIFICATION LAUNCH.

The results obtained shown the correct functionality of the App, as described next. The context-aware application responds according to the user profile, where user = {Undergraduate, DFM, Ciencias Computacionales}, the application waited for the dates for the third exam, and then it sent a notification, as shown in Figure 9.



FIGURE 9.
NOTIFICATION SENT (SCENARIO 1).

Another test case was when user = {Undergraduate, DFM, DUI, Agroindustrial}, the application waited for dates for some exam (in DFM and DUI), and then it sent a notification as shown in Figure 10.

After this preliminary test, the plan is to deliver the application to a portion of students in the school. The new tests will deploy from uses cases, similar as proposed in (Phung et al., 2020); the following phases are planned:

- Phase 1: first trimester of classes (August-October 2023) use of the app by students with their own profile.
- Phase 2: two last months of classes (November-December 2023) evaluation of the use of the app by students, through a survey to measure performance and facility of use.



FIGURE 10.
NOTIFICATION SENT (SCENARIO 2).

CONCLUSIONS AND FUTURE WORK

The use of mobile devices is common in the university community. Nevertheless, it is not always possible to contract a "data plan" or a permanent connection to the Internet (WiFi). Because of that, it is necessary a mobile application does not dependent of a permanent connection.

This work has the motivation of “the students' academic performance improves when they are aware of test dates and school activities”. Therefore, in this work we proposed an autonomous mobile application to provide information about the school calendar and send notifications according to the student's profile. Each profile (user context) considers the academic progress of the student and therefore activities of interest can be associated. So, in this way, the notifications that are sent are considered context-aware notifications.

Concept tests were made on the first established version, with the purpose of testing the performance of the application; that according to a certain profile, the appropriate notifications are received. Successful tests were had in the tested scenarios. The results of the usability evaluation in process are not ready yet, the students will have a trial period for three months and later will answer usability survey.

As future work, it is planned to develop the second version of the application, where the user does not have to define or modify his profile, instead that can be download it in real time from the University server. This will allow the context to be acquired by the application, and to change in situations during the semester, e.g. change the enrollment on department DFM. Additionally, it is proposed to carry out a trial period and an evaluation of the App.

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