A Tool to Enable Knowledge Management

A case study at an educational institution

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***Abstract*—Federal Institute of Paraiba is a school maintained by the government. To enable its operation, it defines and adopts hundreds of organizational processes described by resolutions proposed and approved by its various superior boards. However, unfortunately, the reality is that many employees do not know how the institute works and see everything as complex and unnecessary bureaucracy. This leads to more work and delays due to petitions that are unclear and are missing information. To mitigate this problem, in this paper, we are proposing an app that will concentrate information, in a colloquial language, about petitions, such as regulation and mandatory attachments, as well as create a new communication channel by grouping, in a virtual community, employees from the same Campus. We presented our prototype to some course coordinators and directors and they agreed about the importance of the app to improve the current workflows from the institute and to educate the community.**

Keywords-knowledge management; federal institutes; universtity; application; social network.

I. INTRODUCTION

Knowledge Management (KM) is an effort to increase useful knowledge within the organization [1]. Usually, the sources of knowledge are skillful employees and/or the documented expertise that was produced over the years. Ways to achieve this include encouraging communication, offering opportunities to learn, and promoting the sharing of appropriate knowledge objects and/or artifacts [1]. To support KM policies, organizations can use information systems. These KM tools collect, store and share the intellectual capital that the organization has. With the help of KM tools, organizations start to use their intellectual capital to optimize processes, develop innovative solutions, stimulate creativity and increase productivity.

In this paper, we present our proposal to mitigate some KM problems that we observed in Federal Institute of Paraiba (IFPB) (a Brazilian public educational institution): a multi-platform app that promotes the KM in educational institutions, regarding the internal rules to start any type of petition. We observed that many employees of the IFPB are unaware of the institution's regulations, even due to the inherent complexity of these regulations, which often causes difficulties and even errors when structuring a petition. Our solution helps in maintaining the knowledge in a unique place, where employees will be able to educate themselves on how to proceed to start a petition and through which departments the petition will go. This will also help course coordinators and directors, as it will reduce rework resulting from returning petitions with problems. In addition, our proposal will facilitate communication among employees from the same campus. Finally, we presented our proposal to course coordinators and directors who gave us a positive feedback and suggestions on how to improve the app.

It is important to highlight that, although our project is being developed for IFPB, the scenario that has been described may be common to other Federal Institutes and also to any educational institution in other countries. For this reason, we believe that our solution can easily fit in other contexts, mainly due to the architecture that we adopted when planning it. The app was developed in *Flutter*, a framework created by Google for building natively compiled applications for mobile, web, and desktop from a single codebase. In addition, we build a web application that works as administration panel and facilitates creating data to our platform, as well as delivering to our app, using web services.

This paper is organized as follows: Section II details the context that motivated our research; Section III presents related work, as well the theories related to KM; Section IV describes the architecture and stack used to develop the app; Section V present our proposal, from the user point of view; Section VI reports the impressions that we gathered from presenting our prototype to four employees in management positions; finally, Section VII closes our article with conclusions and future work.

II. CONTEXT AND MOTIVATION

In Brazil, Federal Institutes are schools maintained by the Federal Government that work with a multi-campus structure that offer a variety of courses, ranging from high school to postgraduate courses, such as Specialization and doctoral courses. The main goal of these institutes is offering free and high quality professional education. However, they also develop Research projects and Extension projects with the community. Today, the federal education network has 38 institutes with 661 campus spread across the country, in all its states [2]. The Federal Institute of Paraiba (IFPB) is one of oldest units, with 112 years old, and, currently, it has 20 campuses [3].

All Federal Institutes follow the same Brazilian federal law (law number 11.892 from 2008), but each one creates

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their own internal statute to guide and to rule their operations [2]. It is not different with IFPB. To enable its operation, IFPB defines and adopts hundreds of organizational processes described by resolutions proposed and approved by its various superior boards. These processes are essential for the functioning of the organization and, more broadly, they need to be carried out in order for the Institution to exist and to guarantee the legality of the acts performed by all its employees.

The knowledge about how and what occurs during the flow of a process is essential, especially for those directly associated to the success achievement of the main goal of the institute: teachers, course coordinators, directors and even students. However, unfortunately, the reality is that many employees do not know how their institute works and see everything as complex and unnecessary bureaucracy. This happens for many reasons: (1) there is a high amount of regulations and some are written in juridical terms that make its comprehension difficult (and others present an inherent high complexity); (2) there are only a few employees with an in-depth knowledge of these statutes to instruct others; (3) the changes in who occupies management positions are recurrent. This scenario represents a serious KM problem that can lead to a series of bad consequences [4].

For instance, although a petition can begin and end in the same sector, most petitions actually move through many departments and require several people authorizations, before being granted. Due to this complexity, errors can occur when in the structuring of these petitions that can lead to delays or even make them unfeasible. Let us take as an example a petition for carrying out an excursion. If there is any missing document or the motivations are unsatisfying, a delay can cause the class and the teachers involved to lose the time window for which the visit was planned.

III. RELATED WORK

Knowledge Management (KM) is the process of creating, sharing, using and managing the knowledge and information of an organization [4]. It refers to a multidisciplinary approach to achieve organizational objectives by making the best use of knowledge [5]. Among the advantages of applying KM policies, we can cite: improvement of internal process and better fluidity, more efficient decision-making process and better results, maximization of intellectual capital, possibility of identifying organizational problems (bureaucracy, slowness, and communication problems) [4][5].

Using KM the knowledge transforms itself and it is transmitted. It changes from tacit to explicit and vice-versa. A senior employee can write a textbook using his thoughts about his work. This book will be read by others employees which will develop their impressions about what he does. The thoughts from the senior are his tacit knowledge. The textbook is an explicit form of his tacit knowledge that can be easily absolved by other. The impression from who read the book is the tacit knowledge that they developed after reading. This is the knowledge cycle. To support this cycle, it is common ground to use software based systems. In this matter, we believe is worth to mention: Wiki, Bitrix24 and AnswerHub and Confluence.

Wiki is a website that allows collaborative editing of its content and structure by its users. There are quite a few web sites that can help to create a Wiki (although some require payment for the service), for instance, MediaWiki [6], SlimWiki [7] and Wikidot [8]. Bitrix24 [9] is a social enterprise platform. It is a united work space which handles the many aspects of daily operations and tasks and provides companies with a full range of team working and social networking means. AnswerHub is a KM and community application that offers tools to create and manage an online knowledge-based community. It is possible collect, organize, and share knowledge in a variety of ways including articles, ideas, and questions and answers.

Our proposal reunites some features from all these tools, while also include some new. Each campus administrator will have easy access to near colleagues, since the tool virtually reunites employees of the same campus. Thus, likewise Wiki, administrators will also be able to create and share articles with their subordinates. Likewise the Beatrix24, our solution will improve communication channels, since it also include phone push notifications that will help to inform everyone from the same Campus about meetings and other deadlines. Likewise the AnswerHub, users will also find a section with Frequently Asked Questions (FAQ), where they will be able to share their own doubts and administrators will choose if the question is worth to be permanently added to the FAQ of the petition guide or not. Our solution will offer robust channels to concentrate and distribute knowledge inside the Federal Institutes' structure. In addition, we aim to make it available for use of other organizations.

IV. STACK AND ARCHITECUTE

Our proposal was developed using *Java* with *Spring Framework* (an application framework and inversion of control container for the *Java* platform) [10]. In the client-side, we used two distinct technologies, one for the mobile platform (*Flutter*) and other for the web platform (*Angular*). *Flutter* is a free and open-source mobile UI framework created by Google to create, using one programming language and one codebase, apps for different platforms [11]. *Angular* is an application design framework and development platform for building mobile and desktop web applications [12]. The software administration will be performed by directors and course coordinators using the web interface (written using *Angular*). This will facilitate creating data to our platform. Other users will consume these data using our mobile app available in both Play Store and Apple Store (written using *Flutter*). Finally, for data storage, the relational database chosen for ensuring integrity and data management was *PostgreSQL* [13].

In addition, we chose the REST (Representational State Transfer) Architecture style to structure our proposal, due to simplicity, ease of maintenance, high scalability and reliability in the resistance to failure. REST is a software architectural style that defines the set of rules to be used for creating web services. A Restful system consists of a client-

side who requests the resources and a server who delivers the resources.

In Figure 1, we present the architecture of our proposal as a whole, where the client makes HTTP requests to the server.

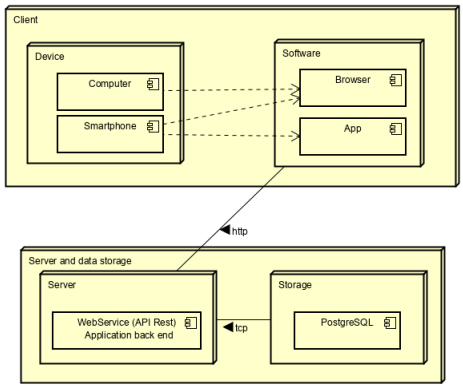

Figure 1. App architecture.

The user, on the client-side, though a browser or smartphone, accesses the system and makes requests for the API, in order to display the information about some petition. The server interprets the request, makes the necessary queries in the database and returns a response in JSON format to the client side. Finally, the app or browser displays the data contained in this JSON file to the client.

V. PRESENTING OUR PROPOSAL

The main goal of our proposal is help employees with structuring their petitions. Besides that, our app also creates a new communication channel that virtually reunites employees of Federal Institute from the same campus and it will facilitate notify all about meetings and other updates.

Regarding the petitions, users will have access to a list of commonest petitions that can be opened by teachers. To have access to these functions, users will have to register and login into the app. Figure 2 shows the Register page (on the left side) and the Login page (on the right side).

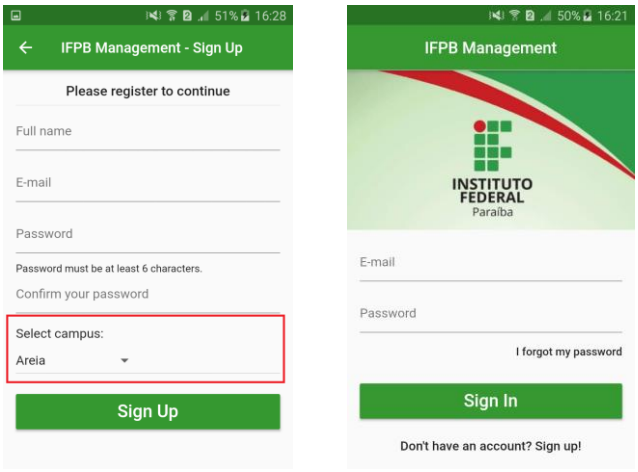

Figure 2. Register page (left) and Login page (right).

The system only allows users to register using their academic e-mail account. While registering, users will inform from which campus they are (the red box in the left side of Figure 2). This information is important to virtually reunite employees from the same campus in the same domain. The final version will enable the domain administrator do personalize primary color, icon and title. In this paper, we decide to describe the prototype using IFPB' design scheme. After being authenticated, users will visualize the list of petitions guides that directors previously saved through the web administration panel, as presented in Figure 3 (left). Since there is a chance of this list increases, they can filter using the text field on the top of the screen. They also have access to a sidebar-menu that serves for navigation only (right).

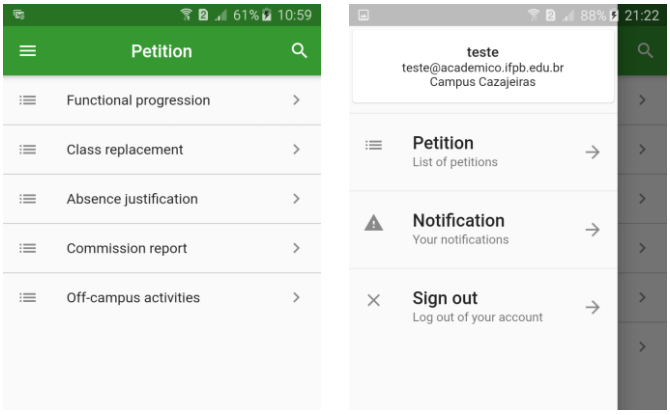

Figure 3. List of petitions guides (left) and Sidebar menu (right).

The Petition menu directs users for the List of petitions page. The Notification menu will direct users to the Notifications list, where they can see, for instance, meetings call and answers for their asked questions. After clicking in one of the petition guides, users are directed to the petition guide itself. Figure 4 shows the main elements that compose the guide.

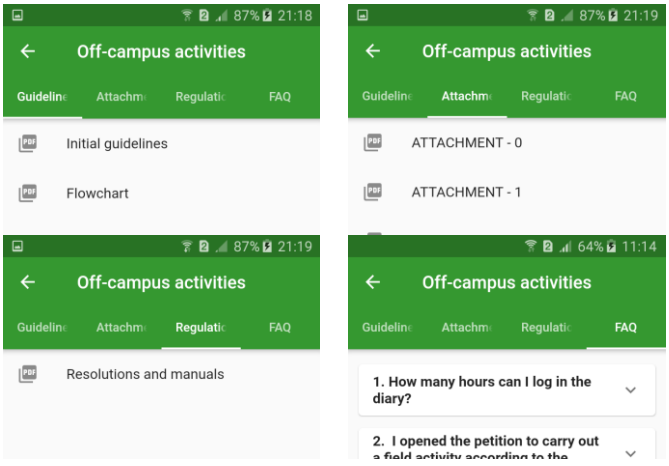

Figure 4. Guideline tab (top left), Attachments tab (top right), Related regulation tab (bottom left) and FAQ tab (bottom right).

Figure 4 shows the Guide page for opening a petition to request an off campus activities. Each petition guide is composed by four elements (four tabs): guideline, attachments, regulations and FAQ. The initial guidelines (top left) will be a document written with colloquial language that will detail the petition, present required attachment, link related regulation and help structuring the petition. This guide is written by directors or course coordinators, who know how the petition works, aiming to help their subordinates and even colleagues who come to occupy their position in the future. The initial guideline tab also will have an optional flowchart. The flowchart will be a visual guide that will describe the algorithm to correctly start the petition and through which departments the petition will go, before being finished. The attachment tab (top right) will group documents that must be included in the petition. The resolutions tab (bottom left) will group all the internal e external legislation related to the petition subject and mentioned in the guideline document. Finally, the FAQ tab will present questions previously elaborated by the author of the petition guide and also questions made by other employees and judged as worth to be public by the author of the petition guide. Users will be able to expand any number of questions from the FAQ to see the answer. In addition, they can send the own questions by clicking the "plus" button on the bottom right. The petition guide's author will receive and answer the employee; he will judge if he wants also to add the question and answer to the FAQ. We claim that gathering this information together will reduce the effort to learn about how to structure a petition and it will create a collective awareness on how organizational processes work.

VI. PRELIMINARY RESULTS

We presented our prototype to two directors and two course coordinators from four different campuses of IFPB. All of them have at least two years of experience in their respective positions. We demonstrated the app functions and explained how it could be used. Our main goal was to gather their opinions regarding our proposal, as well as to identify other functionalities that could be included in the beta version of the app. We asked them basic questions, such as "*which were the problems that they wish our app would solve?*" and "*what were their thoughts about the prototype?*". In this section, we report this preliminary feedback.

One of the course coordinators stated that our app would solve at least three problems: (1) the absence of required documentation in any petition; (2) forwarding petitions to departments without the endorsement of immediate supervisors; (3) the app can educate people about the legal basis for each type of petition and the time required for each request, which solves the problem of the employees' lack of knowledge of institutional rules and the deadlines involved in each type of petition.

Other respondents emphasized that the app would provide agility in the progress of petitions. "*In a daily basis, many petitions return to the interested party for presenting incomplete documentation or for not respecting the correct sequence between different departments of the Campus. Thus, the app can minimize these basic failures that slow the progress of petitions and can allow employees to consult information without the need to consult directors*", as stated by one of the respondents. "*Consistent guidance on how to handle a petition will avoid rework and delays, in processing*", as stated by other. He also said that these mistakes are not fault just of the employees, but the result of the complexity and amount of legislation usually involved.

Regarding the importance of our proposal, one of the respondents summarized the general thought: "*the first impressions are very positive because, with just one click, essential information will be available to the community in a summarized form*". Other coordinator suggested the integration between or app and the academic platform from IFPB (called SUAP): "*the proposal is very important for all employees of the institution, whether they are management position or not* […] *In addition, if the app could be integrated with SUAP, it would further expand its potential for guidance in the elaboration of processes*".

Based on the received feedback, we believe that we are heading in the right direction. In addition, we were able to gather suggestions on how to improve our proposal, for the beta release.

VII. CONCLUSION AND FUTURE WORK

Knowledge Management (KM) is the process of creating, sharing, using and managing the knowledge and information of an organization. Improvement of internal process and better fluidity are some of the advantages of applying effective KM policies. However, in the context of IFPB, a Brazilian educational institution, we observed that many employees do not know how the institute works and see every petition as complex and unnecessary bureaucracy for asking for something. In addition, there are only a few employees with an in-depth knowledge of statutes associated to each type of petition available to instruct others colleagues. This scenario represents a serious KM problem that can lead to a series of bad consequences, such as rework, slowness, communication flaws and even failure to achieve organizational objectives.

To mitigate these problems, we proposed an app that will concentrate information about petitions in a colloquial language; as well it will create a new communication channel by grouping, in a virtual community, employees from the same Campus. We presented our prototype to some course coordinators and directors and they agreed about the importance of the app to improve the current workflows from the institute and to educate the community.

As future work, after finishing the app and releasing it to the IFPB's community, we aim to report the results achieved by the app use with in-deep employees and directors impressions. In addition, we are working in adding new features that will improve even more Knowledge Management, such as indexing data for easy recovering and the integration of our app with SUAP, the academic platform adopted by IFPB. Finally, we want to make a version of the app aiming newcomers students to educate them about the institute and how it works, as well about how to structuring their own types of petitions.

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