

## Empowering Public Education Students to Report Infrastructure Problems and Exercise Civic Engagement

Ciro Luna, Telma Rocha, Haidee Lima, Patricio Mourato, Felipe S. Ferraz  
CESAR - Center of Study and Advanced Systems of Recife  
Recife, Brazil

emails: ciro.luna@gmail.com, telmarocha31@gmail.com, hccl@cesar.org.br, lpm@cesar.org.br, fsf@cesar.org.br

**Abstract**—Studies conducted around the world show that school infrastructure impacts the academic performance of students. The participation of students in the identification of school infrastructure problems is an exercise of citizenship. Taking the opportunity provided by the increasing popularity of smartphone use, this paper, as a work in progress, is aimed at assessing whether there is room for the design and development of a platform which would use smartphones as a crowdsourcing tool in order to allow students to report infrastructure problems in public schools from Recife, Brazil, so those issues would be easier to prioritize. The interviews performed with students showed a high level of engagement to solve problems they find at school, which points to a positive answer to the question above.

**Keywords**-Smart Cities; Education; Citizenship; Infrastructure.

### I. INTRODUCTION

Smart cities are based on efficient management of infrastructure and urban services, the democratization of access to information for citizens, and the improvement of conditions for decision making in the private and public spheres [1].

A smart city should be seen as an organic whole, as a network. In a smart city, attention is given to connections and not only to the parties. The open model of the Internet has contributed to the consolidation of a new type of social worker, immersed in the emerging social networks, that is both consumer and producer of information and knowledge, the *prosumer* (producer+consumer) [1].

Civic improvement stems from improvement between the interfaces and integrations. That means a smart city believes that the most important connectors between the various subsystems are people turning it from a set of mechanistic infrastructure elements into a set of vibrant and interconnected human communities [1].

Brazil is ranked as the 6<sup>th</sup> country in smartphone use, with 38.8 million users. It is estimated that this number will increase to 71.9 million by 2018 [2].

It is important to notice that most of the new smartphone users in Brazil are young people. In 2011, 48% of children and teenagers with ages ranging from 10 to 14 had smartphones, an increase of 12.6 percentage points since 2009. Between the ages of 15 and 17, 67.5% of teenagers had smartphones in 2011, which corresponds to an increase of 15.7 pp during the same period [3].

Also, there has been an increase in smartphone use by people with low income [4]. This part of the population makes up 80% of the public education students who took ENEM (the Brazilian national high school education assessment, often used as the admission test for public universities) in 2011 [5].

The increase in smartphone use has affected a great many sectors of our society, and education isn't an exception. The debate around the actual use of smart devices as a technological learning tool has been in vogue lately. While some would see smart devices in class as an obstacle for education (as demonstrated by the hereinafter research), institutions such as UNESCO reinforce mobile learning as a viable and encouraged use of smartphones [6].

Ironically, despite the technological aspect smartphones may bring to a student's life, infrastructure in schools is still a major education issue [7]. In Brazil, less than 1% of schools have the ideal infrastructure [8]. In fact, infrastructure impacts the well-being of students and their satisfaction levels while attending classes and, consequently, their average scores [9]. It is important to point out, though, that basic infrastructure standards, when not met, take their toll on other infrastructure areas.

While learning support facilities (such as libraries and computer labs) often provide a higher impact on test results [4], lack of water and sanitation facilities, for instance, affects not only students' enrollment and completion rates, but also teacher absenteeism [10].

Considering that students are the most affected party from infrastructure problems, this paper is aimed at assessing the usefulness for a platform where they would be able to report these issues themselves. Such a solution would inevitably rely on civic engagement.

Civic engagement or civic participation is the involvement of citizens in the political process and issues that affect their lives. It is aimed at ensuring the rights of citizens to participate and contribute to the development of their communities, cities, and country. It determines the policies by which well-being will be sought collectively by the members of a community [11].

A school is a place where students spend much of their time and, besides providing academic education, it also has the purpose of contributing to the development of new citizens, as it is a great place to exercise civic engagement and develop values and motivation.

In fact, youth civic engagement in the school community is not unheard of. It is possible to point out examples of initiatives both to help improve other students' skills [12] and report school infrastructure problems [13].

This paper is presented as follows: Introduction describes the problem and the context of Brazil. Section II describes the methodology. Section III describes related works. Section IV presents the interviews with potential users. Section V displays the results of the interviews conducted. Section VI describes the proposed solution. Conclusion discusses the findings and suggest next steps.

## II. METHODOLOGY

This paper started with a research on information about the context of education problems in Brazil. As infrastructure problems proved to be shockingly present in schools in this country, this kind of issue was selected to be addressed by a solution which has yet to be designed, but whose embryonic concept would take form in this paper.

As reference, some solutions which help solve infrastructure issues were examined. It was noted, then, that all those similar solutions which achieved some degree of success relied on crowdsourced problem reporting to feed their platform with data. Also, two of those solutions were smartphone applications, which demanded some research on smartphone popularity among the youth, especially those from families with low income.

Crowdsourced data depends on community engagement and easy access to the platform. In order to assess whether these requirements would be met, interview guidelines were prepared with two main goals: understanding the actions taken by students when they found or faced problems at school, and understanding students' relationship with their smart handheld devices.

Some interviews with students were conducted, then, and the results led to a rough sketch of an architecture to the solution this study aims at. The solution still needs input both from a larger number of students and from the other end of the information flow (i.e.: *desirability* from those in charge of the strategic decisions which define the course education in Brazil will take).

## III. DESCRIBING RELATED WORKS

It is possible to list several solutions regarding civic engagement in both community problem solving and infrastructure problem reporting. Those listed below use crowdsourcing as a means to advise the relevant authorities of issues the communities cannot normally solve by themselves.

- A. **Chinese Sidewalk Repair and Improvement Crowdsourcing Website** - Developed by the Beijing Transport Research Center, a crowdsourcing website asks pedestrians to identify areas in need of repair or improvement in Beijing. The system aims to help transportation planners to know how roads and sidewalks are being used by the public [14].
- B. **Colab** - A social network for citizenship that helps citizens communicate with government. Their goal is to promote civic engagement and create better cities through citizen-government collaboration [15]. Colab won 2013 AppMyCity! Prize for world's best urban app [16].
- C. **SITA (School Infrastructure Tracking Application)** - A mobile-based application that will allow stakeholders (SMC members, NGO staff, Government officials) to track the status of infrastructure facilities in schools, such as toilets, drinking water, barrier-free access etc. and provide feedback on their maintenance [17].
- D. **UnB Infrastructure Mapping Platform** - The Central Students Directorate (DCE) of University of Brasilia (UnB) released the university's infrastructure and salubrity map. The problems reported are taken to the university mayor every other week. By the end of January 2013, more than 70 complaints had been made, and they ranged from lack of toilet paper to classroom floods. The DCE asks students to take photos of the problems and report issues "pinning" them to a digital map of the campus [18].

## IV. INTERVIEWS WITH POTENTIAL USERS

Based on the studies referenced in this paper, interviews were conducted in order to understand students' relationship with their schools and the way they used smartphones. The interviews also included general questions, such as age, gender, schooling, and graduation year.

The questions were divided into two groups: 4 questions concerning smartphone use, and 4 other about their relationship with their school. Two of them were multiple-choice questions (device brand and operating system).

The survey respondents consisted of 13 people from Recife, Brazil, with ages ranging from 18 to 20. All of the participants had graduated from high school between the years of 2011 and 2013. The collected data analysis is presented below.

First, the participants were asked about their age and grade, for what they used their smartphones the most, how often they used their handheld devices, and how they accessed the internet at school while using their handsets (e.g., Wi-Fi, 3g).

After the first part of the interview, they were also asked how long they studied at their current school, what they liked the most about their school, what they disliked the most about it, and how they proceeded when they found or faced a problem at school.

## V. RESULTS

The interviews found that all respondents own smartphones of various models and from various manufacturers. During their schools years, even though the use of handheld devices was banned in school, 7 of the respondents claimed to have used cell phones in the school dependencies. Moreover, 12 of the 13 participants said they used smartphones several times a day.

The research revealed that the respondents used their smartphones mainly for instant communication (such as instant messaging apps and phone calls), asynchronous communication (such as emailing) and social networking (e.g., Facebook).

Among the instant messaging applications used by the participants, WhatsApp [19] was the most popular one despite its need of internet access. Only two respondents claimed to not use the app.

SMS, on the other hand, was the least popular means for instant communication. According to the participants, texting is still relatively expensive when compared to WhatsApp messaging.

Using smartphones to make actual phone calls is common, but it is important to point out, though, that, by the time the interviews were conducted, WhatsApp had not allowed users to make voice calls [20], a fact that might impact future user research.

Facebook was mentioned by the respondents as the only real popular social networking application, as they did not see WhatsApp as such. The use of other social networking apps (e.g., Twitter and Instagram) was minimal.

On students' relationship with their schools, the interviews highlighted that the main problems reported by students revolved around relationship issues, whether they were among peers or between students and the school staff (i.e., teachers and the principal's office).

When asked about how they normally proceeded when they found or faced problems at school, the participants displayed a high level of engagement and participation, as most of them would either try to solve problems by themselves or discuss the issue with friends and teachers.

## VI. THE PROPOSED SOLUTION

Despite the active behavior the students would normally present while trying to solve problems at school, infrastructure issues cannot be resolved directly by them. They can still be part of the problem solving process, though, and the architecture below addresses their proactive attitude.

The proposed solution is a platform aimed at informing the government authorities of infrastructure issues in schools in order to achieve better resource distribution. The data fed to the platform would be crowdsourced from students.

Taking into consideration the increasing popularity of smartphones, especially among the youth, these devices can be seen as a viable technical requirement for a crowdsourcing solution, so the data would be entered through a smartphone app.

Features present on most smart handheld devices nowadays, such as GPS tracking and digital camera, can provide invaluable precise data about infrastructure issues the students may find.

This way, a student would be able to photograph the problem and describe it textually. Through GPS, the location for the problem would be sent without the need of entering the information manually (i.e, address, name of the school etc). The app, then, would either upload the report to a cloud server or save it to be synchronized later, depending on internet connection availability (e.g, 3g, 4g, or wi-fi).

The data the students would provide would then be stored to a database so it would later be accessed by the relevant authorities through a web application which would present the data in the form of graphs, charts, heat maps etc. The problems would, then, be prioritized so the available resources could be better managed.

The proposed solution architecture can be better visualized on Figure 1.

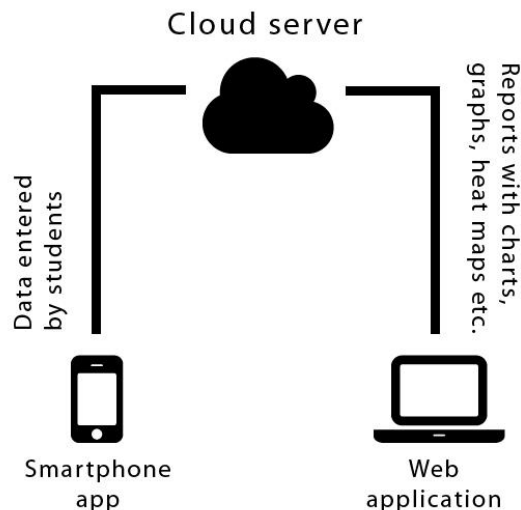


Figure 1. The proposed solution architecture.

## VII. CONCLUSION AND NEXT STEPS

The results presented herein reveal that there is room for the development of a technological solution which can be used by students as a crowdsourcing tool. Such solutions would work not only to improve the school environment, but also to help develop civic engagement in students.

On the other hand, smartphone use restriction may be a challenging issue. It is a matter that needs further investigation, as smartphone use policies vary among public schools and may render the significant use of any handheld device based solution unattainable.

The existing tension between students and faculty is another obstacle to be surpassed. It creates an environment that may be unfavorable for a solution that requires unobstructed communication channels among those involved.

As following steps, it is important that the user research be expanded to a larger number of respondents from a wider

variety of schools. Moreover, teachers, principals, school staff, and government authorities should also be interviewed. As mentioned above, it is needed to investigate the policy on smatphone use in public schools from Recife, Brazil.

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