

An E-Gov application to monitoring children vaccination process in Amazonia using the Return Path of Digital Television

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Abstract. This paper presents an e-government application based on return channel of Interactive Digital Television. The context is based in attendance control of the vaccination process in remote areas, allowing that parents and govern to monitoring the vaccination calendar for children until 5 years old. The use of this resource in areas with no telecommunication infrastructure, like the Amazon region, creates an integration perspective for the native people to the digital inclusion programs organized by the federal government.

KeyWords: E-gov application, Interactive Digital Television, Digital Inclusion, vaccination

1. Introduction

Considering the dimensions of countries with large areas like Brazil and China, and the specificities of each region, it is necessary to presume that alternative solutions to digital inclusion programs are heterogeneous and used according to the peculiarities of each one. In the north of Brazil, for example, where there are insufficient investment in communication infrastructure (60% of northern population,

that have TV, does not have telephone – IBGE 2006) and the people living in underdeveloped regions still does not have access to electronic government services, one possible alternative would be to provide it thru the interactivity digital television (iDTV). One of the great innovations brought by the digital television system is the exactly the interactivity. This resource allows users, until then passive due to the unidirectional characteristic of transmission of the current model, to directly interact with the system.

2. Digital Inclusion

The large information amount available at sources as Internet, implies in the ability of acquire information. As reported by (Butazo 2004), people that know write and read are not necessarily scholar people, although knowing codify and decodify written messages, a lot of them don't know how to construct an argumentation, write a formal invite, interpretate graphics or find a book at a catalog. The point of digital inclusion is not have only basic abilities using a computer and Internet, but also at capacitation using those medias in favor of individual and community interests, with responsibility and sense of citizenship. This process represents both knowledge and ability that a person has to use computers and is called computer literate.(Helena et al. 2005)

Some initiatives at citizen computer literate formation is having a big repercussion in Brazil. The premisses is capacitate agents that can propagate to involved community. That increase the use of services based on digital technology occurs in a colaborative process.

3. CARIMBO Framework

The e-gov application presented here is a based in a flexible framework named CARIMBÓ (Figure 1). CARIMBÓ is an acronym to “Return Channel with Interactivity Mechanism Management by a Continuous Signalization Process Oriented to QoS” in Portuguese and was proposed in INFOCOMP Journal (Margalho 2005) to Brazilian DTV. The structure of the framework, prioritizes the

interconnectivity for interaction based on two basic aspects: the infrastructure resources of the area where the system will be installed and the requirements and needs of the user. As one of the great goals is to exactly conceive a model of interactivity that creates chances for the less favored social classes, the framework CARIMBÓ considers the approach of the user through local Return Channel Providers (RCPs). A RCP works inside the region of the user and, therefore, it operates with suitable resources with the local infrastructure and the requirements and necessities of its customers. Hence, several RCP can coexist in the same area, focusing on differentiated public. This allows that different arrangements (*bouquet* of interactive services) are offered. Thus, users interested in distance learning will associate to the suppliers that offer such services in its bouquet that will have to guarantee technologies in compliance with the applications requirements that they provide. In regions where the perspective of financial return cannot be identified, the government is supposed to take the initiative for providing the bouquet of basic services. In this case, solutions of low cost or without periodic fees must be evaluated, such as the use of infra-structuralized wireless local area networks (WLANs) or power line communication (PLC) for the return channel.

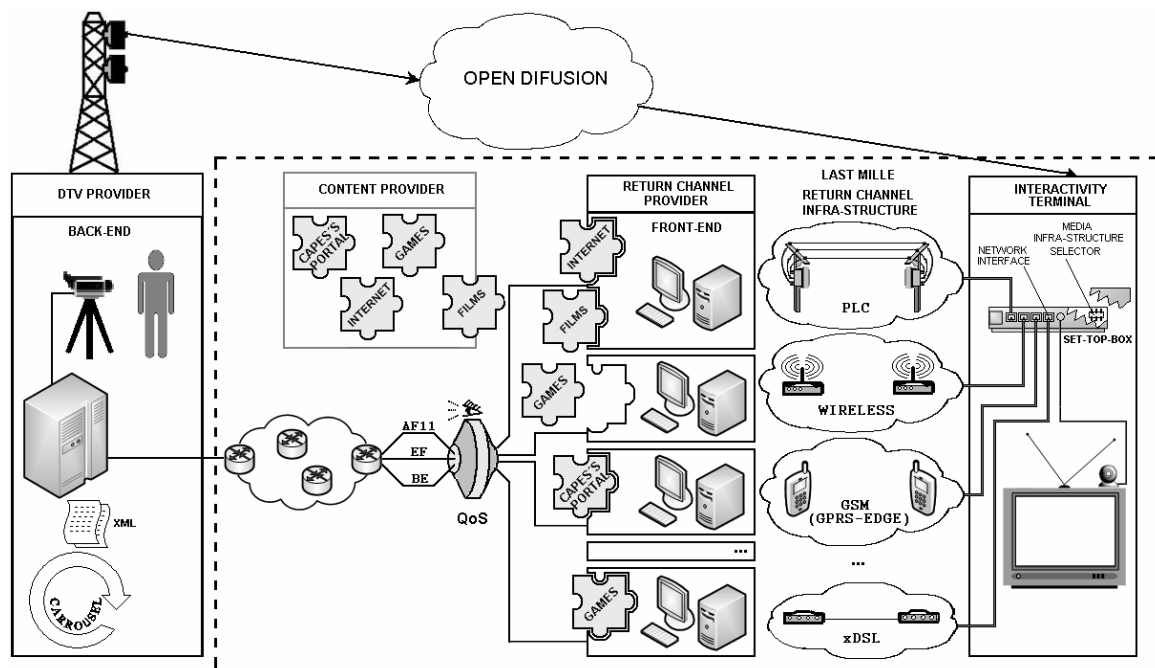


Fig. 1. Carimbó Framework

4. Application

The main forms of electronic government application (e-gov) include the G2C (Government to Consumer), G2B (Government to Business) and G2G (Government to Government) (E-Gov 2006). Our focus is based on a G2C e-gov involving public vaccination's offices of the north of Brazil and the consumers provided by DTV return path. The available e-gov application will make the attendance of vaccination process in remote areas allowing that parents and govern monitoring the fulfillment of the vaccination calendar for children from 1 to 5 years old. The application prototype was development in JavaTV library and XLET classes (XletView 2006), once it is fit to practically all DTV middleware standards. Usability techniques were adopted to make the application easier to the end user (Valdestilhas 2005). Two groups of information are requested to the users monthly:

- The evolution of the child's growth through weight, height and cephalic perimeter and;
- Sporadic information as date from the beginning of the introduction of foods, pneumonia occurrence, diarrhea occurrences, etc.

Each child is identified through a code associated to the birthplace. Graphs that compare the curve of the child's growth with the one of a normal child are presented. In cases of danger, explanatory videos or audios are downloaded from the application provider and then exhibited. The system consumes a small amount of bandwidth and can fit easily in several access technologies. A performance evaluation, in NS (Network Simulator), was focused in the growth of the simultaneously number of connected users.

The application fits in scenarios like rural areas with low demographic density: There are places of the Amazon region, where the population is found dispersed throughout a vast territorial area. Some of these places are half-flooded and located on plain areas, what makes rather difficult the installation of a wired infrastructure.

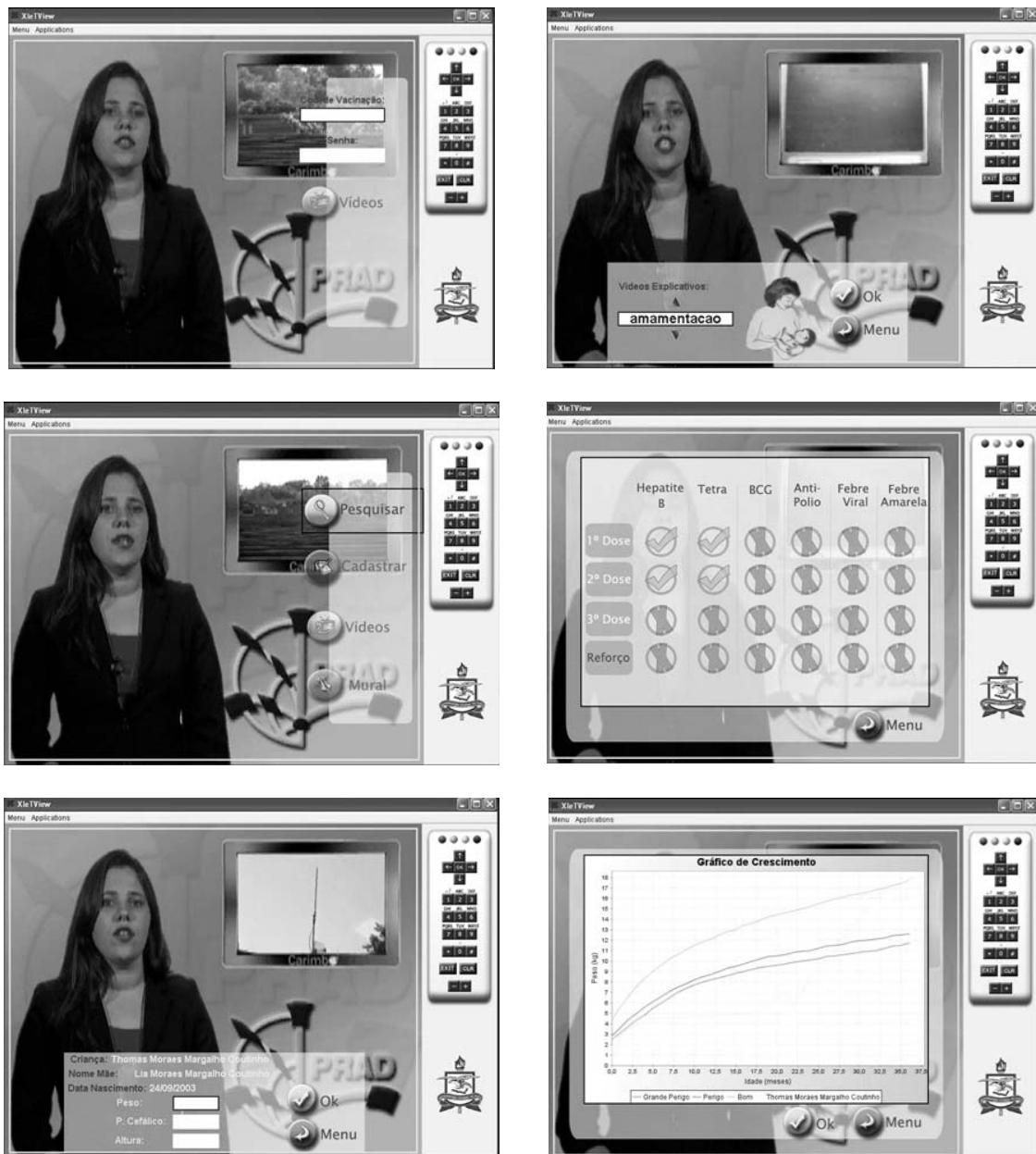


Fig. 2. E-Gov Application

4.1 Performance Evaluation

In order to evaluate the technical viability of the application, a WLAN scenario described in section 3.2 was available. To analyze the results in small scale the experimentation technique was adopted. To evaluate it in large scale, a simulation target on the Network Simulator (NS) version 2.29 was used. (VINT Project 2006)

The NS is a free open source code, what has attracted several researchers, making the simulator robust and reliable. One of those contributions, made by the Monarch group of the Carnegie Mellon University, was responsible for the incorporation of the wireless mobile networks module on the NS.

4.2 Scenario, Legislation and Results

The growth in the availability of broadband network services and wireless access, together with the emergent interactivity technologies, like DTV, is greatly enhancing electronic government applications, especially in the digital inclusion area. In Brazil, this type of service is regulated by an organ named ANATEL that authorize the operationalization thru a resolution called Multimedia Communication Service. The low cost and the easy installation made the WLAN networks attractive for the implementation of the TDV return channel in regions without communication infrastructure. For this reason, the analyzed scenario considered a typical city of the Amazon region (Bragança). The methodology used in the modeling procedure consists in three basic steps: estimate the local population, estimate the potential number of users for the return channel based on wireless networks and estimate and analyze the traffic generated by DTV applications. In order to configure the simulator to act in large scale, the parameters on table 1 (based on a statistical projection available in IBGE 2006) were used. According to the information collected by IBGE at the last population counting, around 87% of the Brazilian homes have a television set. Even though, the ratio between the people that have both a television set and a telephone line is around 40%. The approximate number of potential users of Return Channel by telephonic lines is given by the equation 1.

$$[(\sum \text{Bragança_population} / \mu \text{ (people per households)}) \times 87\%] \times 40\%. \quad (1)$$

Table 1. Potential users of DTV in north of Brasil

Description	Value
Population of Bragança in July 2005	102.203 inhabitants
People per households	5
Number of households	20.440
Number of households with TV set	17.782
Number of households with TV set and telephone line	7.112

Therefore, the number of potential users for the Return Channel by other technologies (not telephone), like WLAN or PLC, is approximately 10.670. It is important to application provider plan their strategy, once that many users do not have both a telephone line and a television set, particularly in rural areas.

The simulator was configured according to the parameters presented on table 2.

Table 2. Parameterization of VoiP experiment

Description	Value
Area (Flat Grid)	500x500 m ²
Number of nodes	8, 10,20, 30, 40, 50,60
Antenna Gain	18 dBi
Standard	IEEE 802.11b
Path Loss Exponent	2.7
Standard Deviation	5.0
Power transmission	100 mW
Data Rate	40 Kbps
Packet Size	224 bits

Fig. 3 indicates the saturation point (30 users) while the number of users grows. It is important to the RCP to define the number of access points. When the number of users was greater than 30, a load balancing scheme became necessary.

Fig. 4 shows the saturation point based on the delay. In this case the entire situation remains below the pre-established level of 150 ms.

Throughput x Escalability

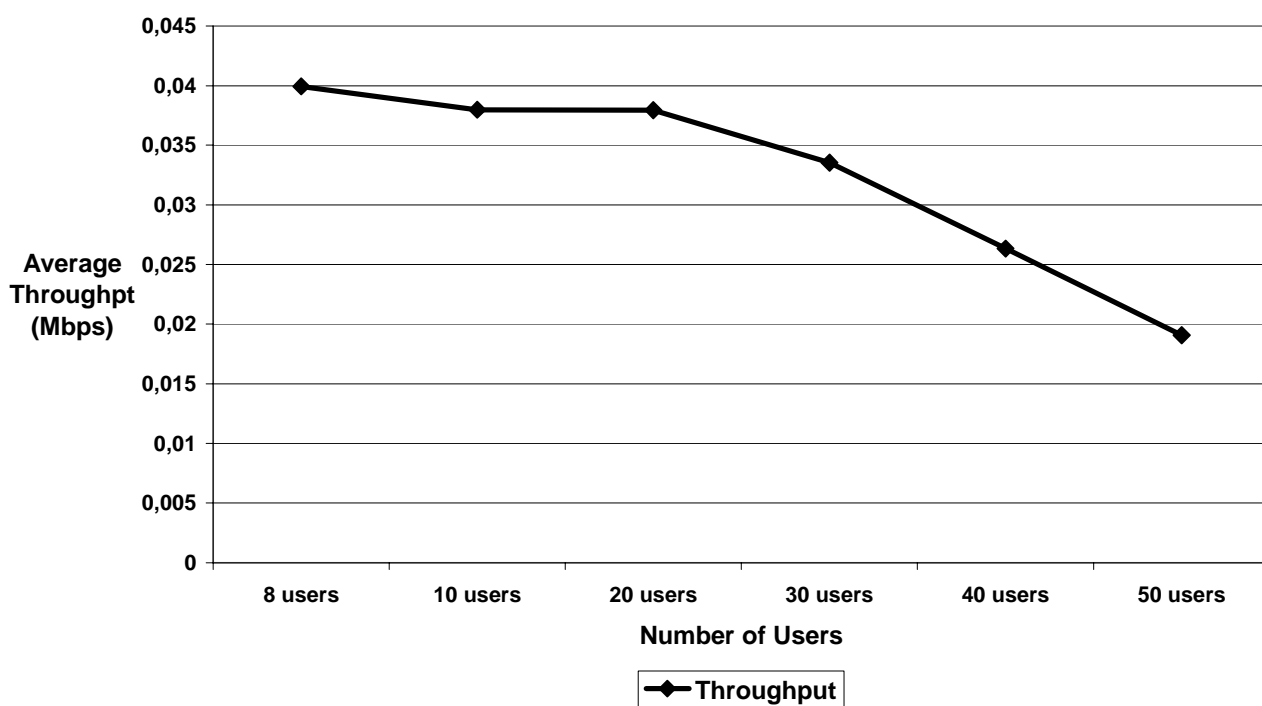


Fig. 3. Throughput versus number of users

Delay x Escalability

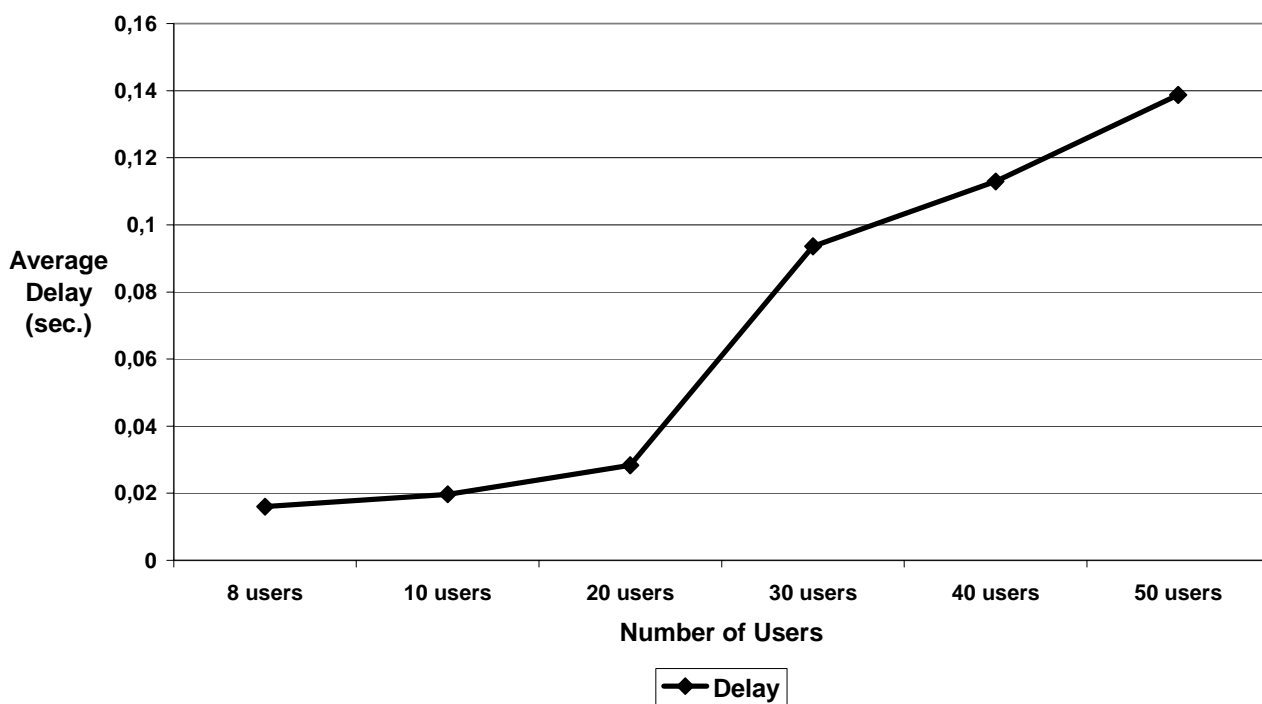


Fig. 4. Delay versus number of users

5. Conclusions

The approach of the user by way of the Return Channel Provider allows compatible solutions with the local infrastructure and the socio-economic situation of the users are adopted. Thus, this application is innovative and, under some points of view, realistic and feasible, and therefore it can strongly contribute to the process of digital/social inclusion of the Amazon region.

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