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APPLICATION DESIGN FOR OPEN DIGITAL TELEVISION TO BE USED BY PEOPLE WITH VISUAL IMPAIRMENT

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ABSTRACT

Usually, people with some physical disability, especially those with some type of visual impairment or diminished vision, are very little considered in all the wide range of advantages offered by technologiesas in the case of telecommunications. Colombia does not escape this reality, thereby, thinking of a solution to assist the population with partial and / or permanent visual impairments, a Geolocation Location System,SUGIH (Sistema de Ubicación porGeolocalización),was developed.This is a multiplatform webapplication whose use is aimed at this group of people. Moreover, the platform was made under the HyperText Markup Language version 5(HTML5), Cascading StyleSheets version 3 (CCS3),Hypertext Preprocessor (PHP),and Javascriptprogramming languages, along with the Artyom.js library, to make the interaction with audio-commands possible.The above is based on the recommendations of good practices issued by international organizations regarding easy access for people with visual disabilities to information transmition by any audio-visual mean and of general interest. Results of the field tests demonstrate the effectiveness and ease of use, being acceptable and appealingfor the users.

1. INTRODUCTION

When cell phones made their appearance on the globalstage in the last century [1], they had a great reception around the world, especially for travelers, CEOs, and reporters.However, it wasonly with the arrival of the 3G generation [2] that the cellular network went from being unidirectional, i.e., only sending and receiving both text and calls, to bi-directional, i.e., the cell phone brought the opportunity to interact with many more services at very good speeds, currentlyevolving to include much more participatory services.

Similarly, with the latest generation in 5G mobile communications, it seeks to take advantage of its connectivity capacity [3] to reach the most remote communities fromdifferent countries all over the world, as in the case of the Colombian territory with vital services such as health, along with many other options that fit into the range of possibilities offered by this technology. In contrast, these changes of technological level are only designed for a population niche that does not suffer from any visual impairment, leading to a digital divide.Reality is that the population that suffers from some visual condition is not small, it is estimated that there are 7000 Colombians for every million inhabitants who may be suffering from glaucoma, diabetic retinopathy, macular degeneration, and other conditions. [4]
One problem that the visually impaired population presents in the country is the few options to move around without depending on a family member to guide and accompany them during the rehabilitation process or in their daily tasks [5].Thus, SUGIH becomes an excellent alternative that restores independence and autonomy to thispopulation, since by using an additional device or beacon, the smartphone can make a reading of the possible obstacles along theirpathway and warn the user through analert functionabout the presence of these [6].In addition to allowing data perseverance for the subsequent construction of an increasingly secure map [7] as a tool for social inclusion, the user can objectively providetheir daily routes to the system and this in turn helps them with alternate paths after a prolonged use of the WebApp.

On the other hand, the study bases the application interface on the standard of rules for good practices from the UNE association (A Spanish norm), which governs a series of experimental regulations, as well as standards, created by the Comités Técnicos de Normalización, CTN [Standardization TechnicalCommittees] from the Asociación Española de Normalización y Certificación, AENOR [Spanish Association for Standardization and Certification] [8], for a correct display of the WebApp forms.

2. METHODOLOGY

Figure 1 shows step by step and in a general way how the SUGIH application designed for this workwas proposed for people with visual impairments. Once the parts of the human eye most naturally affected by aging, and which negatively affect the sight sense are inferred, i.e., the cornea, lens, and retina [9], this WebApp was designed to mostly favor the retina. Consecutively, the HTML5, CSS3, PHP, and Javascript programming languages were used, as well as the Artyom.js library, to continue with this development. Then, a mobile terminal was configured for the user to remotely access the WebApp, using the Google Chrome browser (on the client side) and the XAMPP server (on the server side), installed on a desktop computer to be able to access the WebApp from there, to finally carry out the respective interaction tests with the end users of the WebApp.

Another aspect to consider is that the mobile device (Smartphone) has a proximity sensor to detect objects. It just does not have enough coverage,e.g., for a range of 2 meters in a radius [10] to alert the user on objects that are on the route where the movement action occurs, to complement the mobile device.Thus, it is necessary to have an additional sensor to fulfill this purpose.For that reason, it uses a Beacon [11].This hardware is connected via Bluetooth to the Smartphone.Once the communication between both devices is established, the Smartphone will be able to identify distant objects at a maximum distance of 10 meters.Finally, the environment is persisted to improve the mobility map each time it is used and, in terms of notifications for the End user, the same Beacon according to its configuration, will send the alerts to make the user aware of what is on their way. In figure 2, the handling and administration of the WebApp is presented in more detail.

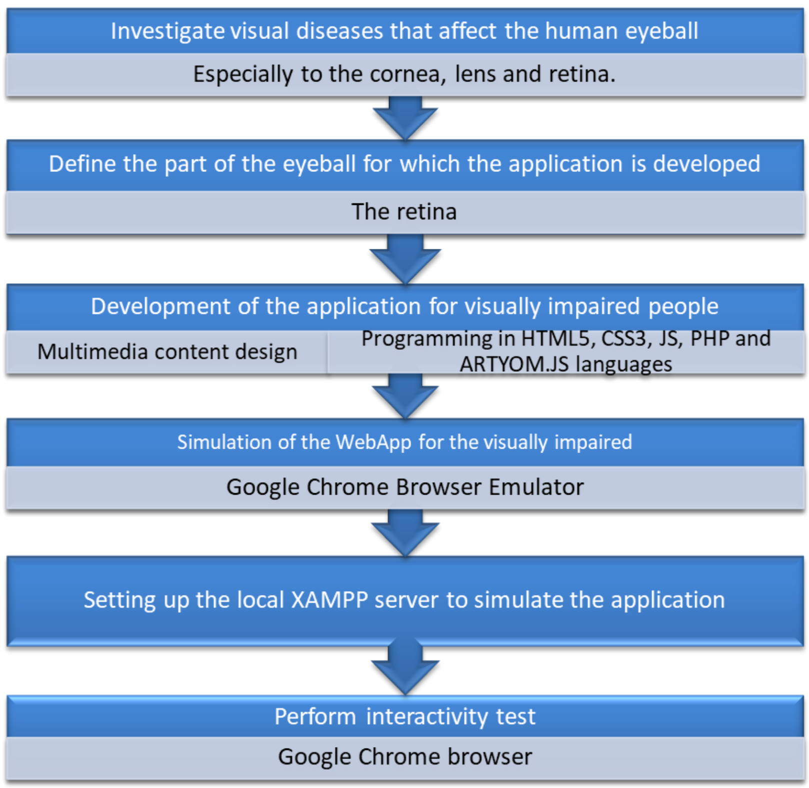

Figure 1. Conception of the SUGIH WebApp

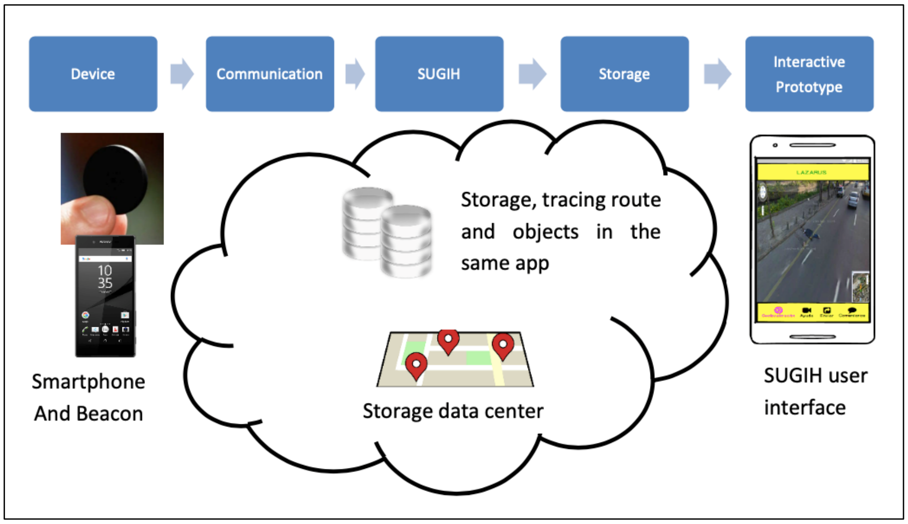

Figure 2. SUGIH Management

Beacon: This is a hardware transmitter that sends information packets, granting access permissions to Smartphone, tablets, and other electronic devices, so that they can carry out very specific actions when they are nearby. The transmitted data includes a Universally Unique Identifier (UUID) and some bytes to be used to fix the physical location of the device [13]. Regardless of the manufacturer or the protocol, beacons have these configurable characteristics:

Tx Power: Power with which the beacon emits a signal that travels by air and decreases with distance. The higher the power, the more battery consumption will be.

Emission interval: This value has to do with the frequency with which a beacon transmits. In contrast, with the Tx Power configuration, the lower this emission interval, the more the beacon consumes.Therefore, it is important to stop and think a bit before defining the values that will be assigned to it, since if they are very high, the receptor team would face difficulties finding the beacon.

3. RESULTS

3.1 Infrastructure design

The infrastructure used is made up of two parts. In the first instance, there is the database server to which the web app is remotely connected.This is where the routes through which the user travels are stored, as well as the obstacles that the person with vision problems encounters, whether temporary or permanent.The purpose is to process this data to recommend new safe routes for the movement of these individuals. As a second measure, the Beacon, is used as an auxiliary device to expand the range of the Smartphone's proximity sensor and give more accurate readings of obstacles, the hardware is connected via Bluetooth and what it does is send a series of alerts about the objects present along the path of the person with partial or permanent visual impairment.These notifications are programmed for the case of the investigation with JavaScript; and for the layout of the

WebApp, CSS3 is used. The complete scheme that was designed is shown in full in Figure 3.

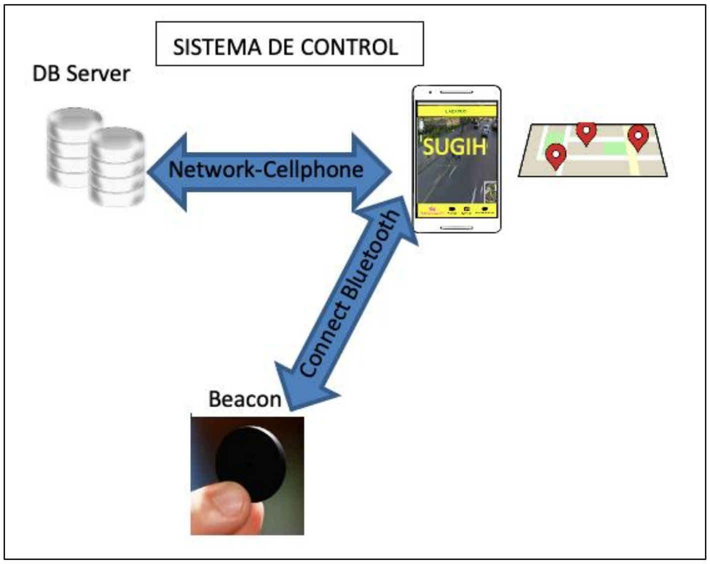

Figure 3. Design of the SUGIH structure.

3.2 Feedback

Part of the feedback from some platform users that made their comments on the comments section is described below:

- "It meets my expectations, and they should do more things like this so that they are really useful to those like me who hardly see."
- "I liked that everything is handled by voice and the comments part caught my attention, it meets my expectations and what I want in an application for someone like me who depends on my son even to see any program on TV".
- "I don't understand the colors that are so strong, for what they are, they should be eliminated. But in general, it is impressive how everything can be controlled by voice without depending on anyone".

Annotations such as those alreadymentioned show the need that people with visual impairments have when it comes to wanting to use an application that helps them in their daily tasks, i.e., that is inclusive, intuitive, and easy to use.

Therefore, it is noteworthy that, in general, it was possible to show that in the group belonging to men (19, for 48.72% of the selected sample) there was greater difficulty in understanding the instructions given by the webapp for its use.In contrast, the group of women (20, for 51.28%) was more empathetic in following instructions. Regarding the following data, although it may not be relevant, it is noteworthy that the age of the group of men participating in the experience was between 45 and 60 years old, while in the group of women it was between 28 and 45 years old. Finally, it is striking to note that some of the women volunteers in the experiment indicated that it was relatively easy for them to understand the application as it was not the first time that they used similar applications, which despite not being inclusive for people with visual impairments, it didease their learning in the use of computer-related applications.

4. CONCLUSIONS

As presented in this article, a whole geolocation and interaction system called SUGIH was designed, developed, and implemented.This software can be implemented both in Open Digital Television (DTV) systems and in smartphones, now only for the Android operating system.This development is aimed at people with visual impairments.The purpose of implementing the System is to leverage the social inclusion of this important group of people, as well as increase their opportunities to enjoy the advantages of the information democratization.

Although it was not possible to count, at the time of the application development, with the audio-commands for Ginga-NCL, and the television and STB infrastructure necessary for the implementation of the VillageFlow platform, what could be developed was quite a System that included the Smartphone with Android to carry out the application implementation that is called SUGIH.Some of these setbacks were solved using these HTML5, CCS3, PHP, JavaScript programming languages, along with the Artyom library .js, thus obtaining an application with audio-commands. Now, for the implementation of the effectiveness test of said webapp, a computer with an emulator in the Google Chrome browser was used as a XAMPP server and in the user unit.

The test results indicate that although, as expected, the application requires some improvements as well as the incorporation of more services, in general terms, the developed version was accepted and easy to use by users.

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REFERENCES

[1] Burnos R.W. (1998). Television: An International History of the Formative Years. TheInstitution of ElectricalEngineers.
[2] Ando A. (2011). Conversion of Multichannel Sound Signal Maintaining Physical Properties of Sound in Reproduced Sound Field. IEEE Transactions on Audio, Speech,and Language Processing, Vol. 19, No. 6 (Pp. 1467-1475).
[3] Pinto A.D., Torres J.M., García-Bello A.S., Pérez N.A., Uzcátegui J.R. (2016). Model for Estimating Propagation Loss in Open Digital Television System. RIELAC, Vol. XXXVII, No. 2 (Pp. 67-81).
[4] Jaksic B.S., Petrovic M.B. (2016). Implementation of Video Compression Standards in Digital Television, in Recent Advances in Image and Video Coding, RadhakrishnanS.Intech (Pp. 199-219).
[5] Besante, A., Guerra, F., Naranjo, M. and Ibadango, D., 2018.Screen Readers: Technological Tools for the Educational Inclusion of Blind People. Online document.

Available in https://scielo.conicyt.cl/scielo.php?script=sci_arttext&pid=S0718-07642018000500081 (Consultation in April 2021).

[6] Zambrano, D. M., Daza-Álava, Y. D., Pinargote-Zambrano, J.D., Lituma-Ramírez, E.D. (2019). Prototype for the orientation of people with visual disabilities through a mobile application. Scientific magazine, 35(2), 247-257. Doi: https://doi.org/10.14483/23448350.14523

[7] Bustos, C. X., 2012.Development of a geospatial information system using free software. Online Document. Available in: Organic Law of Telecommunications. Online Document. Available in http://ve.scielo.org/scielo.php?script=sci_arttext&pid=S1012-70892012000200002 (Consultation in March 2021).

[8] Spanish Association for Standardization and Certification (AENOR) (2017). UNE standards. Online Document. Available in http://www.aenor.com/aenor/normas/normas/quees_norma.asp#.Wq7ak6gbPIV (Consultation in April 2021).

[9] Salvi S.M., Akhtar S., Currie Z. (2006). Ageing Changes in the Eye. Postgraduate Medical Journal, Vol. 82, No. 971 (Pp. 581-587).

[10] Samsung (2020). How to activate the air gesture function ?. Online document. Available at https://www.samsung.com/latin/support/mobile-devices/how-can-i-activate-air-gesture-feature/ (Consultation in April 2021).

[11] Villapol, E. Maria., 2012. Analysis of the properties of the establishment of the Bluetooth Bandabase connection using Colored Petri nets. Online document. Available at http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-55462012000400006 (Consulted in April 2021)

[12] Vega Luna, J. I., Sánchez Rangel, F. J., Salgado Guzmán, G. Y Lagos Acosta, M. A. 2018.Access system using an rfid card and face verification. Online document. Available at http://scielo.senescyt.gob.ec/scielo.php?script=sci_arttext&pid=S1390-860X2018000200102 (Consulted in April 2021)

[13] Bordón López, R. Y Montejo Sánchez, S. 2015.Cognitive radio and its impact on the efficient use of the radio spectrum. Online document. Available at http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1815-59282015000100004 (Consulted in April 2021)