Location Guide DV

Mori Junior, C., da Silva, F. J., Bertolino, P. V. and L. F., Delboni,
claudiomorijr@gmail.com, francislei@pucpcaldas.br, delboni@pucpcalda.br, bertolino.paulo@gmail.com
Department of Electrical Engineering PUC Minas
Avenida Padre Francis Cletus Cox, 1661
Poços de Caldas – Minas Gerais, Brasil

Abstract – The guidance system, which was named DV Location Guide, was created to help people with blindness or low level of visual acuity to locate places and distinguish objects. The Location Guide DV uses a RFID system that provides the current location information to the user through audio waves. The system has a database of places that can be updated by a USB connection plugged in computers.

Keywords—RFID; visually impaired; orientation system;

I. Introduction

The association of the RFID with technology systems nowadays is increasing qualitatively and quantitatively with the tremendous possibilities of applications created by electronic and programmable microelectronics. Many buildings, hotels and residences have replaced traditional keys by RFID access cards because of security and easiness that the own system provides. It creates the own controlled hierarchical systems with access levels, then the access to specific sites is restricted to persons in accordance with the RFID chip personal card. The microcontroller systems in the drive allow the ability to store and report on access to local (GLOVER, Bill; BHATT) [1]. More recently, the RFID system has been used in locating products in market and industry, and livestock by the possibility of identification of animals (GOMES, Hugo Miguel Cravo) [2]. For the data identification the processing is done through technology RFID where the basic implementation elements required are Tag (at the object), Reader, Antenna and Processing Device. The operation of set consists on a reader device that keeps searching, through radio frequency signals sending by antenna, objects to be identified. At the moment of the objects is reached by radiation, a coupling between the Reader and the Tag is established, which enables that the data stored in the Tag are received by the Reader. The processing device is responsible for handling and treating the incoming information, when this information is associated with another technology, as an audio device. Generally, the Reader receives the information and, according to its utility, it is treated by a central device, often a microcontroller, that processes them according to the application (GLOVER, Bill; BHATT) [1]. When in some applications there is a need for using different RFID frequencies, different Tags and Readers has to be used.

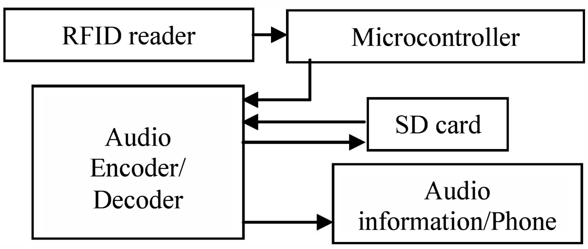
As mentioned another important element of the RFID system is the frequency of operation between Tag and Reader. The frequency selection is determined by the specific application requirements, including speed and environmental conditions. An RFID digital system functions as a powerful system for data acquisition in real time. However, to be explored, it is necessary that the acquired information is promptly processed and sent to other systems that may make use of it. Then associated with RFID technology there is a strong demand for processing information , storage and analysis of data generated.

The *Location Guide DV* was designed through a partnership with the “Associação de Apoio aos Deficientes Visuais” (AADV) of Poços de Caldas, Minas Gerais, which participated actively with suggestions and features to be incorporated in the prototype tests. The AADV has over two hundred and fifty active members with some type of visually impairment, which have need some type of support or care. The members and coordinators of the association believe this product will be incorporated into the current forms of guidance used by the visually impaired, such as walking stick and guide dog.

II. Composition of Prototype

The *Location Guide DV* was designed on a ARDUINO UNO’s® platform with ATMEGA’s® 328P-PU microcontroller. The system of identification consists in a RFID’s reader of 125 kHz model ID-12 of INNOVATIONS® produced on a board of communication of SPARKFUN’s company, one MP3 VLSI® 1053 encoder/decoder of audio, which is responsible for the access to the SD’s memory card, in which are stored audio files from local or identified products. The system is fed with 6V battery, but each technology works with different voltages, then a voltage regulator is necessary . The programming was done in C/C++ language with different settings for each technology and was structured in the flowchart shown in Figure 1.

Figure 1 – Flowchart of system *Location Guide DV*.



The places are identified with a unique code passive cards that is stored in the integrated circuit label, which are linked through the *Location Guide DV* system to specific MP3 audio files form SD cards location.

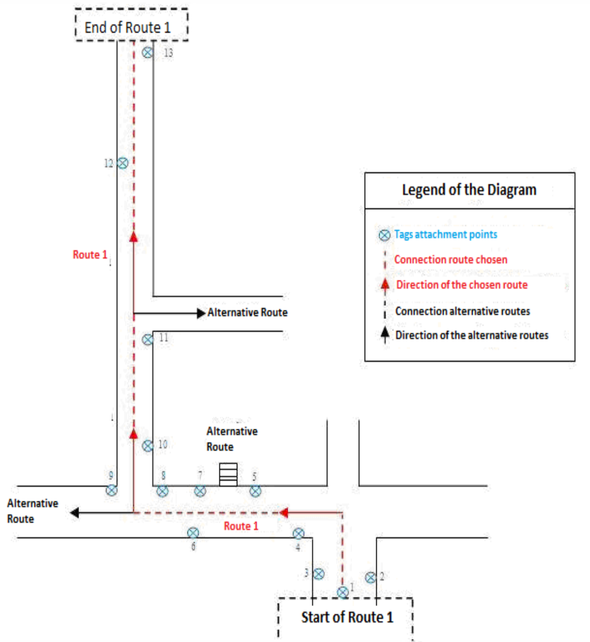
Figure 2 – First version of *Location Guide DV*.

The system also has external regulators (Potentiometers) and switches (buttons) that gives the user the control of the headset audio's intensity (with a resolution of 0.11 dB) , the battery level (low, medium and high), choice to play audio from last location set and the system's on/off. The system is set in the user's arm through adjustable elastic due the location of the reading cards that were set at heights ranging from 1.0 m to 1.5 m (Figure 2).

III. METHOD OF USE (PROTOTYPE)

For testing the *Location Guide DV*, thirteen locations and multiple access points at the corridors were identified with a RFID card in the main building of PUC Minas in Poços de Caldas (Figure 3). The route was defined from the main entrance, in which there was a multiple access ID card, to a course room, particularly the Physics Laboratory, in which there was a location card.

Figure 3 – Route Diagram 1 of PUC Minas in Poços de Caldas.



The ID cards were previously registered in a database and the location and multiple access point audio was connected to the ID of each card by software based on the same system using the RFID reader connected to the computer. The new databased, with these thirteen locations and multiple access points and the corresponding audios, was transferred to the SD card of the *Location Guide DV*.

For the first test, one of the authors had the system fixed at one arm and start to follow the previously defined route of thirteen locations and the multiple access points. It was possible to read each ID card by the RFID reader of the *Location Guide DV* when the distance between them was around 10-15 cm (Figure 4). Then the software of the system searches the corresponding audio location or the multiple access point. So the program directs the audio playback on the handset of the system to the Audio Encoder/Decoder. The user then listens to the audio which identify the corresponding location or the point in the route. The user could identify all the locations and points of the route.

Thirteen allocated Tags were assigned according with specific locations and difficult access. In the Route Diagram 1 (Figure 3) it is possible to see the various route options that the user can choose which are included in the audio.

Figure 4 – Tests with Location Guide DV in PUC Minas Poços de Caldas.

The last Tag is installed at the end of route and is represented by the thirtheenth label in Route Diagram 1 of PUC Minas Poços de Caldas (Figure 3). The end of the first route is next to Physics Laboratory which has a step at the end of the hallway.

Figure 5 – End of first route in PUC Minas Poços de Caldas.

A second test of the *Location Guide DV* was performed at the instalation of AADV in Poços de Caldas. Previously to the tests there was an initial presentation to the staffs of AADV (Figure 6), in which specific points of how the prototype works were raised. The route was defined from the main entrance to the lunchroom, in which thirteen location and multiple access point ID cards were fixed. As before, a visually imparied user succesfully get the final location, identifiyng locations and multiple access points of the route.

Figure 6 – Tests with Location Guide DV in AADV.

IV. RESULTS

The *Location Guide DV* was built in a very robust platform and easily handled by the user. The database can be easily updated by a simple USB connection to a computer. The database from different installations could be accessed by the web, when the systems get in the market. Due to the operation mode, mainly in standby, the *Location Guide DV* has very low battery energy consume. This new approach for location and orientation system to visually impaired people has an enormous advantage when compared to the usual braille identification boards.

The first route made by one of authors of project was indicative of how the prototype work, and which are the dificulties encountered by useres whith different types of visually impairament. Some adjustments were made so that the information store in the audio was of great consistency. The information store in the audio can be improved by the users, which it is easily incorporated in the database.

The main difficult observed in this prototype was the very short distance between the ID card and the RFID reade, about 10 cm, needed to be identified. To visually imparied people, this distance can be an enormous problem maily in building with large spaces. This system can be improved if active Tags are used, but with different frequencies. Nevertheless additional analisys has to be done concerning the widness of the range to avoid conflit of information.

Another difficulty observed was related to walking stick where the visually impaired need to getting around. Even using this new location system the stick is still very important to help avoinding obstacles that can hinder you mobility.

V. CONCLUSION

In this article a new location and orientation system was developd based in the RFID techmology. The *Location Guide DV* was able to provide to visually impaired person a guidance through a stabilished route, identified by ID cards along the locations and multiple access points. The system still needs improvement mainly in the distance between the user and the ID cards. In our system this distance is around 10 cm, but disntance of about a meter could provide a better accessibility in a large number of spaces. This improviment could be obtained by using active ID cards, that will be considered in our new version.

The *Location Guide DV* can also act as an object identifier, where its main function is to destinguishing what is the correct object where the deficient are dealing. The intention of this prototype is mainly in helping the visually impaired locomotion, but in the testes it was observed that the system can assit in solving various difficulties. The improvement over the dificulties encountered during testing and with the aid of the disabled were very important for continuing in the develooment of new improved versions.

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