Locator Bracelet with QR Code for Elderly People with Alzheimer's

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Abstract— *An accessory for monitoring and offering personal information related to risk situations of patients with Alzheimer's, thereby providing support, security and tranquility for family members and caregivers. A bibliographic research is carried out in this study with focus on on Alzheimer's Disease as well as on the patient's relationship with the family and the care offered to them. Furthermore, a quantitative study is performed, using specific forms and documentary based on public domain documents about the disease. Alzheimer's is an incurable and degenerative disease that affects nerve cells, and is responsible for causing spatial disorientation on memory. Spatial disorientation is one of the recurrent symptoms in with a patient suffering from AD. When the symptoms of this disease start to evolve, some patients do not feel familiar and do not even recognize certain places. The difficulty for family caregivers is noticeable when in dealing with these risk factors. This project is aimed at facilitating the reunion of the elderly with their family by proposing an accessory that provides 24 hours a day monitoring, along with a code that contains the patient's personal information. Given this context, cognitive research is relevant to express the need for minorities, leveraging home security, allowing patients the ability to have their independence for a longer time, without the disease preventing them from completely exercising their daily activities.*

Keywords— *Alzheimer; Spatial disorientation; Location; QR Code.*

I. INTRODUCTION

Alzheimer's is a disease that causes dementia, or loss of cognitive functions (memory, orientation, attention and language), which comes as a result of the death of brain cells. Neuronal losses do not happen homogeneously. The most commonly affected areas are nerve cells (neurons) responsible for memory and executive functions that involve planning and executing complex functions.

According to the Brazilian Alzheimer's Association (ABRAz), Alzheimer's Disease - AD is a dementia characterized by three main phases. It starts with forgetfulness and subtle memory loss as well as difficulties at work. It may be confused with depressive states; it progresses with more severe memory loss, the inability to perform complex tasks such as calculations and planning and has as third-stage manifestations the marked impairment of functional capacity, difficulties in feeding, dressing and bathing. This disease can destroy memory until it generates great gaps.

It is estimated that there are more than 45 million people living with dementias in the world, with projections that this number will double every 20 years, according to data provided by The Brazilian Alzheimer's Institute (IAB). Dementias usually affect the elderly population. In Brazil alone, where today there are more than 29 million people over the age of 60, according to data from the Brazilian Institute of Geography and Statistics (IBGE), it is believed that almost 2 million people have dementias, with about 40 to 60% of them of Alzheimer's type. There are about 1.2 million cases, most of them still undiagnosed.

As the disease progresses, the patient's dependence also increases. The emotional impact for the patients' family members is undeniable. The use of medication is combined with doses of dedication and love from the people around them. It is necessary to live daily with manias, mood swings and the patient's memory loss. Despite good motivations, caring for such patients is not an easy task.

Starting with the premise that AD is a chronic and neurodegenerative disease, it is extremely important to think about the diagnosed patient's daily life, and also about the patient's caregiver. This study will apply the technology of locators on wristbands, making it possible to create a device that informs the patient's location in real time.

II. BIBLIOGRAPHIC REFERENCE

Choosing this project's theme was based on the observations made with respect to the need for care for patients with AD in their daily lives. This section presents the theoretical aspects that address the entire study used for the idealization of this project.

2.1 Alzheimer

Alzheimer's disease is an incurable disease that worsens over time, but it can and must be treated. Almost all of its victims are elderly people. It is not known what causes Alzheimer's disease, but some brain lesion characteristics of this disease are known. Neuronal losses do not happen homogeneously. The most commonly affected areas are nerve cells (neurons) responsible for memory and executive functions that involve planning and executing complex functions. Other areas tend to be affected later, increasing the losses.

2.2 Spatial disorientation

According to AbraZ, spatial disorientation occurs when the patient is no longer able to locate himself/herself in space, that is, he/she has difficulty with routes or identify the right direction. Initially, this occurs in less known environments, and may, as the disease progresses, it may include difficulty for the patient to direct himself inside his/her own home. Furthermore, if asked, he/she will also not be able to say when and how he/she got there.

2.3 QR Code

Quick Response (QR) Code is a 2D code originally developed for use in the automotive industry, in order to track vehicles during the manufacturing process. It is currently used to obtain quick access to websites, texts and numbers.

2.4 QR Code Generator

The QR Code Generator is a website that offers a tool with many resources for creating a QR Code with the possibility of downloading and tracking statistics.

2.5 ESP32 Board

Also known for being a "System on a chip", ESP32 is a series of low-cost microcontrollers, containing RAM memory, 2 processing cores, hybrid Bluetooth, WIFI connection, noise reduction, encryption and numerous other features which makes it a small but powerful microcontroller. It is coded in the Arduino IDE.

2.6 ESP32 and the Arduino IDE

The Arduino development platform has a large number of followers (developers) that provides several opensource codes to new programmers. To use the IDE to encode ESP, simply select your card's model, add a new library in the card management. This way, the passage of codes between IDE and card will be free.

2.7 GY-NEO6MV2 GPS Module

The GY-NEO6MV2 GPS module is a compact board with easy connection and configuration, suitable for air or land navigation projects, the module can be used with several types of microcontrollers, it is widely used due to quality, ease, size and reduced weight.

2.8 Java

Java is an object-oriented programming language developed for creating continuous platforms. In this programming paradigm the developer can carry out updates or continue with unfinished projects instead of starting a new one. The object makes one's code more organized and easier to modify.

2.9 MIT App Inventor

MIT App Inventor is web software created for Android applications development using a connected browser and smartphone. It is possible to create applications by selecting components, using block programming that shows how the application should behave. The entire development of the application is done visually by joining pieces as in a puzzle. At the end of the project, the project can be stored, and thus, an executable file is generated and ready to be installed on other smartphones.

III. MATERIALS AND METHODS

A bibliographic research is carried out, consisting of studies addressing the topic 'Alzheimer's disease: challenges faced by the caregiver in the family routine", "The elderly with Alzheimer's disease: the family caregiver's care and knowledge".

A quantitative survey was also conducted using google Forms and printed questionnaires with 15 closed questions for family caregivers of patients with AD, as well as participants in the Caregivers' Support Group of Alzheimer Patients. The evaluation criteria was defined as follows: being a family caregiver for one year or more of an elderly person with AD and living in the same household.

Another method used was a Documentary research based on exploratory readings of material during its trajectory, data collection was carried out through the official website of ABRAz, seeking to gather information through reports, guidelines, and identification of documents made available in the public domain. It is an Applied research based on the proposal of the use of bracelets in diagnosed patients.

As relates to the prototype development, the QR Code Generator website will be used to generate the QR Code with the patient's personal information and medical data, 1 GPS GY-NEO6MV2 Module, and 1 ESP32. An application for Android devices was developed on the MIT APP Inventor platform, in the JAVA language, using

boxed programming. The application would allow the user to have access to the locator used by the patient, and will be able to read the data available in the QR Code.

IV. RESULTS AND DISCUSSION

4.1 Learning to Cope with Alzheimer's Disease Symptoms

Spatial disorientation is one of the recurrent symptoms in the life of an AD patient. The episodes initially occur in unknown places. After the disease progresses, some patients end up fleeing their homes, as they do not feel familiar with, and do not even recognize, the place. A patient may just automatically walk out of the house. There are even times when he/she does not recognize the place where he/she is. Thus, the patient has problems in creating a strategy to return to the place of origin.

It is noted that family caregivers do not have knowledge about symptoms and care related to Alzheimer's disease. The disease, due to its characteristics, significantly affects the family, leading to total the patient's total dependence on these family members.

"My father knows he is forgetting places, but he does not accept going out with anyone, he says that he is the boss, he has gotten lost a few times, people have called me." Reports Sonia Fonseca, who takes care of her father, diagnosed.
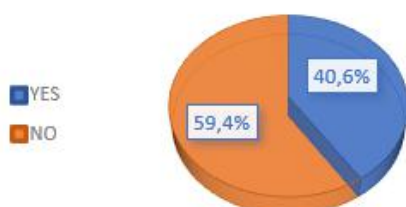
"It happened very early. He went for a bike ride, fell and only came back because the police brought him back." Icaro Jordão, about his grandfather.

"After some situations he got lost on the way to my home, I had to make caps with his name on them, and a phone number for contact. But there were days when he forgot to wear the cap." Vanessa, referring to her father.

4.2 Quantitative Research

After conducting a questionnaire using Google Forms, we obtained significant results that drive the evolution of this project:
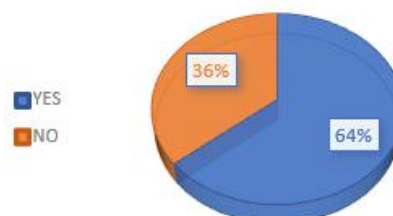

Graph 1: Did you already know about the situation, regarding spatial disorientation? Source: The Authors, 2020.

40.6% claim to have knowledge about the severity of spatial disorientation, however 59.4% do not have the same knowledge, a result considered alarming because spatial disorientation is one of the risk factors that cause the elderly to get lost.
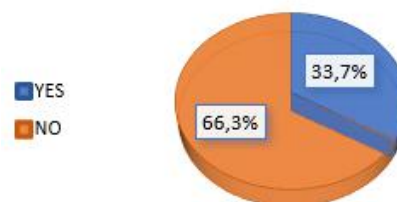

Graph 2: Has it ever occurred that the patient got lost? Source: The Authors, 2020.

64% of participants claim to have gone through situations where the disoriented patient got lost, and 36% say they have not experienced this disorder.
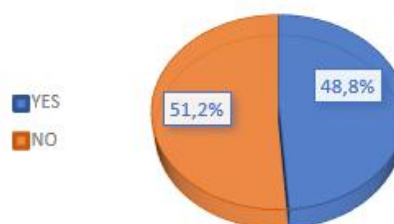

Graph 3: Did you have to make a custom object with identification information (shirt, badge, etc.)? Source: The Authors, 2020.

Despite the severity of the spatial disorientation risk factor, which causes the AD patient to get lost, only 33.7% of the interviewees claim to have made an identification object. 66.3% do not consider its use necessary.
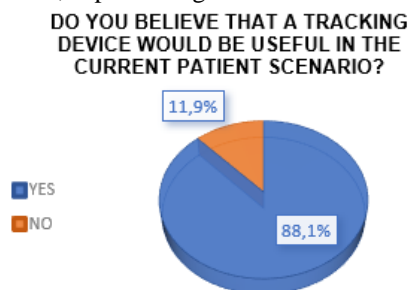

Graph 4: About the objects, was their use efficient? Source: The Authors, 2020.

Of the objects made, 48.8% achieved some effectiveness. 51.2% did not provide any good result. Patients may not want to wear a certain accessory that would be different from what they are already used to, such as a new shirt, caps or badges.

Graph 5: Do you believe that a tracking device would be useful in the current patient scenario?
Source: The Authors, 2020.

88.1% of respondents agree on the use of a device that would allow remote monitoring of the patient, and 11.9% disagree on the use of these technologies.
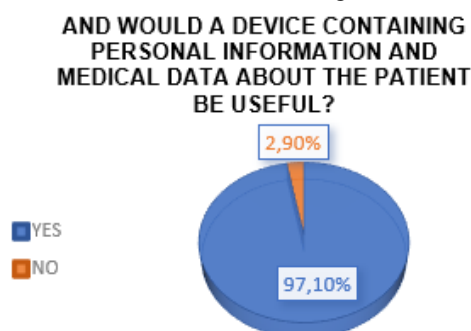
Graph 6: And would a device containing personal information and medical data about the patient be useful?
Source: The Authors, 2020.

97.1% are in favor of a device with personal and medical information, aiming at a scenario where the risk factor of spatial disorientation is the patient's result, whether the information about the lost patient would be useful to assist in the reunion with the caregiver. And only 2.9% see no need for this device.

4.3 The Proposal

This work proposes the development of a locating bracelet together with the use of the QR Code containing the patient's personal information and family contacts, an ESP32 that connects the bracelet to the smartphone with the android application and a GPS GY-NEO6MV2 Module that grants the precise location from the wearer of the bracelet to the responsible caregiver, aiming to handle situations in which the patient is disoriented or lost.

4.4 The Project
4.4.1 Software

The development refers to the QR Code Generator website (Figure 1). When accessing the QR Code, one must start creating the patient's data, including the patient's name, contact person's phone number, caregiver's name and the patient's diagnosis.

Fig. 1: Symbol of the QR Code Generator site.
Source: QR Code Generator site

The software consists of an ESP 32 technology (Figure 2) that will communicate with a smartphone through an Android application, developed by the group at the MIT APP Inventor (Figure 3). It will show the location to caregiver, who will have access to the application.

Fig. 2: ESP32 Microcontroller.
Source: Usinainfo site.

Fig. 3: Symbol of MIT APP INVENTOR.
Source: Celular1 MIT APP INVENTOR site.

4.4.2 Hardware

The QR Code will be generated and printed on adhesive tape that will be attached to the bracelet, containing information that will assist in providing assistance to the lost patient.

Fig. 4: QR Code generated by the QR Code Generator site.
Source: QR Code Generator site.

The bracelet will have the ESP 32 module (Figure 2) that maintains communication via Bluetooth or via Ethernet through an Android application. Alongside is the GPS GY-NEO6MV2 module (Figure 5) that will display the patient's caregiver's location.

Fig. 5: GPS GY-NEO6MV2 Module
Source: Autocorerobotica site.

4.4.3 The Bracelet

The purpose of the project is to facilitate the reunion of the elderly with their family just by scanning the code with a smartphone. The code will be generated on the QR Code Generator website. After being fed with the information, it can be printed on an adhesive containing the name, telephone number of a responsible person, caregiver's name and patient's diagnosis. The GPS Module connected to ESP32 is the location and communication service. The bracelet (Figure 6) will be made of silicon in the model without closure to make it difficult for the user to remove the object.

Fig. 6: Prototype of the Identification Bracelet
Source: Adapted by Source: The Authors, 2020.

V. CONCLUSION

The results acquired by collecting data through the forms present a wide lack of information regarding the cognitive problems of Alzheimer's Disease and despite being a known disease, people are not sure on how to react with some symptoms. The difficulty of some caregivers to handle technology was also noted, which could in turn assist in the daily life alongside the patient.

There was the development of a bracelet that transmits the location in real time to the caregiver's device, adding to the use of the QR Code with personal information and the patient's diagnosis. The bracelet won good prospects. The communication of the bracelet's GPS with the recipient device worked well. The information contained in the QR Code is useful to help the lost patient. The project is very effective, the use of the bracelet allows remote monitoring of the elderly, as well as providing necessary information in situations of risk, offering tranquility and security to caregivers and family members.

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