Application Development for Blood Pressure Meter and First Aid Alert

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Abstract

Hypertension affects one out of every four adults in Brazil, mostly older people who, according to research, do not have comprehensive knowledge of the disease, its symptoms and how to identify them in someone, thus causing arterial damage throughout the body. consequently it can generate strokes. Two methods were used to fetch data; the amount that was based on Google polls; and the qualitative through bibliographical research and articles on blood pressure in Brazil. Using these methods, a prototype alert software was developed that can work in conjunction with existing technologies such as SMARTBANDS and SMARTWATCH, which quickly and conveniently measure pressure from their users by collecting data and sending it to the system. The data collected through the sphygmomanometer are sent to the arduino that together with the HC-05 communicates with the system, meeting the expectations. The

communication of the user application with the monitor worked correctly. Having collected the data through forms, a software and a prototype that could be used together with other technologies were elaborated to propose to smart watch manufacturers the implementation of the alert software, for the improvement of the existing technologies.

Keywords: Blood Pressure, Systolic, Arduino, Sphygmomanometer, Smartwatch, Smartband;

1. Introduction

In Brazil about 300 thousand people die per year because of arterial hypertension, according to the Department of Health and Human Services about 24,7% of Brazilian population claims suffering the illness. In agreement with new data from VIGITEL (Risk Factors Surveillance for chronic noncommunicable diseases), 60% of the interviewees who believes being hypertensive are over 65 years old.

According to hospital Santa Lúcia, posted on April 26 2018, "Hypertension causes damage to artery throughout all the body and the impairment can lead to hemorrhagic strokes when happens frequently bleeding associated to hypertensive attack or ischemic strokes, destructions on artery lead to formation of clots".

Blood pressure rises getting abnormal values when vascular resistance appears from blood vessels blocking a good flow for blood passage, causing a superior effort from the heart to pump blood. One of the main problems of hypertension is the stroke due to acute myocardial infarction or chronic kidney disease, hypertension can also lead the one to a cardiomyopathy (heart muscle atrophy) causing cardiac arrhythmia, abdominal bloating, shortness of breath and fatigue. It's good to remember that any disease added up to a hypertensive picture can become much more serious, the risks multiplies according to the Department of Health and Human Services.

Defined this scenario, applied to the technology of SMARTBAND and SMARTWATCH, it's possible to create an alternative to both diastolic and systolic pressure measurement, facilitating the control and prevision of arterial variation of patients, assisting decision making to prevent correlated problems about blood pressure.

2. Methods and Materials

The methods that were used to make this research for elaboration of the project are: the quantitative, realization of google forms polls and polls at hospitals and on the street; and the qualitative doing bibliographic researches for analyzing articles about arterial pressure in Brazil and checking how many people would approve the start of the project, the data collect occurred at August 12, 2019 until October X, 2019.

With the goal of measuring arterial pressure and show an alert system to rescue the technology bearer user like the Smartwatch, will be elaborated a prototype.

For the realization of the data collect prototype it was used 1 Nano Arduino, 1 ESP8266, Jumps, 1 bip, 1 GPS, Sphygmomanometer, it was developed and app for android through the MIT APP inventor platform, using the JAVA language, working with box programming. The Arduinos will be programmed in C language, on the own microcontroller platform.

3. Development

3.1. Theoretical Referential

The choice of the project thematic came from observations about the lack of assistance to the ones who have arterial pressure problems. In this topic is showed the theorical aspects that address all the study for the idealization of the project.

3.1.1. Systolic and diastolic pressure

Systolic and diastolic pressure goes along together, they're the Cardiac cycle. Systolic is measured when there is heart artery compression, where the blood is pumped to blood vessels. The diastolic pressure is measured when there is artery decompression leading the blood entrance to the heart. In a normal adult the average measure of systolic pressure is 120 millimeters of mercury (mmHg), while the diastolic is 80 millimeters of mercury (mmHg).

3.1.2. SMARTWATCHS e SMARTBANDS

Both Technologies are WEARABLE "Technologies devices that can be used by the users as a clothing part" both SMARTSWATCHES and SMARTBANDS have similar functions, although having a big difference in usability terms, the smartwatch works without a smartphone connected to it and the smartband needs the use of a smartphone connected to it to accomplish all its functions.

3.1.3. Correct way of measure the diastolic and systolic arterial pressure using an sphygmomanometer

Anyone can measure the arterial pressure of anyone, but the one needs to have minimal basics knowledge to do it correctly. When you don't have an digital device certificated by ANVISA it is possible to use an sphygmomanometer, a manual measure that leads to a precise collect.

For the correct collect of arterial pressure, the one needs to be with his arm outstretched, supported in a table, the armband is wrapped through the left or right arm squeezing it 2cm above the elbow. The branquial must be identified right below the cubital fossa, when it is identified, a stethoscope diagram will be put above it. With the stethoscope in the ear, the cuff must be inflated, given a certain moment, the arterial pulsation will be heard and the cuff must be inflated till the pulsation is gone, when it's gone, the armband must be slowly emptied, when the sound reappears, a value will be shown in the device and it's called systolic pressure (maximum pressure), continuing cuff deflation. When the sound of pulsation is gone again, a value will be shown and it will be the diastolic pressure (minimum pressure).

3.1.4. Arduino

The Arduino is a board compound by a microcontroller Atmel, with entrance and exit circuits that can be connect to a computer and programmed trough an IDE (own Arduino), using the C programming language.

3.1.5. Java

Java is an object-oriented programming language developed for creation of continued platforms. On this programming paradigm, the developer can do updates or continue unfinished projects instead of creating a

new one. The object makes your code more organized and easy to be modified.

3.1.6. App inventor

App Inventor is an web software created to the development of android apps using a navigator and a connected smartphone. It's possible to create apps selecting components, using block programming that shows how it must behave, all the app creations it is made by visual form together with pieces like a puzzle, the app is shown in the smartphone as you are programming in the navigator simultaneously, it is a way of test of the application. At the end of the project, it is stored and the executable is created to install it in other smartphones.

4. Results and Discussion

4.1. Qualitative Research

After the realization of the quiz using Google Forms, we got significant results that promotes the evolution of the project

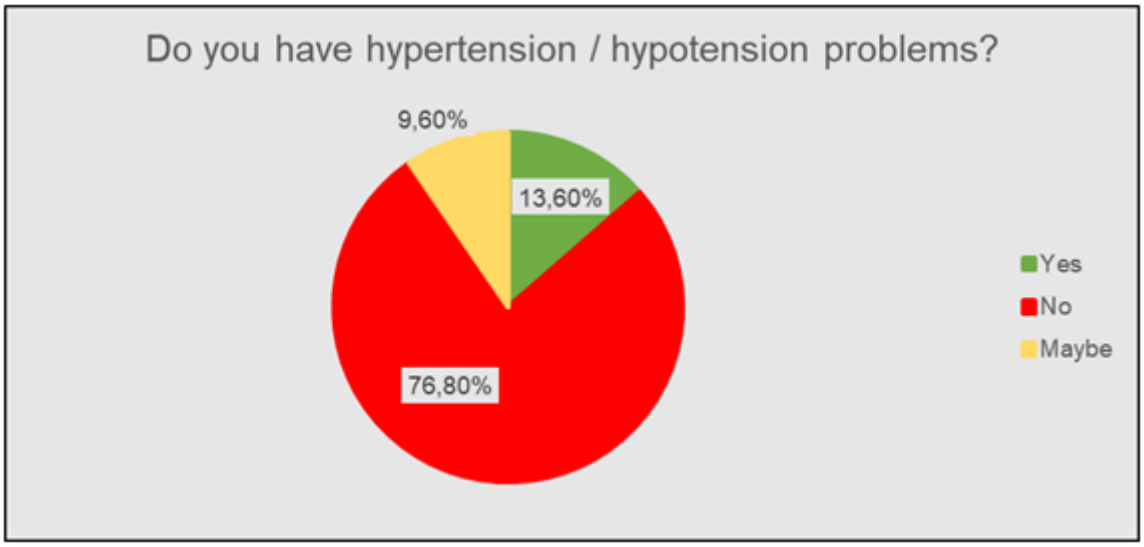

Figure 1 – Graphic 1
Source: Elaborated by member of the group

76,8% of the interviewees answered not having any trouble with arterial pressure, 13,6% answered having trouble and 9,6% answered not knowing. Although is a problem that hits 300 thousand people in our country, the bigger part who were interviewed claims not having hypertension.

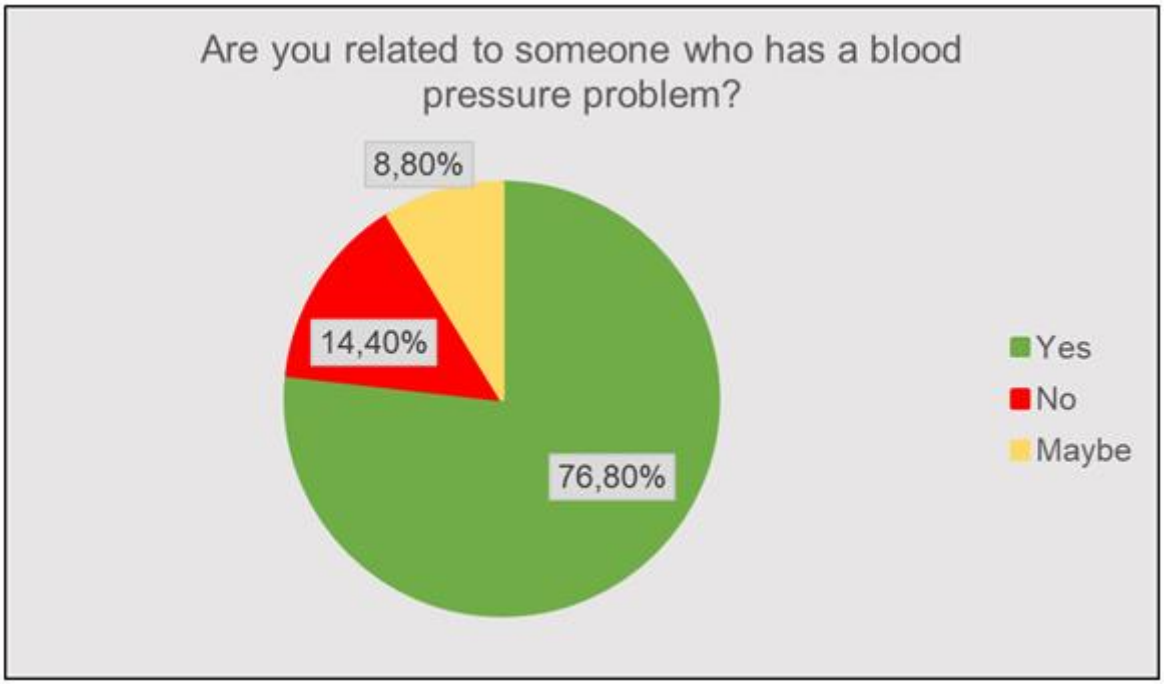

Figure 2 – Graphic 2
Source: Elaborated by member of the group

76,8% of the interviewees said that knows someone who has arterial pressure problems, which is a curious fact because this same statistic is given to the number of people who says not having problems about it.

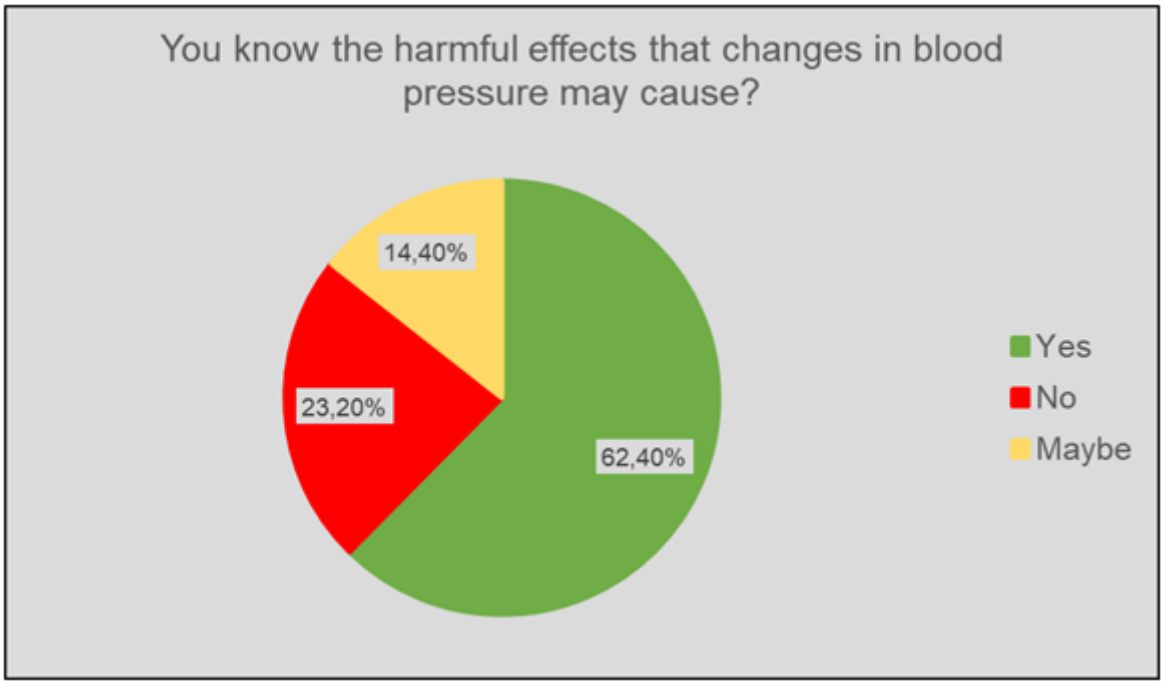

Figure 3 – Graphic 3
Source: Elaborated by member of the group

62,4% of the interviewees claims to know the harms of arterial pressure, 23,2% claims not having the same knowledge. Summing the ones who said NO and MAYBE results in a total of 37,6%, another alarming statistic, considering the lack of knowledge about the harms that the arterial pressure can result in.

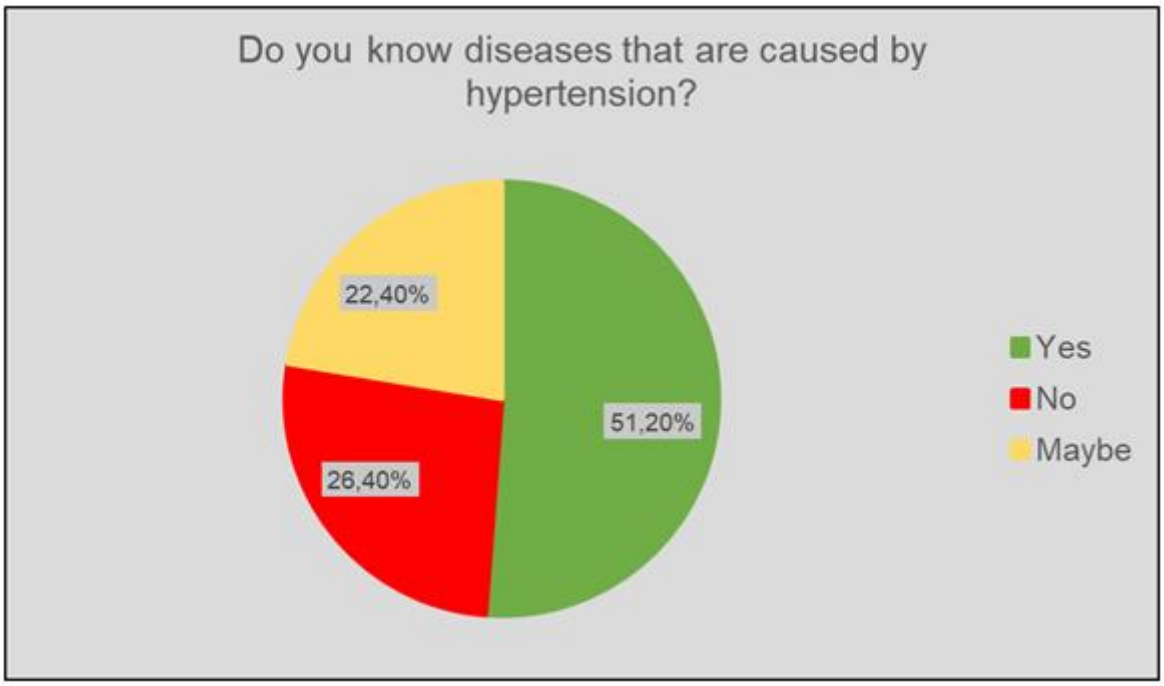

Figure 4 – Graphic 4
Source: Elaborated by member of the group

This graphic contrast with the above graphic, because we can see a reduction of people that claims to know the harms of hypertension/hypotension. Only 51,2% claims to know about the diseases. Summing data of NO and MAYBE, we have that 48,8% claims to not know about the harms of hypertension/hypotension.

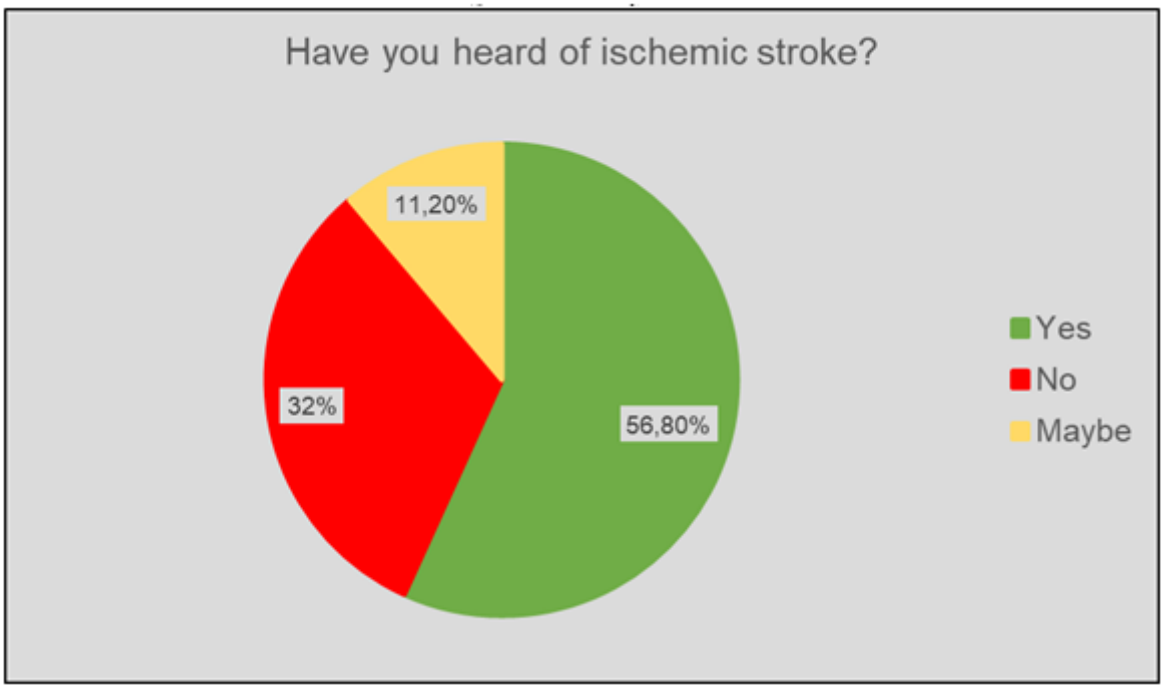

Figure 5 – Graphic5
Source: Elaborated by member of the group

56,8% claims that heard about ischemic strokes, 32% claims not to know about what it is and 11,2% have doubts. The number of people who voted NO is high and worrisome, because the ischemic stroke is the

bigger cause of death and its caused by hypertension.

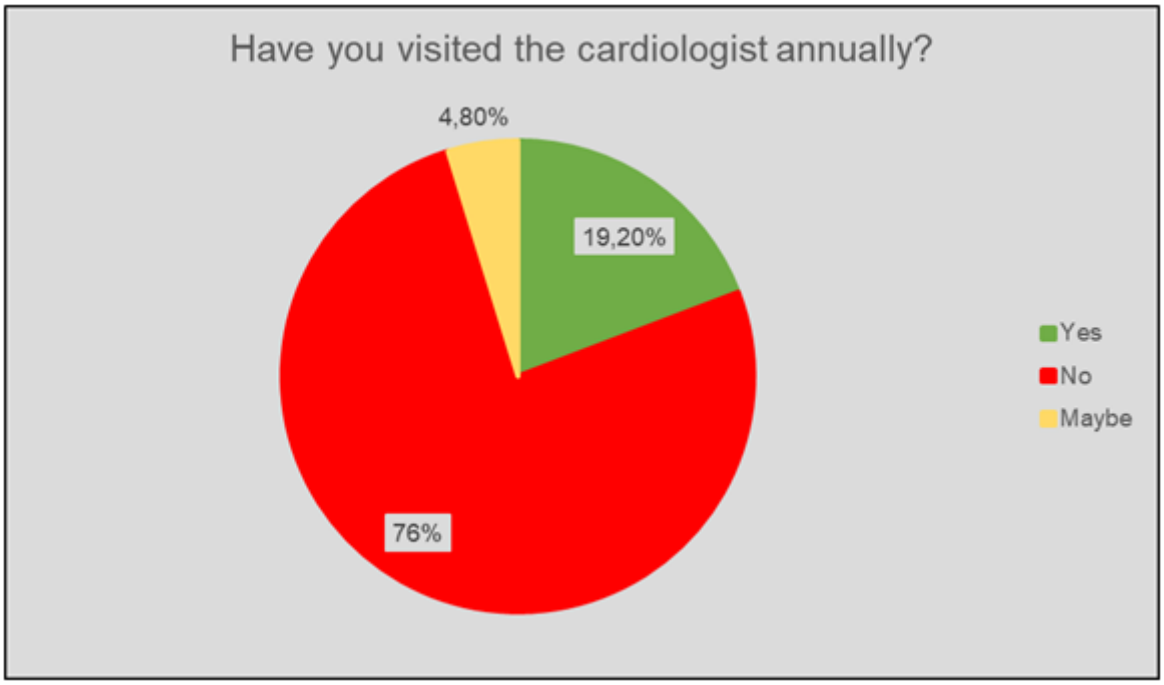

Figure 6 – Graphic 6
Source: Elaborated by member of the group

19,2% of the interviewees voted yes, 4,8% maybe. It's an alarming data, because 76% of the interviewees don't go to a cardiologist annually, and it is recommended going at least once a year, during the CHECK UP.

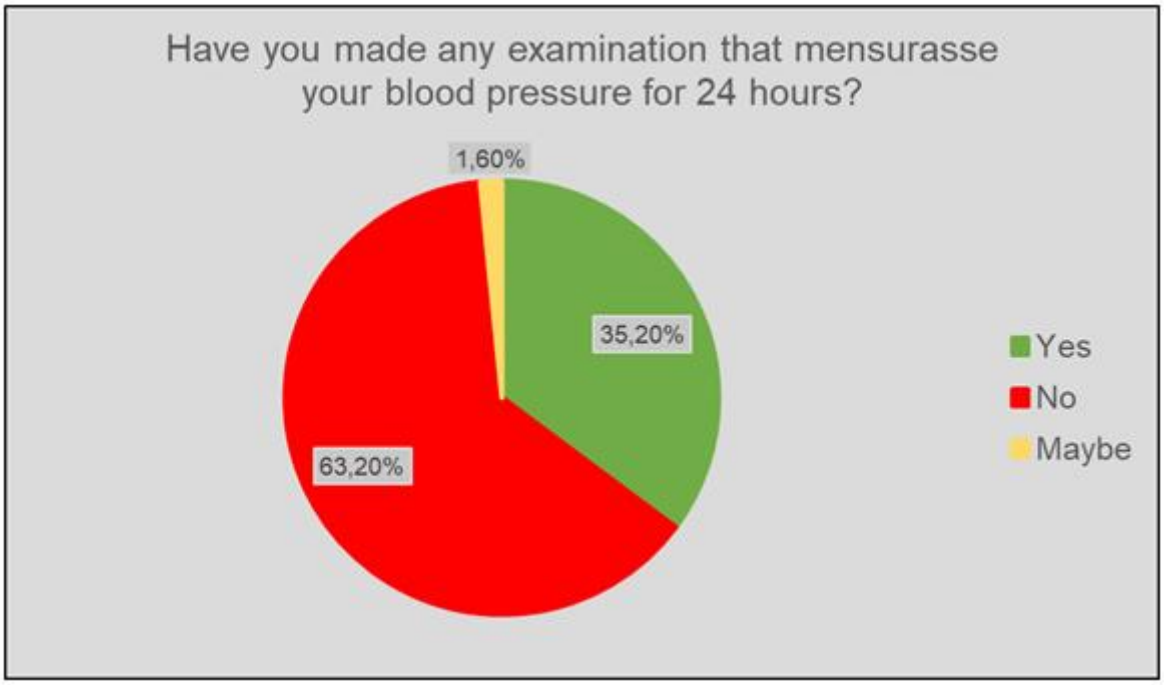

Figure 7 – Graphic 7
Source: Elaborated by member of the group

63,2% of the interviewees never did a 24 hours map, 35,2% of the interviewees did an exam that measures

the pressure during 24 hours and 1,6% said not to know if did or not something about it.

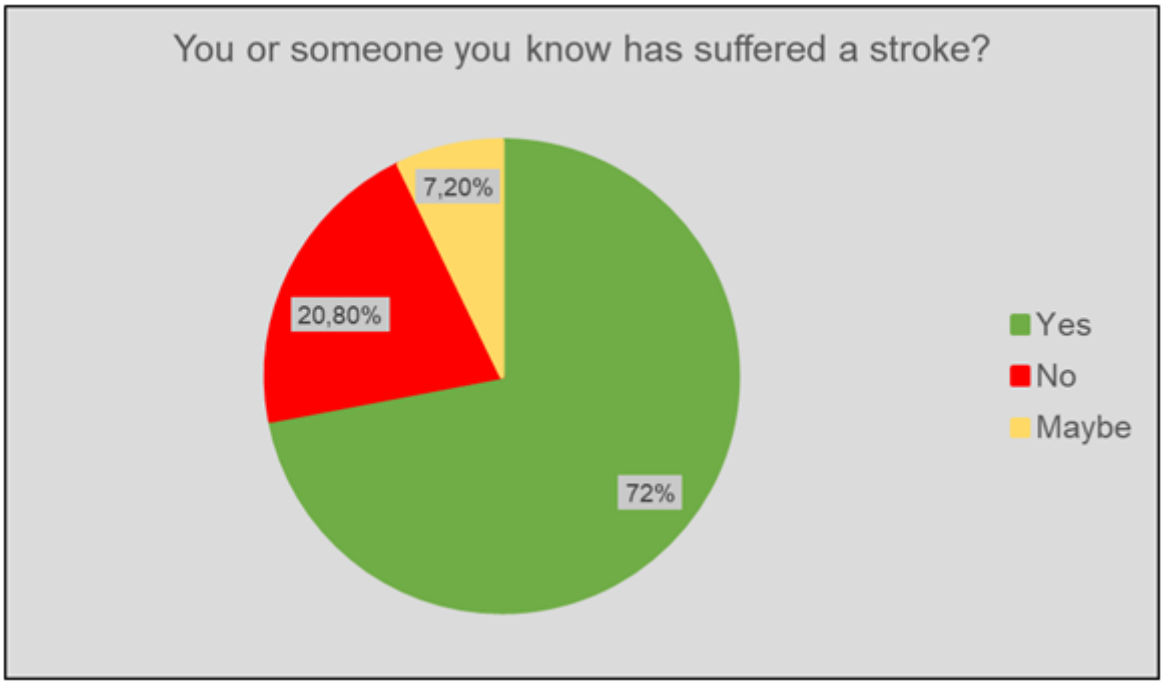

Figure 8 – Graphic 8
Source: Elaborated by member of the group

20,8% of the interviewees voted no, 72% of the interviewees claims that yes and 7,2% voted maybe. Another alarming graphic, because show a high index of strokes crisis.

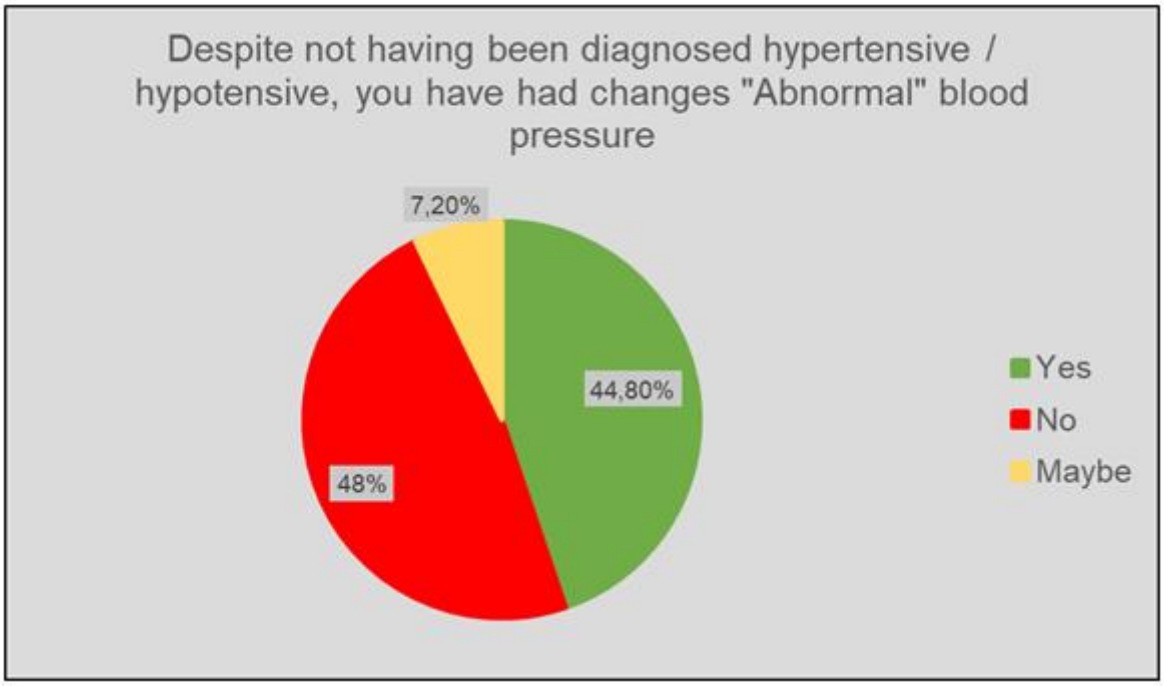

Figure 9 – Graphic 9
Source: Elaborated by member of the group

48% voted no, 44,8% voted yes and 7,2% voted maybe, in other words, don't know about it. This data contrast a lot with the number of interviewees who voted not going to a cardiologist periodically (a year).

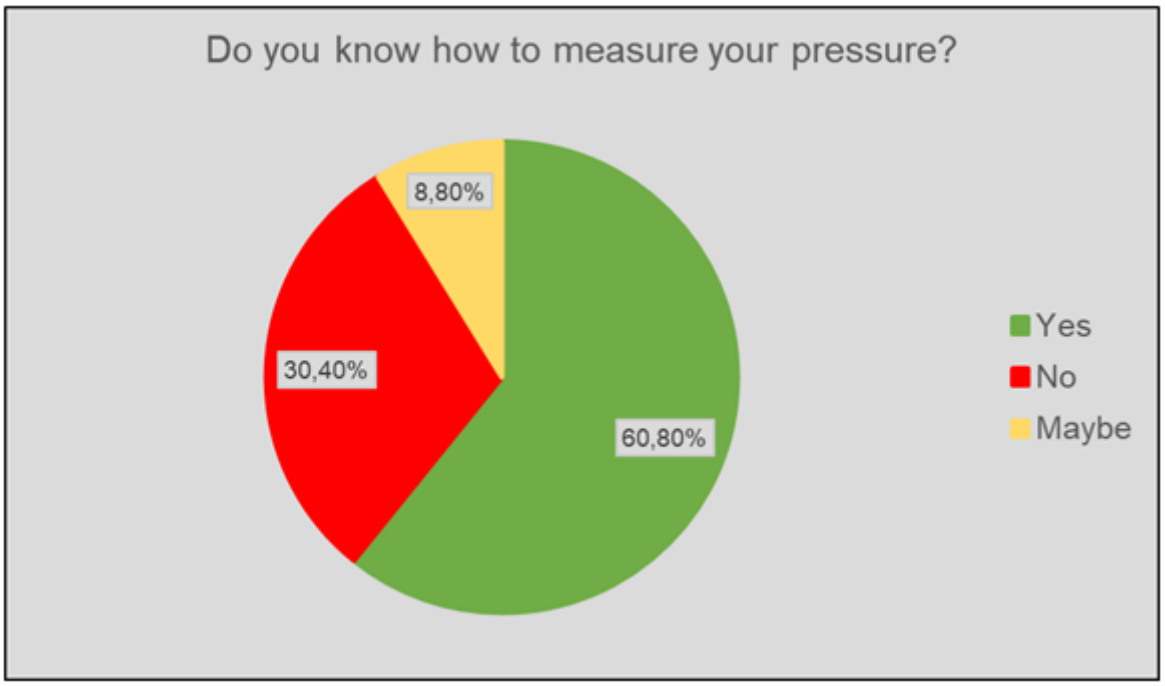

Figure 10 – Graphic 10
Source: Elaborated by member of the group

60.8% claims knowing how to measure the arterial pressure, 30,4% claims not knowing and 8,8% claims maybe. It's seen on the graphic that the percentual of interviewees not knowing how to measure the arterial pressure is higher than average.

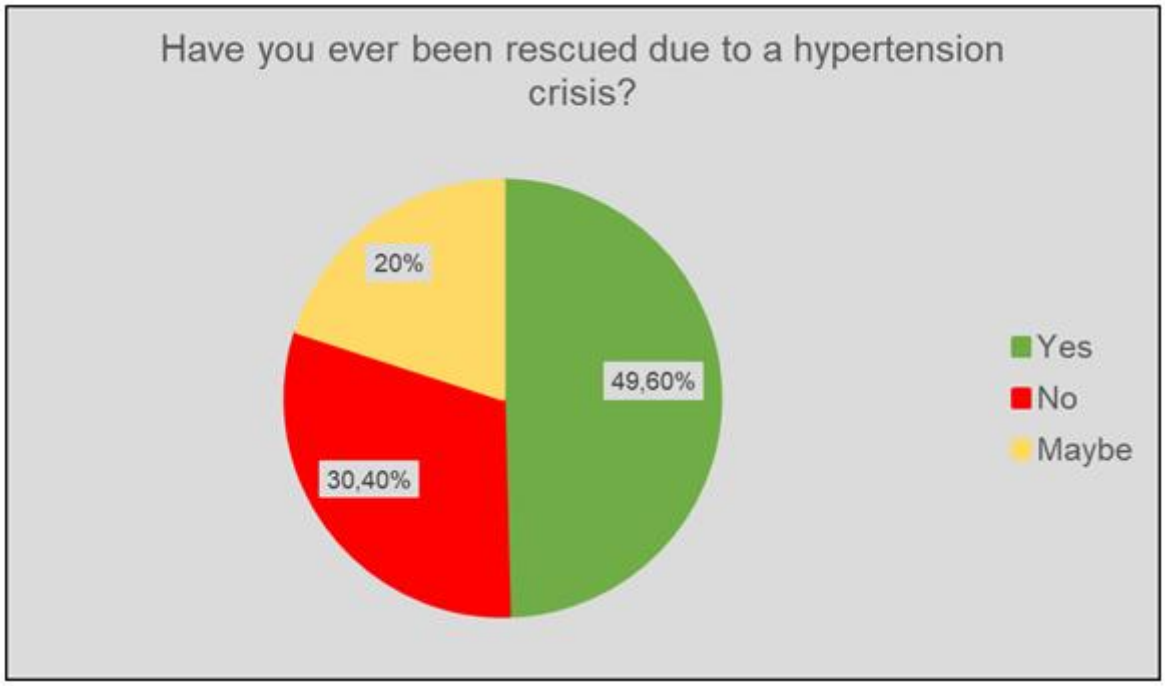

Figure 11 – Graphic 11
Source: Elaborated by member of the group

49,6% claims to need help during a hypertensive crisis. 30,4% claims no and 20% claims not knowing if it was necessary or not. The number of yes is high, and fortifies the idea of the project, about the need of an

alerting system.

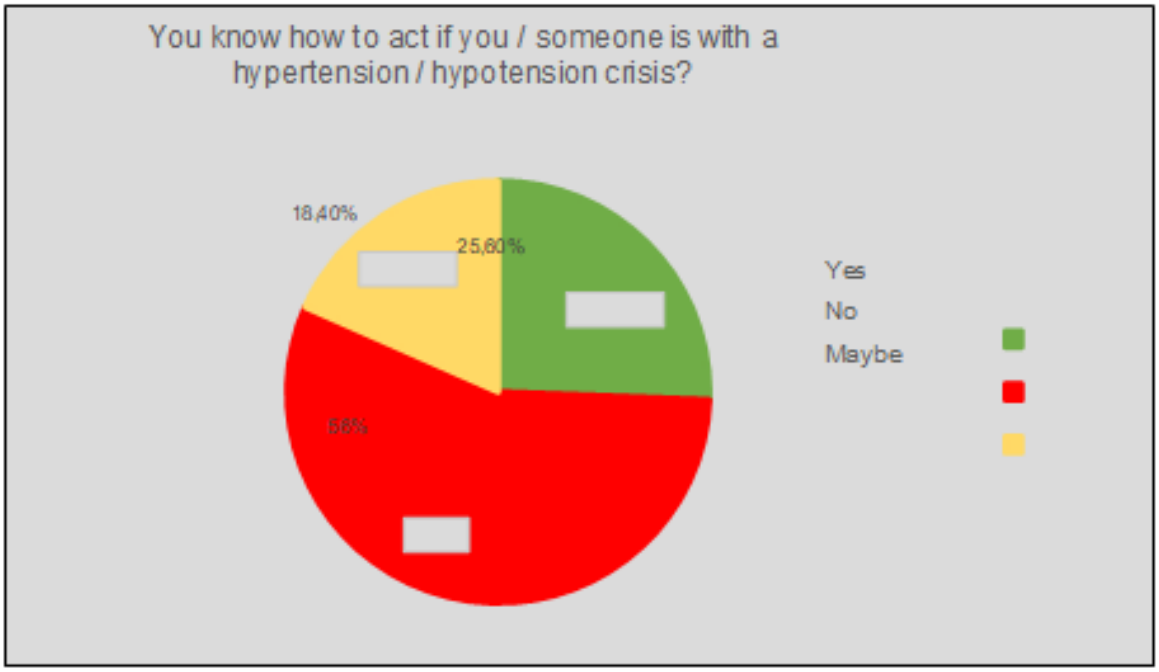

Figure 12 – Graphic 12
Source: Elaborated by member of the group

56% claims not to know how to help a hypertensive, 25,6% claims to know how to help. The number of interviewees who claims not knowing how to help is higher.

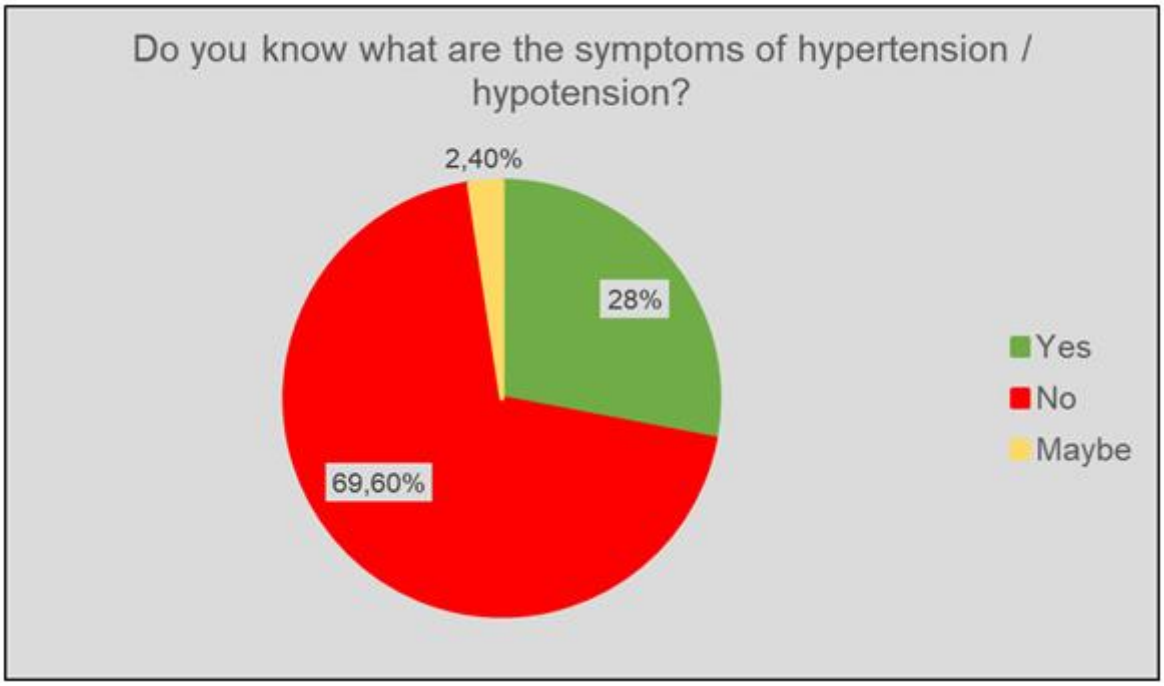

Figure 13 – Graphic 13
Source: Elaborated by member of the group

69,6% claims not knowing how to identify a hypertensive crisis, 28% claims to know how to identify and 2,4% maybe knows. The number of interviewees who doesn't know the symptoms of hypertension are

much above the average, this data is alarming because a lot of people have already died for not knowing how to identify if it was with a higher or lower pressure than normal.

4.2. Prototype

It was idealized an alarming software to complement existing technologies like SMARBANDS, SMARTWATCHES or any kind of smartwatch capable of measuring the arterial pressure that has the necessary equipment to do it, to simulate the operation of this application will be made a prototype to measure the arterial pressure of the user, it will collect the data and the prototype will send to the system, if it noticed abnormal values, the system will emit an alert to the responsible user to provide aid to the prototype user. The system will work this way: it has a monitor and user screen, the user screen will be connected to the own user device and the monitor screen will be on to somebody device (responsible one) who has shared code, in case of values higher or lower than the average, the application will emit an alert, opening automatically the location of the user.

For the elaboration of the prototype it was used an sphygmomanometer to collect data about the user's pressure, it is connected to the Arduino, which there is an barometric pressure gauge on.

Figure 14 - Sphygmomanometer INCOTERM.
Source: Page of MEDCLEAN. (Hospital Medical Products).

After the arterial pressure data has been captured by the sphygmomanometer, it will be converted to an absolute pressure sensor – MPX5700AP. The calculation is done by the Arduino logics, the values will be converted in barometric values and displayed like arterial pressure.

Figure 15 – Arduino
Source: Mundi Shop Page: Limites Technology.

Figure 16 - Absolute Pressure Sensor - MPX5700AP.
Source: Electronics Chest Page

The system receives the data by the HC-05, the application sends the data to the user-monitor releasing automatically the GPS location, so the responsible for helping can go to the user.

Figure 17 - HC-05 Module.
Source: Short Circuit Page.

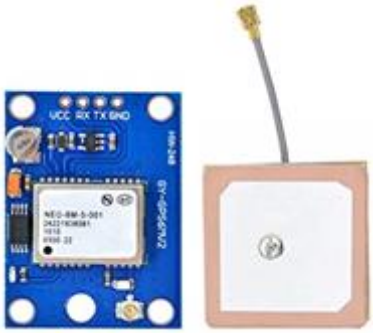

Figure 18 - GPS Module for Arduino
Source: Amazon Page

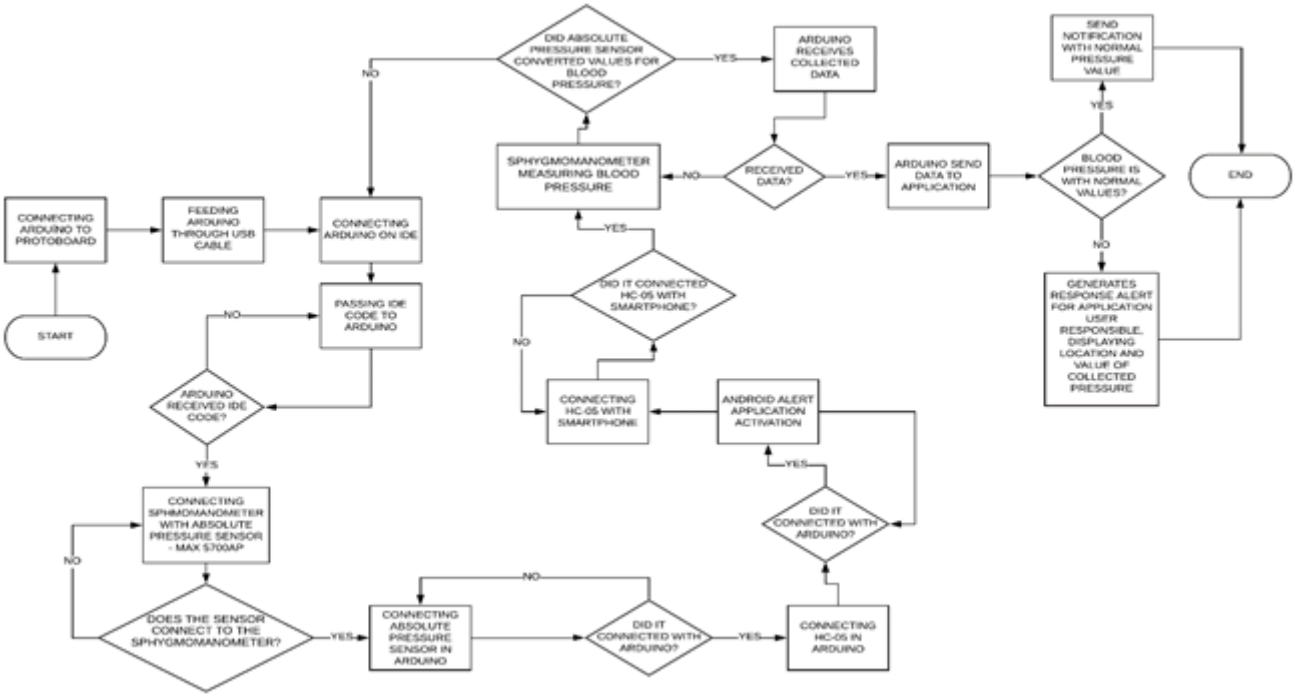

Figure 19 – Prototype building model
Source: Elaborated by member of the group

5. Final Considerations

The data collected by the forms shows the uncertainty of population about the knowledge of facts that a disease who covers tightly our country, it was found that despite the name HYPERTENSION be well known, people don't know how to identify or react to a hypertensive crisis, was evaluated that out of every 8 people who answered the form 7 of them also knows someone who suffers the disease.

It was accomplished the elaboration of an alert software that can be used together with other existing technologies like SMARTBANDS, SMARTWATCHES or any kind of smartwatch that has the appropriate device to measure the arterial pressure. It met the expectations well. To collect data and give it to the system, we transformed an sphygmomanometer manual to digital, the same passed data to the Arduino and the microcontroller together with the HC-05 communicated well with the system.

It is proposed to SMARTWACH and SMARTBAND manufacturing companies, the implementation of

software XXXXXX, for the improvement of existing technology.

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