Methodology For Information Security, in the Process of Sending Biomedical Signals in Telemedicine Applications for Rural Areas

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Abstract

With the advancement of information and communication technologies, new ways of being able to transmit information from remote places where they are technologically inaccessible are being presented, these applications related to the health area, gain importance because in areas with little access to technology and much more to mobile technology, it occurs in most of the countries of South America, where due to the conditions of the Andes mountain range, this work makes it very difficult to implement large-scale solutions. But the need for health care cannot be ignored and much more when the population is at risk. This work proposes a methodology to be able to transmit medical information safely and with integrity, and with it biomedical signals, for solutions where telemedicine is applied, the methodology proposes a communication protocol based on the ordering of information based on a priority structure and XML modeling for sending and receiving, the result presented is an easy to implement and scalable protocol depending on the complexity of the information to send and is not linked to a particular telecommunication network, it can be implemented in telephone networks and wireless networks of different architecture.

Keywords 1

Biomedical signal, telemedicine, sending, reception, protocol.

1. Introduction

One of the positive consequences of the COVID-19 pandemic, related to the use of information and communication technologies, is related to the use of technology applied to medicine, medical consultation services are carried out online, for In most specialties that are not related to COVID-19 [1], there are works where many experiences are presented in the use of teleconsultations [2],

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presenting many configurations to improve the experience with the patient [3], many called teleconsultation, remote care among other names [4] [5].

In the study of living beings, the analysis of biomedical signals is of vital importance, from any type of record, in this task we find works where a radar signal is used to be able to discriminate the functioning of the heart [6]. The most common and simple subjects for recording the biomedical signal is the cardiac one, where by using an ECG recording the signal can be compressed for effects that can be sent remotely [7]. In the evolution of m-Health, solutions are found with many sensors that can record different types of biomedical signals, for the monitoring, diagnosis and treatment of diseases [8]. Regarding the transmission of signals, it is not only the signal itself that is considered, but the transmission medium through which the information is sent is also important, with two main reasons, first the security of the information and second the integrity of the information, these two aspects must be taken into account when carrying out communication protocols for sending biomedical signals [9]. In the search for secure means of transmission, we found telephone networks that, through their use, can transmit signals from anywhere on the planet, as long as we have a cell phone connection [10].

In the present work we present a methodology for sending biomedical signals under a secure communication protocol and with the main characteristic that is the integrity of the data by means of an XML encoding.

2. Materials and Methods

The methodology presented is constituted by a series of previous steps from the acquisition of the signal from the medical equipment, its processing and adaptation of the signal and the articulation with the development of a protocol for the generation of a file that contains all patient information so that it can be transmitted, received and interpreted by hospital information systems. The methodology and its development are developed below.

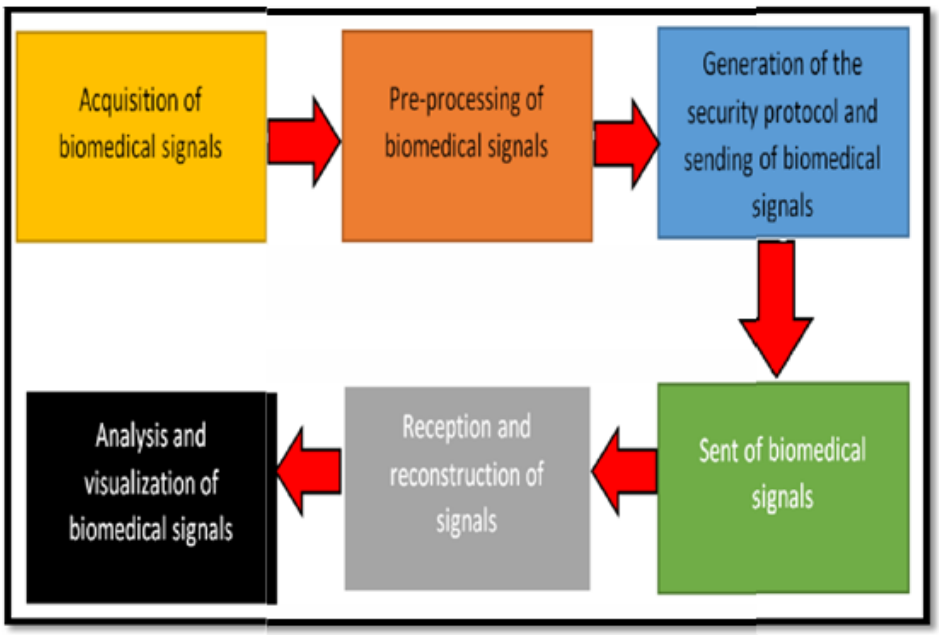

Figure 1: Block Diagram of the Proposal

2.1. Acquisition of Biomedical Signals

The acquisition of biomedical signals is related to the recording and storage of the signals that come from medical equipment. The recording can be done through the different communication

interfaces that the medical equipment has to export the signals; these can be USB, RS232 among others.

2.2. Pre Processing of Biomedical Signals

The processing of the information consists of being able to order the data from the saved record, for which it is ordered according to an order: patient information, health center information and location of the center, type of exam performed and date of the exam. According to the following figure:

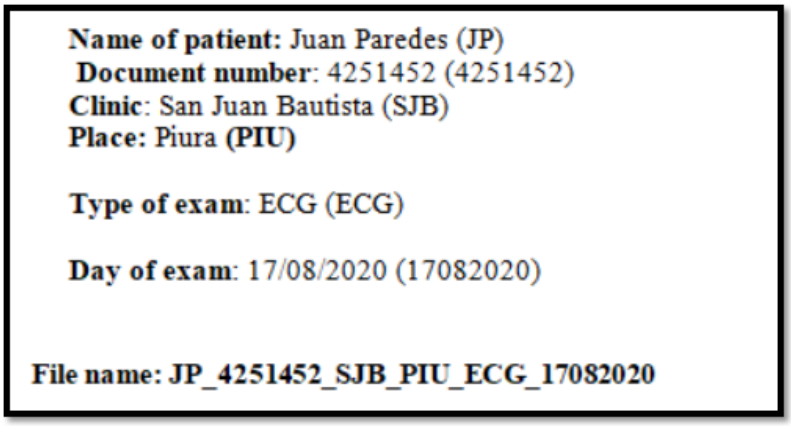

Figure 2: Record data

2.3. Generation of the Security Protocol on Sending of Biomedical Signal

To ensure the security of the information, it is necessary to carry out a validation process between the transmitting and receiving device, for which a communication assurance mechanism must be carried out by both parties, in such a way that we ensure the integrity of the information.

2.4. Sent of Biomedical Signals

The sending of the information is done through the XLM protocol, for which it is organized according to the following order, as shown in the following figure:

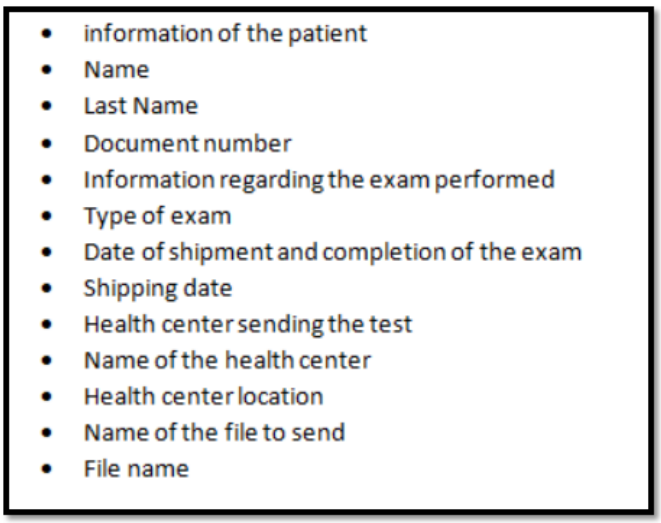

Figure 3: Organization of the information to be transmitted

2.5. Reception and Reconstruction of Signals

After receiving the XML file, the information is reconstructed in its initial state, for which the file is taken and the information is generated, in order to feed the various systems such as the electronic medical record.

2.6. Analysis and Visualization of Biomedical Signals

Having reconstructed the information, the following procedure consists in being able to exploit it, for which it could be visualized in the different systems, with the intention of being able to close the process; the exploitation of the information is a very important part in the process cycle of the recording of biomedical signals.

3. Results

The results that are presented, after having implemented the methodology, are related to the detailed description of the architecture, where it is explained from the registration of biomedical signals to the visualization in a health center, indicating all the processes to be carried out, according to the following image:

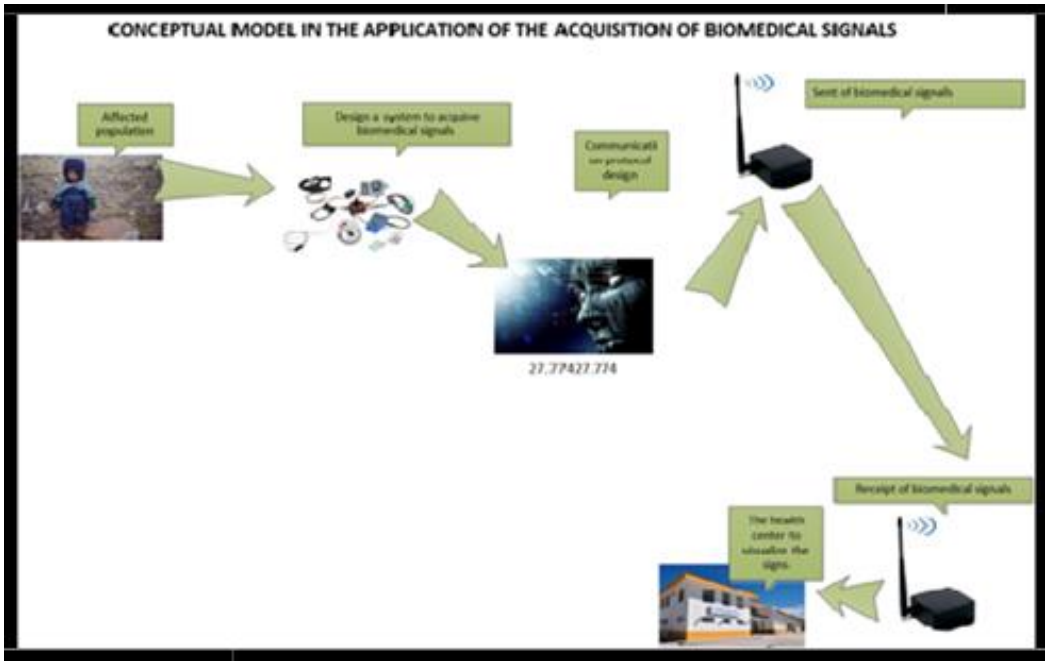

Figure 4: Conceptual Diagram of the Proposal

As a result of security, an example of the message content is presented in XML, with information about the patient and the exam performed.

3.1. Message Content in XML

<information of the patiente>
<personal information> Juan_Paredes_ 4251452
</personal information>
<test information>
<type of test> ECG
</type of test>
<date> 17082020
</date>
<clinic>
San Juan Bautista
</clinic>
<place> Piura
</place>
<name the file> JP_4251452_SJB_PIU_ECG_17082020
</name the file>
</test information>
</information of the patiente>

Figure 5: Xml message content

4. Conclusion

The conclusions that we reached at the end of the investigation, as well as having implemented the methodology, indicate portability through the use of the XLM protocol, for which it is necessary to have both protocols implemented both in the transmission stage and in the reception stage.

Depending on the internal structure of the equipment and the communication mechanism that you have, you can export the signals, an important requirement for the implementation of the methodology, it is necessary to be able to export the signal in digital format.

We conclude that one of the results of the implementation, we managed to democratize health, for this reason we developed the methodology to be able to bring health mechanisms to vulnerable populations, with which the methodology can be applicable and scalable.

5. References

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