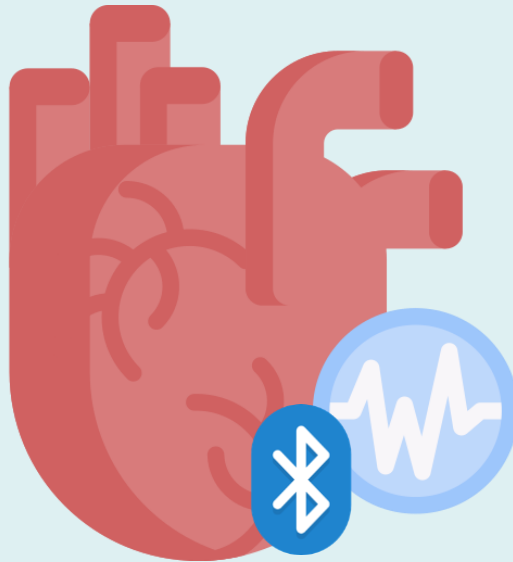


Project Documentation



CEU San Pablo University

Biomedical Engineer – Telemedicine

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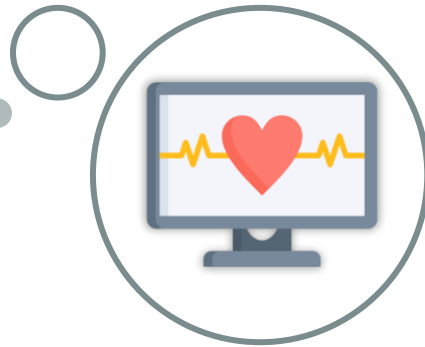
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What is the Purpose of this APP?

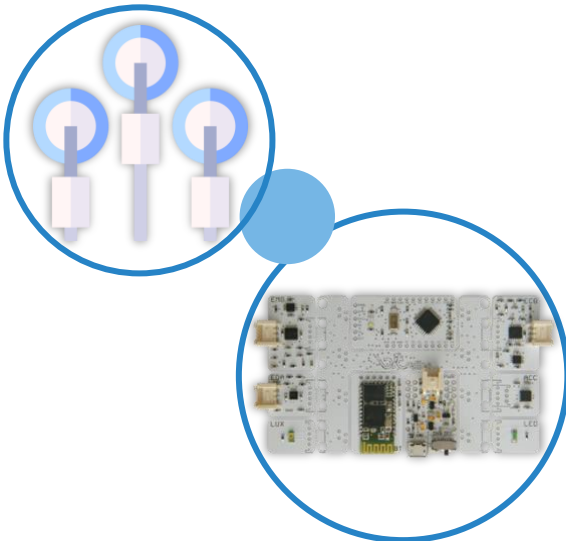
What is intended to be achieved with this application is to help patients with arrhythmia to monitor this condition from the comfort of their home. With this application, the patient can be connected to the doctor, allowing the latter to assess the perceived heart rhythm. This can be measured and sent, attached to a description of the signs and symptoms, to a server located in the hospital. The clinician will be able to access this information and supervise the patient's condition. The registration of the physiological parameter (ECG) is made by a BITalino device, which will be connected to the application via Bluetooth. For a better understanding of the project, below you will find a brief explanation about arrhythmia.



What is an Arrhythmia?

An arrhythmia, or irregular heartbeat, disrupts the normal rate and rhythm of the heart. While occasional variations in heart rate are normal, frequent irregularities may indicate inadequate blood pumping, causing symptoms like dizziness. Treatable with medication or procedures, untreated arrhythmias pose risks of severe conditions such as stroke, heart failure, or cardiac arrest, the latter being a life-threatening situation where the heart suddenly stops beating and requires immediate intervention within minutes to prevent death.

Now that this is clarified, before running the application, it is necessary to consider certain conditions for its proper operation.



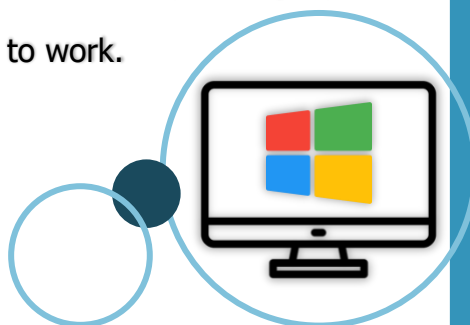
Requirements of the APP:

- BITalino and Electrodes:

In order to record a signal and send it to the server, the patient must use ECG electrodes along with a 3-lead cable that is suitable for the BITalino device, which has to be connected to the application via Bluetooth.

- Operative System:

The person intending to run the client and server applications needs to have a computer with Microsoft Windows as the operating system for this to work.



How to Start the APP?

First, you should run the application called "Server," which will remain open, waiting to receive clients. Next, you will need to run the application called "Client," for which three credentials have already been created. The first one is for the system administrator, the second is for the clinician, and the third is for the patient. The respective usernames and passwords for these are as follows:

username: admin **password:** admin

username: clinician **password:** clinician

username: patient **password:** patient

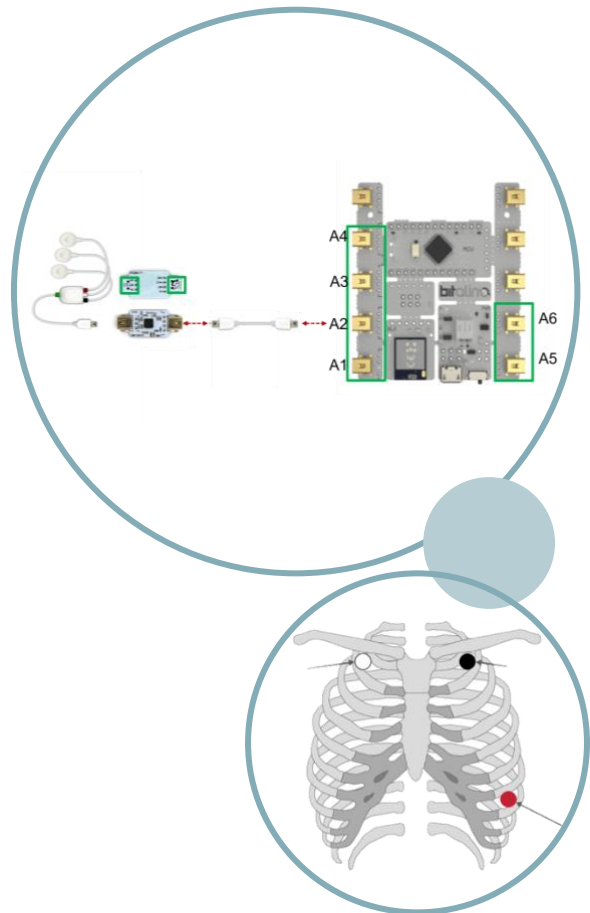
It's important to note that, by default, the client and server have assigned the loopback address as their IP address to establish local-level communication. If you wish to change the IP address of the client and server, you should use the following commands, respectively:

```
Client.exe <ip>
```

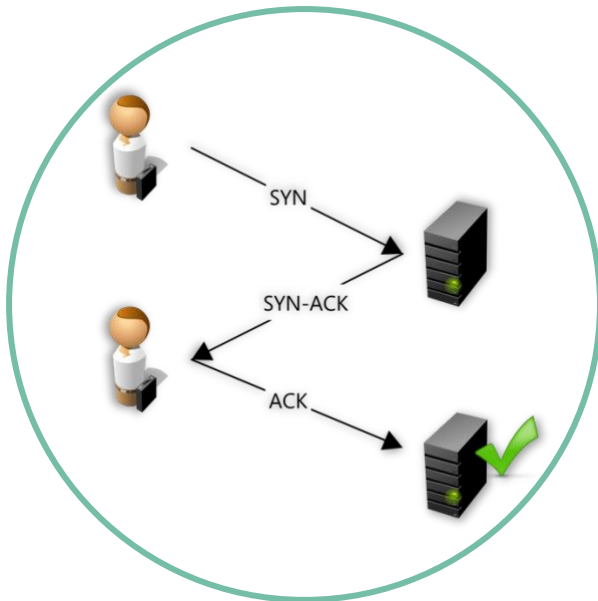
```
Server.exe <ip>
```

Actions Available:

- Patient:
 - Log in.
 - Place a new medical report. The patient could record an ECG signal, download the OpenSignals APP, and assure the BITalino is ready to record. The patient must connect the cable of the electrodes in the A2 channel that corresponds to the ECG measurement. The electrode's correct position for an ECG is the following: the white electrode under right clavicle, mid-clavicular line within the rib cage frame; the black electrode under left clavicle, mid-clavicular line within the rib cage frame; and the red electrode on the lower left abdomen within the rib cage frame.
 - Log out.



- System Administrator:
 - Log in.
 - Create a new user.
 - Delete selected users.
 - Shut down the server.
 - Log out.
- Clinician:
 - Log in.
 - Show patients.
 - Add comments to reports.
 - Show reports.
 - Log out.

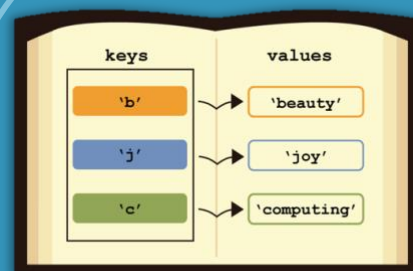


Communication Protocol between Client and Server:

To establish communication between the server and the client, TCP was chosen as the communication protocol. Similar to UDP, TCP is an Internet protocol situated in the transport layer of the OSI model. TCP ensures reliable transport of bitstreams between applications, in contrast to UDP, which provides an unreliable transport level for datagrams. This implies that data will reach its destination flawlessly without errors and in the same order in which it was transmitted, even in cases where lost or damaged packets need to be retransmitted.

This program was developed using dictionaries in Python version 3.11, and to elucidate the communication diagram between the client and server, it is necessary to first explain this concept.

In Python, a dictionary is a versatile data structure capable of storing various types of information, such as text, floating-point numbers, lists, and other dictionaries. The data in a dictionary are stored using a pair of values that are always linked. One is called the Key, which allows us to locate a piece of data within the dictionary. Each Key is associated with the data or value it represents.



In our program, an example of this is a dictionary with two fields: the "control" field and the "content" field. The "control" field contains the action the client wishes to perform with the server, while the "content" field carries the necessary information for the server to respond to the client's request. For instance, if the "control" field indicates "add_comments", the "content" field contains the report ID. This allows the server to search for that ID in the database and respond to the client's request accordingly. Down below, you will find the diagram associated with this example.

