ICU Monitoring Center

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Abstract—The current article proposal is to introduce the development of an application of computer network within the hospital setting.

Keywords—ECG, HL7 Standards, Python, Twisted

1 Introduction

THIS Technology is increasingly present in the medical field and aims to improve the care that is offered to patients in healthcare facilities. It also allows diagnoses to be faster and accurate, besides the option for less invasive treatments. On this scenario, a modern Intensive Care Units (ICU) has many equipments essential to support patient's life, such as multiparameter monitors, mechanical ventilators and infusion pumps, for instance. Thus, it becomes a complex task to analyze all the data that is provided by these devices, especially considering the fact that the routine of doctors and nurses in the ICU is not just the care of patients, there are also administrative tasks to be carried out, for example. In addition, each patient may have a clinical picture different from the other, making the environment more complex and less predictable. All these variables are likely to complicate the care that is offered to patients. In this scenario, the idea of creating a Central Monitoring in the ICU becomes interesting because it allows to concentrate the information of the various devices connected to each patient in a single room for one or more analysts may be on duty , checking and analyzing patterns and critical clinical inpatient in each location. The purpose of this project is to develop a central monitoring vital signs. Data will be obtained through network from each device and displayed on the screen , so that all patients can be observed in real time, simultaneously. This center will also include alarm and warning capabilities, plus allowing statistical studies correlate the visualized data, and also try to predict possible anomalies in the cardiovascular system of patients according to the electrocardiographic signal (ECG) of the same . The center can also issue reports and advice to the medical staff , so that it may update with new information, make new analyzes of the clinical picture and can get the best strategies in the treatment of patients. The implementation of a core like this in a real environment of a UTI can bring benefits to the management of this environment , which as previously mentioned , is very complex and involves many variables that make it unpredictable. From the information extracted is possible to distribute the routines of nurses , for those patients whose condition proves more unstable to have a preferential service . Correlating the data enables a deeper analysis of patient outcomes in the ICU and alarm system to detect and forecast faster adverse events and reactions , which can ensure better preparation and greater flexibility in patient care.

1.1 Subsection Heading Here

Subsection text here.

1.2 Subsection Heading Here

Subsection text here.

2 METHODOLOGY

The methodology goes here. - Descrio do projeto - Apresentar e justificar a placa escolhida - Justificar a utilizao de Python - Arquitetura do sistema - Montar um diagrama de blocos - Dividir em duas partes: Simulador de sinais vitais e central de monitoramento

2.1 Programming

2.1.1 Python

Python description

2.1.2 Twisted

Twisted description

2.1.3 PyQt

PyQt4 is a blending of Python programming language and the Qt library. Consists on a toolkit for creating GUI applications and it is implemented as a set of Python modules. Qt is a cross-platform application development framework, that is implemented in C++ and possesses objected-oriented concepts. The tool enables the creation of an interface with different visual objects such as labels, text boxes, buttons, and graphics in order to meet the needs of the current project.

2.2 Vital signs simulator

- Apresentar o que um monitor multiparamtrico
- Quais so os principais sinais vitais monitorados
- Descrio de como foi desenvolvido
- Desenvolvimento de API's
- Desenvolvimento da interface

2.2.1 Graphical User Interface

Consists of a form that displays simulated data of a patient: Patient's name, blood pressure, SpO2(saturation of peripheral oxygen), temperature, heart rate and monitor's ID, are displayed on seperate text labels while the patient's EKG data is presented in graphic view. When the monitor simulator application starts running it initiates the patient's monitor. While in execution the program keeps updating the application view with patient's measures.

2.3 Central monitoring

- Desenvolvimento de API's
- Desenvolvimento da interface

2.3.1 Graphical User Interface

The ICU Monitoring Center is the main interface of the application. In the center is the main part of the application: the central monitors, the detailed view of the monitor and for last the settings. Those options can be switched through tabs. At the monitors The central display provides data for each instantiated monitor as soon as they establish connection. The monitors are arranged in tabular form. The idea is that the user can see a brief of data for each patient and observe whether each parameter is within the specified limits. If one reaches a given threshold value that was previously provided, a visual alarm is issued in order to highlight the region that contains the information of this patient. The specific parameter that triggered the alarm is also highlighted in order to inform the user which is the parameter that is in critical condition.

At the top of the window there is a menu bar where is possible to open or close the connection with the network and at the bottom of the form, a status bar provides information regarding the connection

2.4 HL7 Standards

2.4.1 Purpose

The Health Level Seven (HL7) is an ANSI Standard for electronic data exchange in health care environments, in special for inpatient acute care facilities, like hospitals. The term "Level 7" refers to the highest implementation protocol level for a definition of a networking framework as presented by the International Organization of Standardization. The standard was originated from and is maintained by a committee of health care providers, vendors and consultants, which is established since 1987. The aim of this committee is to simplify the implementation of software interfaces between computer applications that deal with patient data. There are several groups, spread internationally, involved in the development of the

HL7, including in Brazil, because of that is expected from the medical devices manufactures to follow this important convention, when building devices doted of network interaction. Based on that, is this work an special type of HL7 message was used to transport the data from the monitors to the monitoring center, using the 2.7.1 version, which is the latest in the version 2 stream.

2.4 Structure

The HL7 protocol is based on the exchange of messages, preventing the necessity of keeping a connection between the communication endpoints. There are different types of segments which are arranged in many ways to build specific messages depending on the nature of information which is being transmitted. Some basic segments are the MSH, which is the header of the message, and the PID, presenting the patient identification. The segments can be repeated in the same message and they can also be nested. The messages contexts are broad, covering information from chemical analysis passing thought image annotations to financial transactions.

2.4 ORU Observations

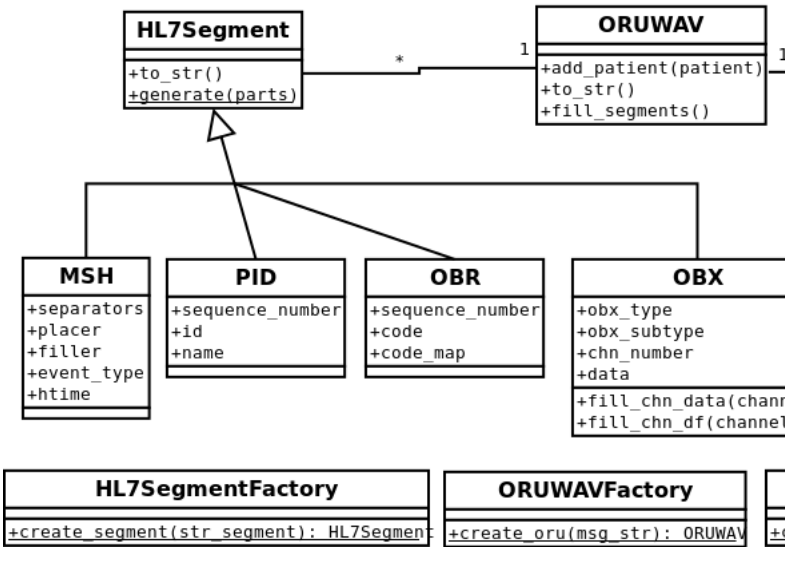
There is an special chapter in the Standard for observations, which is a type of message that can be used many a variety of information, including waveform data. The observations, as other messages, can be sent in two ways, when solicited by the server, or not. When using the unsolicited way, the sender should know the network information required to send the message, like IP address and supported port number. In the HL7 the unsolicited observations are called ORU Observations. The specific observation for waveforms are the ORU WAV Observations, this is the category used to encapsulate data into message. The following table shows the segments required to compose an specific form of ORU WAV messages, the ORUW01. It is possible to send more than one group of observations within one message.

TABLE 1
Required segments

Segment	Purpose
MSH	The header, containing the type of message, field delimiters, participant devices and the date
PID	The patient identification, containing the name and unique ID
OBR	The observation description, including the filler and requester ids
OBX - CD	The first observation containing the waveform channel details, like range and measurement units
OBX - DTM	The second observation containing the sample time information
OBX - NA	The last observation containing a sequence of data

2.4 Message Parser

In the application, a parser handle the creation of messages from application domain objects, and the converse as well. One class called Patient is used in the application to hold the data of the vital signals, objects of this class are created in a vital signal simulator and then turned into message by the parse. While in the monitoring center the message is received and then converted to Patient using the parser again. The following class diagram shows the architecture of the data organization and message creation, note that only important methods and attributes are shown, for brevity sake.



3 RESULTS

The results goes here.
- Apresentar as interfaces

- Funcionamento do sistema

4 DISCUSSION

The discussion goes here.
- Discutir os resultados apresentados
- Performance do sistema
- Robustez
- Performance da placa

5 CONCLUSION

The conclusion goes here.
- Consideraes finais sobre o trabalho
- O que aprendemos
- Comentar sobre o desenvolvimento de uma central de monitoramento de UTI

APPENDIX A
PROOF OF THE FIRST ZONKLAR EQUATION

Appendix one text goes here.

APPENDIX B

Appendix two text goes here.

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The authors would like to thank...

REFERENCES

[1] H. Kopka and P. W. Daly, *A Guide to LaTeX*, 3rd ed. Harlow, England: Addison-Wesley, 1999.

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Michael Shell Biography text here.

John Doe Biography text here.

Jane Doe Biography text here.