Graphical User Interface for Multi-parameter Medical Sensor Device

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Introduction

The purpose of this research work is to design the *Graphical User Interface (GUI)* for the **View and Control Terminal (VCT)** of the Wireless Patient Monitoring System. The GUI will be used to observe the health conditions of the patient and control the device to act accordingly.
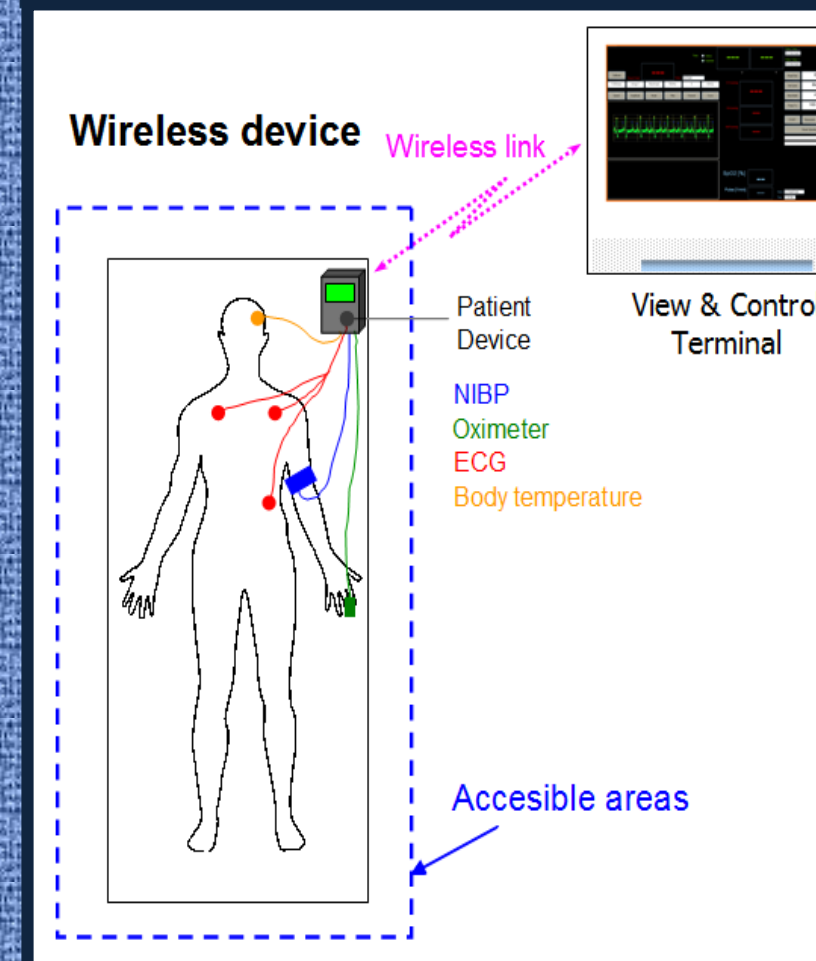
Background

- Conventional patient monitoring systems limit patient *mobility and degree of access* since they require wirings between patients and bulky devices.
- Similar to the conventional system, in our system, patients' vital signs will be tracked continuously in real-time to identify any deterioration in patients' health and trigger appropriate responses.
- With its wireless design, the developed system aims to enhance patient mobility, degree of access, transfer speed and convenience, and thereby improve hospital workflow efficiency, and save time and money.

Existing Commercial Systems

Philips Intellivue MX40

ViSi Mobile Monitors

Drager Infinity M300

EDAN Vital Signs Monitor M3

- Some devices measure *one* or *few* vital signs, which leads to difficulties in *managing* multiple interfaces.
- Some are *bulky* and *heavy* which decreases *mobility*.
- *Inflexible* interface, hence cannot be *optimized* for individual viewing.
- Cannot be further *modified* or *developed* unless new model is released.
- *Incompatibility* with other existing devices such as laptops, smartphones, tablets, etc.

Proposed System

Wireless device
Wireless link
Patient Device
View & Control Terminal
NIBP
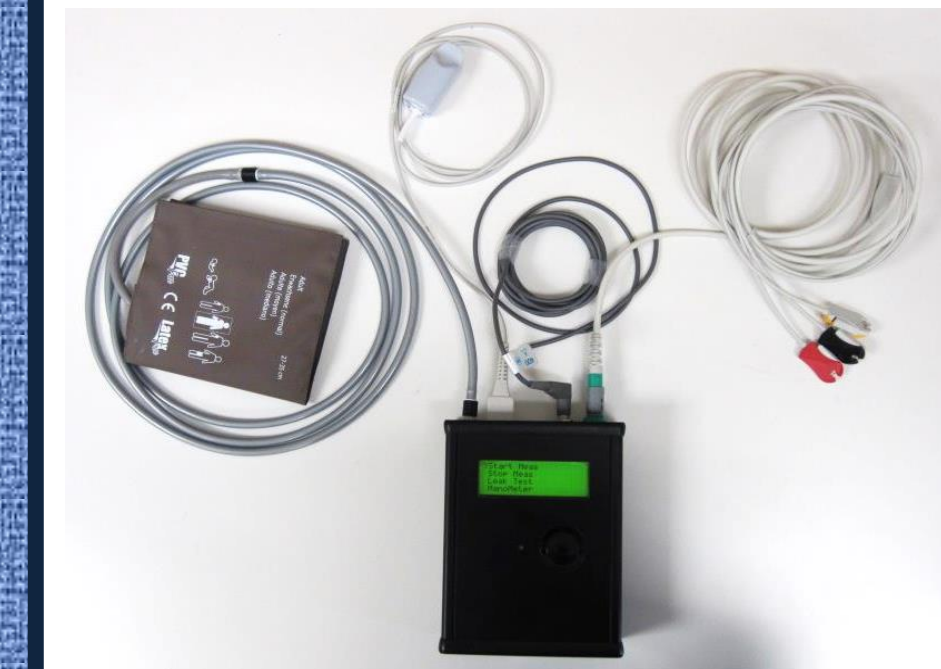Oximeter
ECG
Body temperature
Accesible areas

Advantages:

- No wire between the patient and the monitor.
- Medical staff can access patients 360º around the bed.
- Patients can move/can be moved easily without detaching/re-attaching probes.
- Immediate monitoring after patient arrives at a new location.
- Patients can be monitored from any networked terminal at any time.

Design & Components
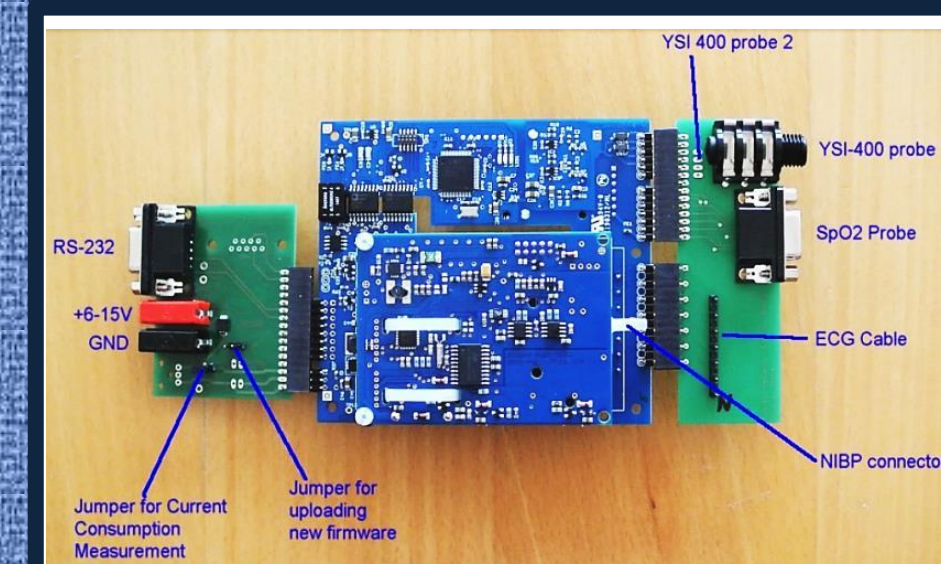
The Microprocessor for the VSD

Prototype of the VSD

A. Vital Sign Sensor Device (VSD):

- A portable device that can be attached to a stretcher/wheelchair or carried by a patient.
- Monitors and stores vital signs:
  - Non-Invasive Blood Pressure (NIBP)
  - Pulse Oximetry (SpO$_2$)
  - Electrocardiography (ECG)
  - Body Temperature
- Can be controlled and configured using the LCD touch-screen on the device.

VSD — Serial COM (RS-232) — VCT
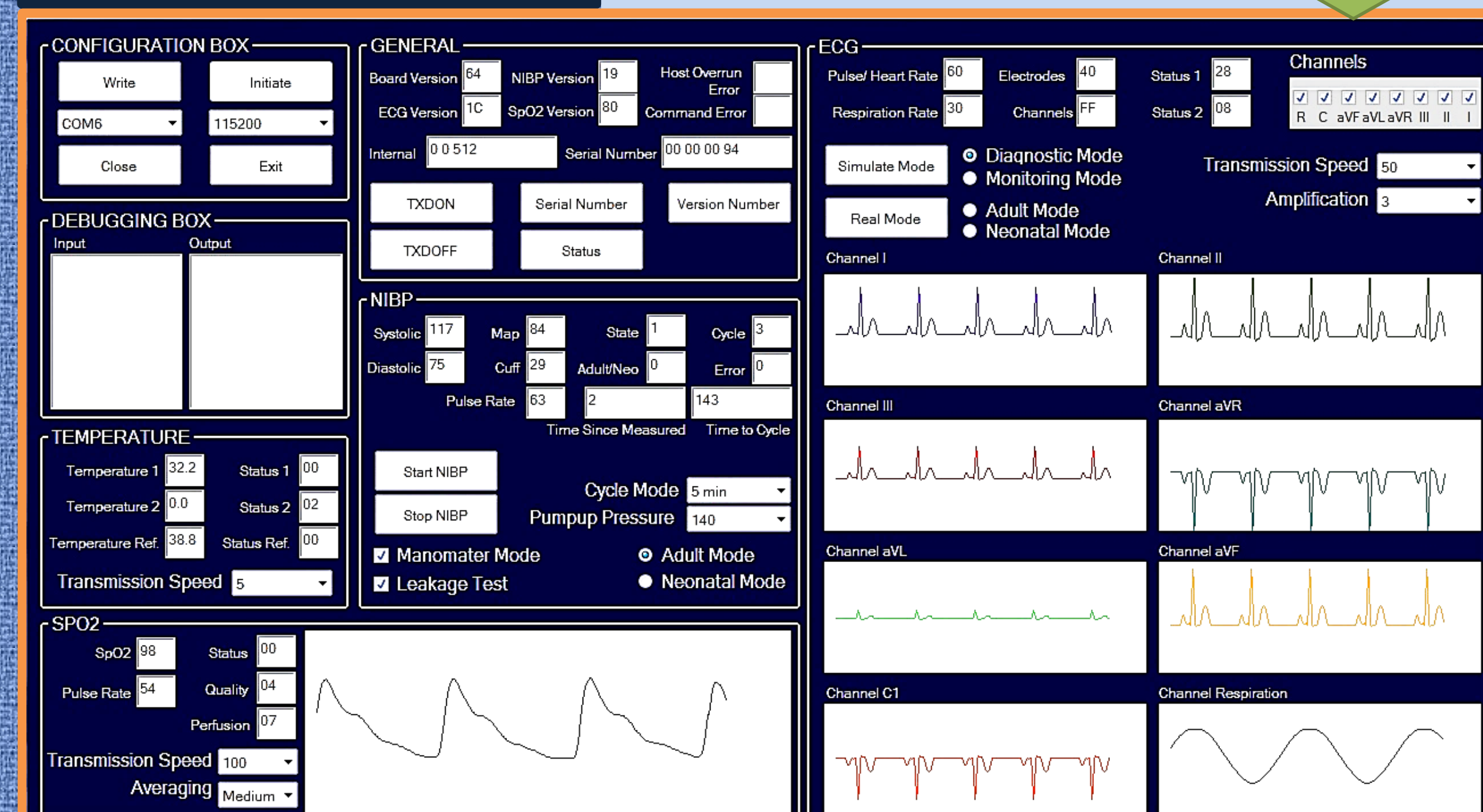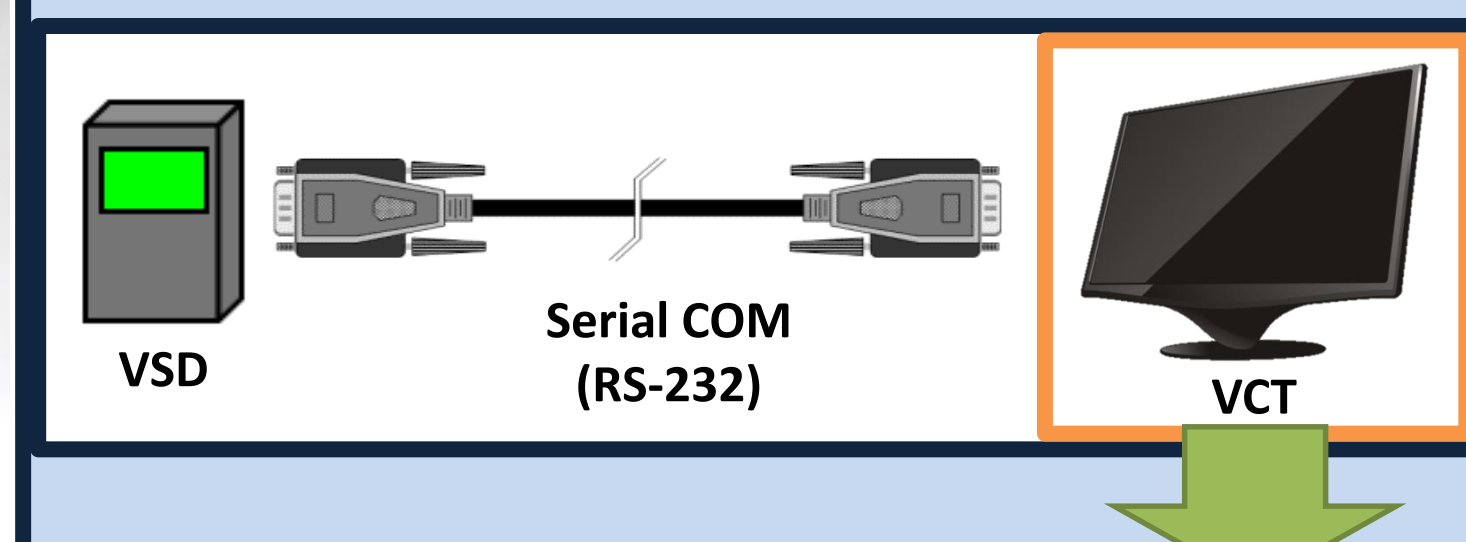
Prototype of the Graphical User Interface (GUI) for the View and Control Terminal (VCT)

B. View & Control Terminal (VCT):

- Displays the medical conditions of any patient of interest when connected to the patient's VSD.
- Can remotely control and configure VSDs.
- Can be used on *any* device with a **Windows** platform such as a PC, laptop, smartphone, tablet, etc. connected to the LAN or internet.
- Flexible and can be easily optimized for each individual devices.
- Provides a platform for experimental use and tests in the hospital.
- Allows further research and development of new applications for the hospital.

Serial Transmission Protocol

- The host connection to the board is a serial communication interface (where one bit is sent one at a time).
- The operating configuration of the transmission:
  - 115,200 baud rate
  - 8 data bits
  - 0 parity/check bit
  - 1 stop bit
- The device sends all the data received from all the four sensors in a single continuous stream of bytes.
- The stream of bytes has a certain protocol which consists of code blocks.
- Data from the respective sensors had to be unmasked and interpreted from the code blocks.

Code Block

Header				Data Block (Payload data)	End	
STX (0x02)	Bytecount	Identifier Low	Identifier High	Data (1-8 Byte)	CRC-8	ETX (0x03)

Conclusion

So far the *prototype* for the *Graphical User Interface (GUI)* of the **View and Control Terminal (VCT)** has been developed and tested. The test results have been proven to be *positive*. This GUI can be used as the basis to further develop multiple GUIs of specific design and structure to meet the requirements of individual viewing devices and the viewer's preferences. This would make the VCTs specialized for specific purposes.

Future Work

Radio Transmission
VSD
Gateway
Server
Database
Terminals (VCTs)
Remote Devices
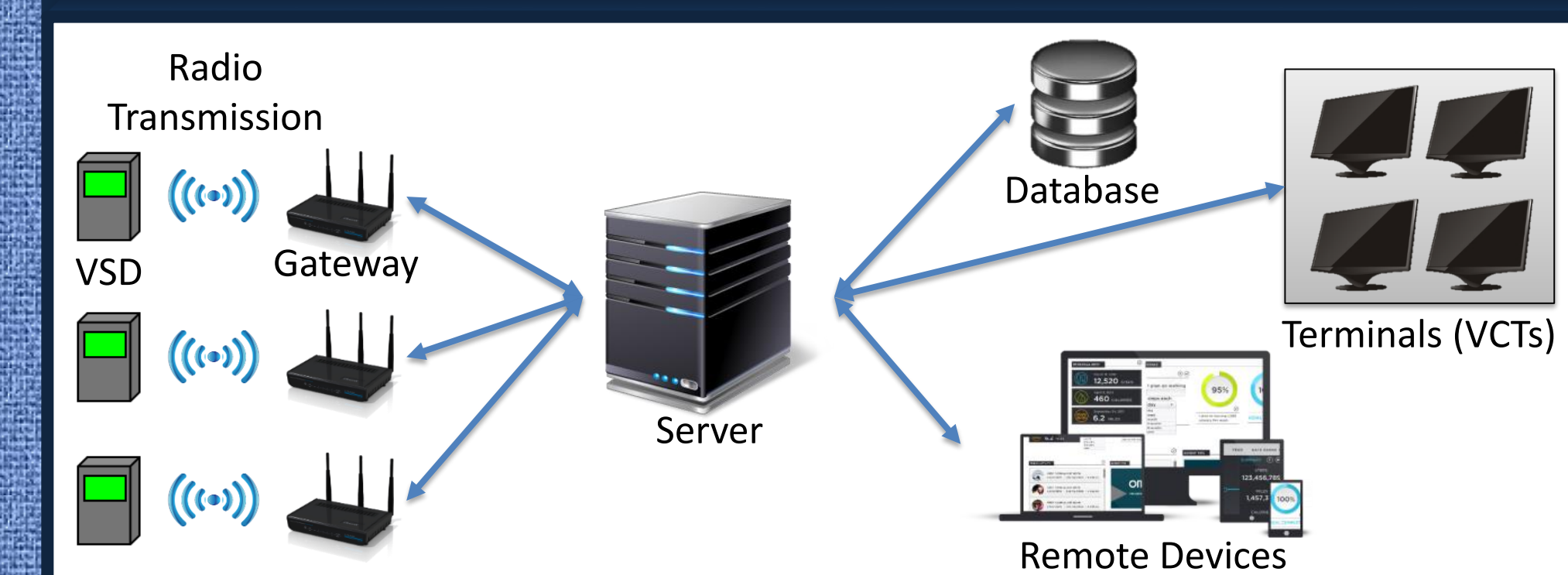
Server & Database:

- The medical data from all the VSDs will be relayed to the *server* through *radio transmission* and *gateways*.
- Different *terminals (VCTs)* with connection to the server will enable remote monitor and control of VSDs, allowing nurses and doctors to work efficiently and react promptly in case of an emergency.
- The online *database* will store and organize all the medical measurements. These data can be analyzed over a long period for better healthcare and diagnosis.
- The server can also be accessed from *remote devices* with internet connectivity (smartphones, tablets, etc.) to view the medical data.