SRS: Heartrate monitor

Group: Knight

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1 Introduction

This document contains the software requirement specification for the controller of a heart monitoring device build by group Knight. It will explain the purpose, the features and the interfaces of the software. The workings of the software are explained as are the constraints under which operates. This document is intended for users of the software and potential developers.

The purpose of this device is to monitor the heart of a hospital patient. It consists of multiple sensors that accurately measure the pulse, oxygen levels and blood pressure of the patient. The interface of the heart monitor is a display which shows the values of the readings and when appropriate a warning. This display is updated every 0.3 seconds. The possible warnings, explanations of the warnings and when they occur are explained in the rest of the document.

2 Controller values

The controller has the ability to monitor pulse, oxygen level, and systolic and diastolic blood pressure. The device will give appropriate warnings corresponding to the severity of the readings. This section consist of four parts. Each part will cover one of the aforementioned measurements. In every section the possible values for each measurements are given and the warnings explained.

2.1 Pulse

Your heart rate, or pulse, is the number of times your heart beats per minute. Normal heart rate varies from person to person. Knowing yours can be an important heart-health gauge.- **American heart association**

The values for the 'pulse' measurement are positive integers. Table 1 (pulse measurements) shows the value ranges for the pulse and their meanings.

2.2 Oxygen

When blood oxygen levels drop below normal, a condition known as hypoxemia occurs. Hypoxemia is determined by measuring the amount of oxygen present in a blood sample taken from an artery, or an arterial blood gas. It can also be estimated using a pulse oximeter, a small device that attaches to your finger and measures the oxygen saturation level in your blood.

Normal arterial oxygen levels as measured by an arterial blood gas range from 75 to 100 millimeters of mercury (mm Hg). According to the Mayo Clinic, values under 60 mm Hg usually indicate that a person needs supplemental oxygen. Normal oxygen saturation levels as measured by pulse oximetry range from 95% to 100%. Values under 90% are considered low (Kent et al., 2011).

What is unsafe? Unsafe oxygen levels are according to Medicare guidelines when your arterial blood gas is at or below 55 mm Hg and/or your pulse oximetry reading is at or below 88% under certain conditions. This doesn't mean that a pulse oximetry reading of 90% is safe for you. Whenever blood oxygen levels drop for more than a short period of time, your organs and tissues don't get the oxygen they need to function properly. Over time, this can lead to serious health consequences, such as pulmonary hypertension (high blood pressure in the lungs) and polycythemia (increased amount of red blood cells).

The measures we use for the system is as following; less then 80 is very low, less then 90 is low and more than 90 is normal.

2.3 Blood pressure

The strength of the blood pushing against the sides of the bloodvessels is your blood pressure. **- American heart association**

When your heart beats, it pumps blood round your body to give it the energy and oxygen it needs. If your blood pressure is too high (hypertension), it puts extra strain on your arteries (and your heart) and this may lead to heart attacks and strokes. Systolic blood pressure indicates how much pressure your blood is exerting against your artery walls when the heart beats Diastolic blood pressure indicates how much pressure your blood is exerting against your artery walls while the heart is resting between beats.

Table 1 shows the boundaries for the blood pressure values. The possible messages on the heart monitor display regarding blood pressure are explained below:

- Low Blood pressure: A low blood pressure has been recorded for a longer period of time. Please consult a medical professional:
- Okay: Everything is okay.
- Hypertension STAGE 1: Mild hypertension. Contact your doctor for a phsyical examination.

- Hypertension STAGE 2: Moderate hypertension. Contact your doctor as soon as possible.
- Hypertension CRISIS: Call ambulance immediately.

Table 1: Blood pressure ranges. Values taken from www.heart.org

Blood pressure category	Systolic pressure		Diastolic pressure
Low	<90	or	<60
Normal	<120	and	<80
Elevated	120-129	and	<80
Hypertension STAGE 1	130-139	or	80-89
Hypertension STAGE 2	> 140	or	> 90
Hypertensive CRISIS	> 180	or	> 120

Warnings

In the following table we have stated all combinations worth warning about, where the last column states the emergency level. Note that oxygen levels can not be high neither can they be very high since 95%-100% oxygen would be perfect. Due to lack of space, the warnings are categorized letters.

Pulse	Oxygen	Sys. pressure	Dia. pressure	Warning
very low	”	”	”	B
very high	”	”	”	B
high or very high	”	high or very high	high or very high	A
low or very low	”	low or very low	low or very low	A
”	”	low	low	D
”	”	high	high	D
low	”	”	”	C
high	”	”	”	C
”	low	”	”	C
”	very low	”	”	B
low	low or very low	”	”	A
”	low	low	low	B
”	very low	very low	very low	A

Table 2: Warnings corresponding with the sensor values (” = normal).

All warnings and their corresponding letter:

- A. Call ambulance immediately.
- B. Contact doctor immediately.
- C. Make doctors appointment for physical check.
- D. Pay attention to your vitals

Bibliography

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- Mayo Clinic. Hypoxemia (low blood oxygen). Consulted on: May 3, 2018
- Kent, B. D., Mitchell, P. D., and McNicholas, W. T. (2011). Hypoxemia in patients with COPD: cause, effects, and disease progression. International Journal of Chronic Obstructive Pulmonary Disease, 6, 199–208. http://doi.org/10.2147/COPD.S10611.