Heart Rate Monitoring

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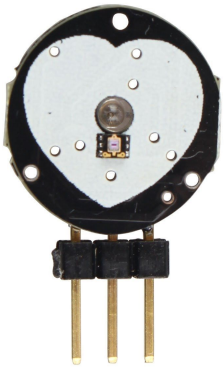
Project:

We made a Heart Rate Monitor using:

- An STM32F429
- An Arduino Nano
- A Heart Sensor MAX30100



Our project uses the cardiac signal given by the Heartbeat sensor to compute the BPM of a patient and to display the cardiac signal and the BPM on the screen of the STM32F429 board. In addition, we make the led blink according to the heartbeat.

We had some difficulties in using the Analog ports of the board to read the sensor. So we used an Arduino Nano to read the sensor's output and to send it by Uart to the STM32F429 board.

Since the sensor used is not very accurate, the measurement does not correspond to the real Heart Pulsation. We tried the AD8232, but the given cable seems to not work.

The project use Ada_Drivers_Library from AdaCore
https://github.com/AdaCore/Ada_Drivers_Library.
We included files from serial_ports example: message_buffers.adb
serial_io.adb
serial_io-blocking.adb (We added a function Get_Uart_Value to get data as Uint16 instead of String)
src/main.adb is the main loop that retrieves values from Uart and display the graph and BPM on the screen.
src/display_graph.adb contains function to display an array of values on the screen as a graph.
src/bpm_compute.adb are the function to compute the BPM from the data of the sensor.
The Arduino folder is the code used to send the data from the sensor to the STM32 using Uart.

Contracts:

src/display_graph.ads contains some preconditions to check that the inputs of the functions are valid before displaying them on the screen.
src/bpm_compute.ads give some postconditions to verify the behavior of the BPM computing.