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Forecasting potential Health Threats using Machine Learning

A Hardare / Software approach

[Nishant Ramakuru, Yash Deo, Devaharsha Meesarapu]

***Abstract*—The idea proposes that an amalgamation of hardware input/output with the right software can be used to forecast and potentially avoid future health threats.**

***Keywords*—Health , Machine Learing , Hardware**

I. Introduction

The proposed work describes the idea that an efficient amalgamation of hardware and software can be used in order to potentially predict particular health threats. The uniqueness of our approach is the use of machine learning which will build upon a set of guidelines and tune the predictive model to each individual patient making its predictions for that particular patient more accurate rather than having a basic set of rules for all the patients as a whole.

II. Hardware

The hardware used in this project are used to obtain the vitals of a human i.e. The patient wearing the device in which the sensors are embedded. The main Processor used in an Intel Edison processor and Arduino microcontroller is used to interface the sensors with the processor used. Hence there are various peripherals attached to it. The detailed hardware description is given below.

A. Controller

1)The Arduino Uno R3 is a micro controller board based on the ATmega 328P.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs. Additionally, it supports a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the micro controller. The Uno is compatible with most shields designed for the Arduino/genuino boards. The Arduino Uno 328p is programmed using the Arduino Software (IDE), Integrated Development Environment..

Figure: Arduino Uno

2) Intel Edison: The Intel Edison is a computer-on module designed with two different processors built in to get better performance. The module is designed to be as small as a SD card and contains dual core Intel Atom CPU at 500MHz and Intel Quark micro controller at 100MHz.The module comes in a 70-pin flat package with a 70-pin Hirose connector to be connected to different available breakout board. It contains everything needed to support the micro controller. The Intel Edison can be programmed using Arduino IDE (Integrated Development Environment) and also supports C++, Python, etc.

Figure: Intel Edison

B. *Peripherals*

- AD8232 is an integrated signal conditioning block for ECG and other bio potential measurement applications. It has incorporated amplifier, embedded micro controller and filters. This design allows for an ultra-low power analog-to-digital converter (ADC) or an embedded microcontroller to acquire the output signal easily. To improve the common mode rejection ratio (CMRR), AD8232 has designed amplifier for driven lead such as Right leg drive (RLD). AD8232 is a Heart Rate sensor module. It comes with either two or three electrodes. Avoid combining SI and CGS units, such as current in amperes and magnetic field in ousted. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.

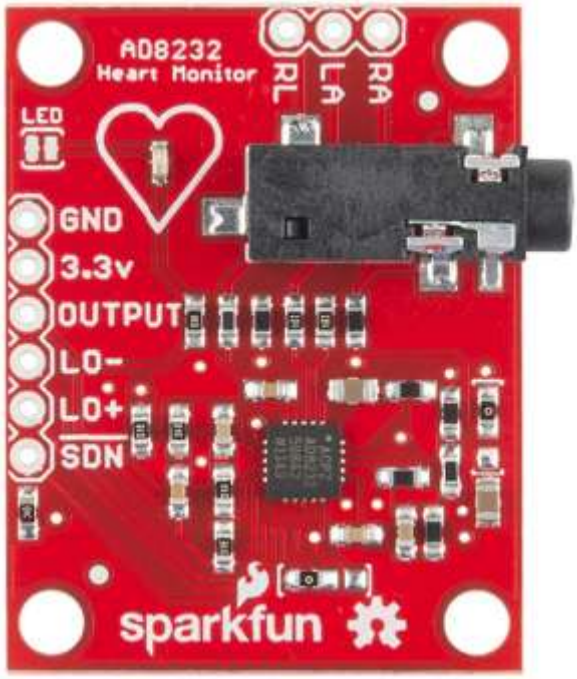

Figure: Heart Rate Sensor(AD8232)

- Temperature and Humidity sensor module DHT11 is a digital temperature and humidity measurement sensor. Among most sensors, DHT11 produces an output directly proportional to the temperature scale without any external calibrations. The DHT11 module is an integrated temperature and humidity sensor with an internal calibrations. The low output impedance and precision of DHT11 device makes interfacing to readout or control circuitry reliable and easier. It has four pins i.e. VDD, GND, DATA and NC. DHT11 has an in-built high performance 8-bit micro-controller which gives an accurate calibrated output.

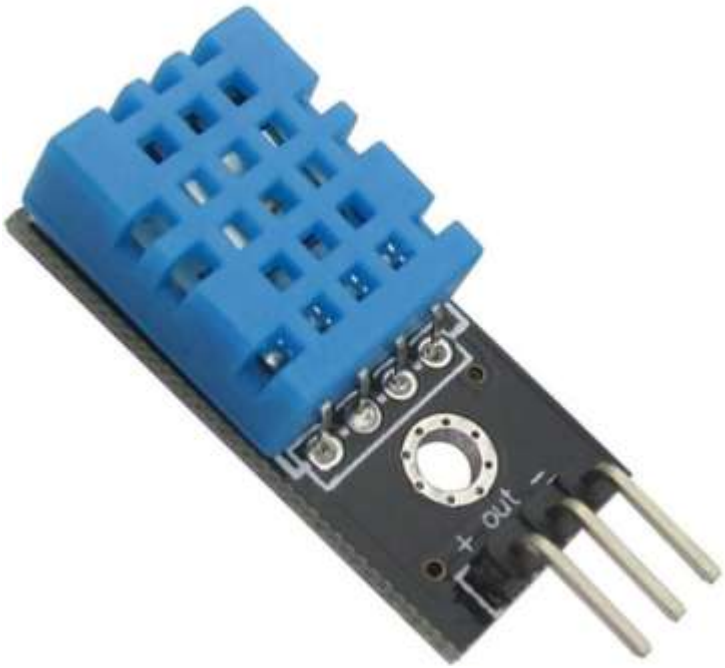

Figure: Digital Temperature and Humidity Sensor(DHT11)

The MAX 30100 is an integrated Pulse Oximeter and Heart rate sensor which comprises of two LEDs, a photo-diode and an optimized optics with an analog signal processor.

MAX 30100 operates from 1.8-3.3 V and can be power down with negligible stand by current. It has high SNR value providing robust motion with high sample rate and fast data output capability. It provides SpO2 level with the help of estimating the amount of oxygenated blood level by passing the IR light through the finger and the device is I2C compatible.

Figure: Pulse Oximeter Sensor(MAX30100)

C. *Algorithm*

We propose to use a variation of the SVM (Support vector machine) model with tuned hyper parameters to predict a health threat. This algorithm will already have a set of general rules as to when a health threat can occur (Eg. Sudden drop in heart rate / blood pressure could mean there is a particular threat). The machine learning model will be trained over these "rules" , in case a patient suffers from a health issue which the rules could/ could not predict , the readings from the hardware at that time are labeled "TO" (Threat Occurred) and then the previous 4-5 reading are labeled "BT" (Before Threat) while the rest of the readings will be labeled "N" (Normal) The algorithm will then be trained to predict "BT" values so that we can get to know if a threat is going to occur.

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