Love Watch 1702

ELEC 327 Final Project

Yoseph Maguire, Yovahn Hoole, Chandler Burke

# Abstract

Love Watch 1702 is a smart watch capable of measuring heart rate, oxygen saturation and most importantly the presence of loovvee. We three members of the Lonely Hearts Club, Yoseph Maguire, Yovahn Hoole and Chandler Burke have come up with a unique and state of the art system to help a user detect if they are in love by detecting a spike in heart rate. This research has far reaching consequences in protecting young ELECs from the distractions of college life.

# Pulse Oximeter

Oxygen is passed throughout the body by means of the hemoglobin in our blood. The hemoglobin within our blood can either be oxygenated (carrying Oxygen) or deoxygenated (not carrying Oxygen). The concentration of oxygenated vs. deoxygenated hemoglobin is the basis for pulse oximetry.

## Physical properties of Blood

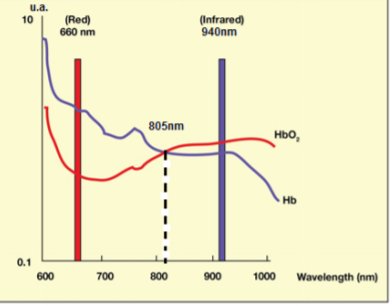
Pulse oximeters utilize the reflection and absorption of light to measure the oxygen saturation of a user’s blood. Oxygenated hemoglobin is distinctively red and deoxygenated hemoglobin is a distinctly dark blue. The optical properties of blood are highly dependent on the amount of oxygen within the body. When blood is exposed to a light source, the oxygenated hemoglobin content determines the amount of light that is absorbed and reflected back. As can be seen in *Figure 1* the absorption of red light dips when exposed to oxygenated hemoglobin while the absorption of Infrared light drops when exposed to deoxygenated hemoglobin.

Figure 1: Oxygenated vs. de-oxygenated blood light absorption of IR and Red

## Measurements

The pulse oximeter uses an LED and a sensitive photodiode to measure these differences in reflection of red and Infrared wavelengths to measure the oxygen content of blood. The photodiode converts the reflected light into an electric signal that is proportional to the intensity of the light and an ADC converts this into a digital signal.

### Heart Rate Measurements

To measure heart rate, the pulsatile nature of blood can be used. In systole, when the heart muscle contracts and pulsation is at its peak, the volume of blood in the tissue increases. The increased volume of blood leads to more light being absorbed. In diastole, less blood is present in the tissue. The reduced volume of blood allows for less light to be absorbed and more to be reflected back to the pulse oximeter. The MAX30105 uses an IR sensor to collect relative reflectance information which can be processed to obtain a simple heart rate metric.

# Hardware

The Love Watch 1702 utilizes MAX30105 particle sensor and an Adafruit 14-Segment LED Backpack driven by a HT16K33 chip.

### Adafruit LED Backpack

In order to output the estimated heart rate, we obtained a 4-digit 14-segment display that could accept I2C communication. We decided to use the 0.54'' 14-segment LED HT16K33 Backpack from Adafruit, as this can be used with I2C to create alphanumeric letters.

The controller can be controlled via an Arduino library, making it easy to interface with and update when necessary. The code allows for control over each segment of each block in the Backpack, making it useful for personalized messaging. Also, the LED's are very bright and adjustable. In short, this device is a good choice as it allows one to very quickly and efficiently output numbers using the I2C protocol.

### MAX30105 Particle Sensor

 The MAX30105 particle sensor include internal LEDs, photodetectors and ambient light rejection. The product is quite small and can easily be used for wearable devices such as the Love Watch 1702, fitting right under the wrist of the user. Furthermore the presence of ambient light rejection is an important feature for Love Watch since external light sources can easily interfere with the readings of the sensitive photodiodes needed to measure oxygenation. To preserve long battery life, the MAX30105 also allows for Ultra-Low Power operation.

Figure 2: MAX30105 Particle Sensor

# I2C Communication

Both the MAX30105 particle sensor and the Adafruit LED Backpack utilize I2C communication.

# References