Development of Disposable Probe Blood Oxygenation Monitor

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Introduction

❖ Pulse oximetry is a widely used, non-invasive method for monitoring oxygen saturation (SpO2) levels of the blood.

❖ Oxygen saturation is simply the fraction of the hemoglobin that carries oxygen relative to total hemoglobin in the blood.

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$$SpO2 = \frac{HbO2}{Hb + HbO2} \quad [1]$$

❖ The purpose of this project is to make a separable and disposable probe to be used for patients with highly infectious diseases such as COVID-19. Additionally, a main monitor is developed to observe the SpO2 levels in the blood.

System Description

❖Oxygen saturation (SpO2) is simply the fraction of the hemoglobin that carries oxygen relative to total hemoglobin in the blood.

❖Absorption of light at these wavelengths differs significantly between oxygenated and deoxygenated hemoglobin.

❖LEDs and the photodetector are placed facing each other so that the maximum amount of light can be detected.

❖The transmitted light is received by a photodetector.

❖Received signal is converted from analog to digital by a microcontroller.

❖Finally, the results are converted to SpO2 percentage.

❖With the help of a bluetooth module, data is transferred to the mobile app.

❖A fully disposable SpO2 sensor has been achieved by using a 5 pin connector to detach the sensor from the main circuit easily.

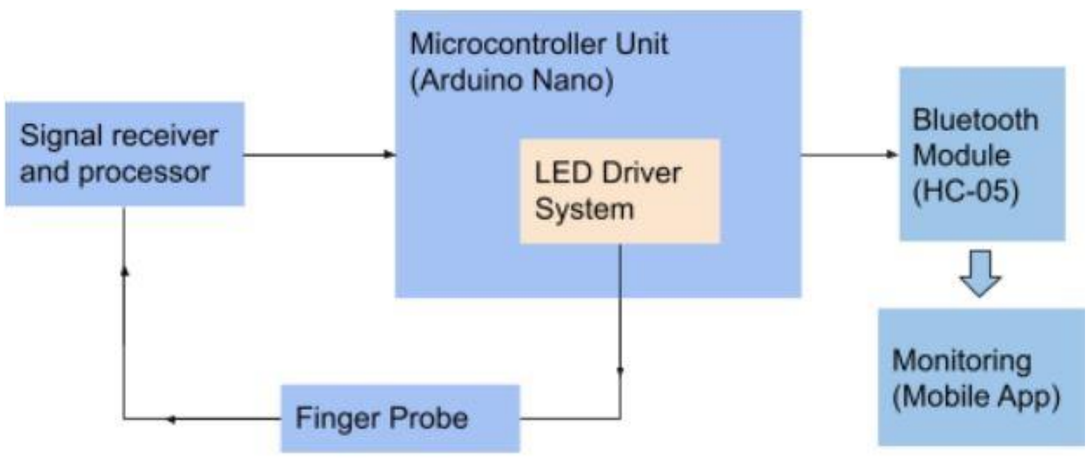

Figure 1: Overall system design.

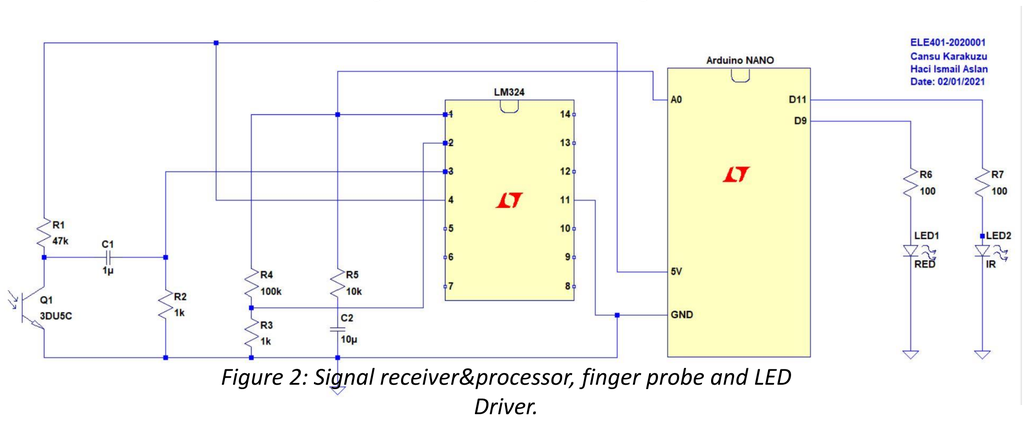

Figure 2: Signal receiver&processor, finger probe and LED Driver.

Application Areas

❖Application areas of disposable SpO2 sensors are mostly related with medical issues such as patient monitoring services. As a multiplier effect, the importance of these sensors increased since there occured a market demand during COVID-19 outbreak.

Results and Discussion

❖The formula [1] was our departure point to arrive our goal.

❖Results which are represented in our demo video depend on this particular formula.

Figure 3: System output on mobile app.

Figure 4: Final version of the disposable probe.

❖Results that we observed are mostly affected by ambient light, positions of LEDs, phototransistor and patient's finger. A more stable system should fix these issues.

❖A more stable system can be built by improving these analog to digital conversion quality. By setting a proper reference voltage inside the microchip, it is possible to obtain better results precisely.

❖Capabilities of the system which was designed in the context of ELE402 can be enhanced by implementing a data logging system. This implementation would give the chance to the medical staff to track down the previous abnormalities in a patient's past medical data.

References

• [1] Babikir, Sharief Fadul, and Reem Abedalmoniam Ismail. "Oxygen Level Measurement Techniques: Pulse Oximetry." Journal of Science and Technology, 2015.

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