"Assessing Vital Signs Using Light Waves and Skin Color Detection: A Study on Tissue Properties and Light-Tissue Interaction"

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Idea

Triage is a critical healthcare process used to assess and prioritize patients based on the severity of their condition and the urgency of their need for care. Vital sign assessment is a crucial part of triage, which involves evaluating factors such as level of consciousness, respiratory distress, medical history, and vital signs. Our project aims to assess vital signs related to electromagnetic and light waves, specifically detecting heart rate, oxygen saturation, and skin color. This report outlines the parameters related to light waves and tissue properties that we used to detect and measure these vital signs.

Vital Sign Assessment Using Light Waves:

To measure heart rate and oxygen saturation, we used the MAX30100 pulse oximeter, which utilizes photoplethysmography (PPG) to detect changes in the intensity of light absorbed by blood vessels as blood flows through them. The pulse oximeter emits red and infrared light, with the red light being absorbed more by oxygenated blood and the infrared light being more absorbed by deoxygenated blood. By measuring the amount of light absorbed by the blood vessels, the pulse oximeter can calculate the oxygen saturation and heart rate of the patient.

Skin Color Detection Using Light Waves:

To detect skin color, we used the TCS3200 color sensor, which has an array of photodetectors, each with either a red, green, or blue filter, or no filter (clear). The filters of each color are distributed evenly throughout the array to eliminate location bias among the colors. The sensor produces a square-wave output whose frequency is proportional to the intensity of the chosen color. By selecting different color filters, we can allow only one particular color to get through and prevent other colors from passing through. We aimed to detect five skin colors: cyanosis, jaundice, normal, pale, and reddish.

Tissue Properties:

The MAX30100 pulse oximeter is typically placed on a patient's finger or earlobe. The light emitted by the sensor is absorbed differently by oxygenated and deoxygenated blood. Here, we are dealing with two tissues: skin tissues and blood. The TCS3200 color sensor can be used to detect the color of tissues in medical applications, such as in the detection of skin cancer or analysis of blood samples. We used it to detect the color of the skin.

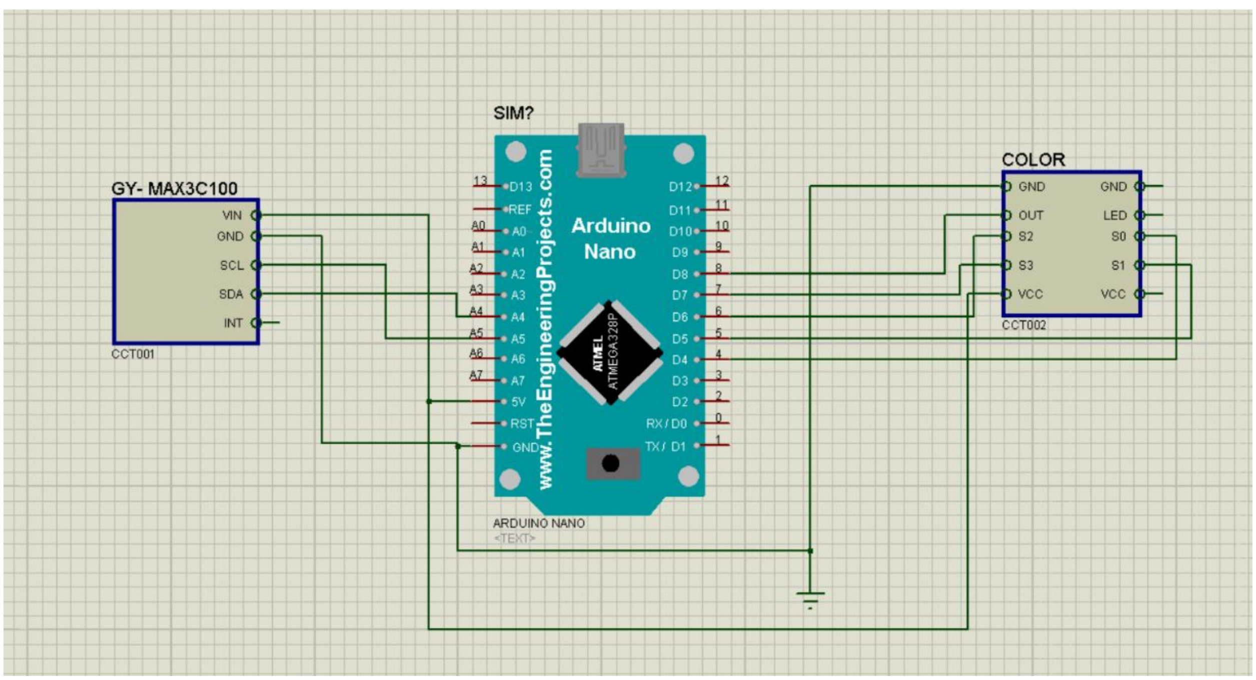
Light-Tissue Interaction: (Absorption - Reflection - Scattering)

To measure heart rate, the MAX30100 pulse oximeter detects changes in the amount of blood in the blood vessels that occur with each heartbeat. As the blood vessels expand and contract with each heartbeat, the amount of light that is reflected back to the sensor changes, allowing the pulse oximeter to calculate the heart rate. To measure oxygen saturation, the MAX30100 pulse oximeter compares the amount of red light and infrared light that is absorbed by the blood vessels. The pulse oximeter can calculate the oxygen saturation of the patient's blood by comparing the ratio of red to infrared light that is absorbed. The TCS3200 color sensor can detect the color of an object by measuring the intensity of red, green, and blue (RGB) light reflected from the object.

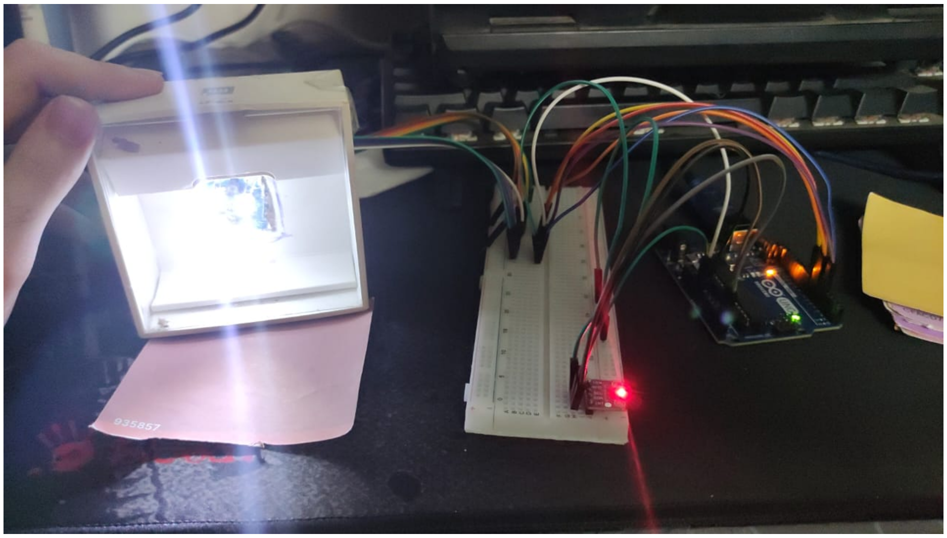
Conclusion:

Our project aimed to detect and measure vital signs related to electromagnetic and light waves, specifically detecting heart rate, oxygen saturation, and skin color. By using the MAX30100 pulse oximeter and TCS3200 color sensor, we were able to achieve accurate measurements of these vital signs. Our findings can be used to improve triage assessment protocols and provide prompt and appropriate treatment to critically ill or injured patients.

Schematic diagram:



Snapshots of the Hardware: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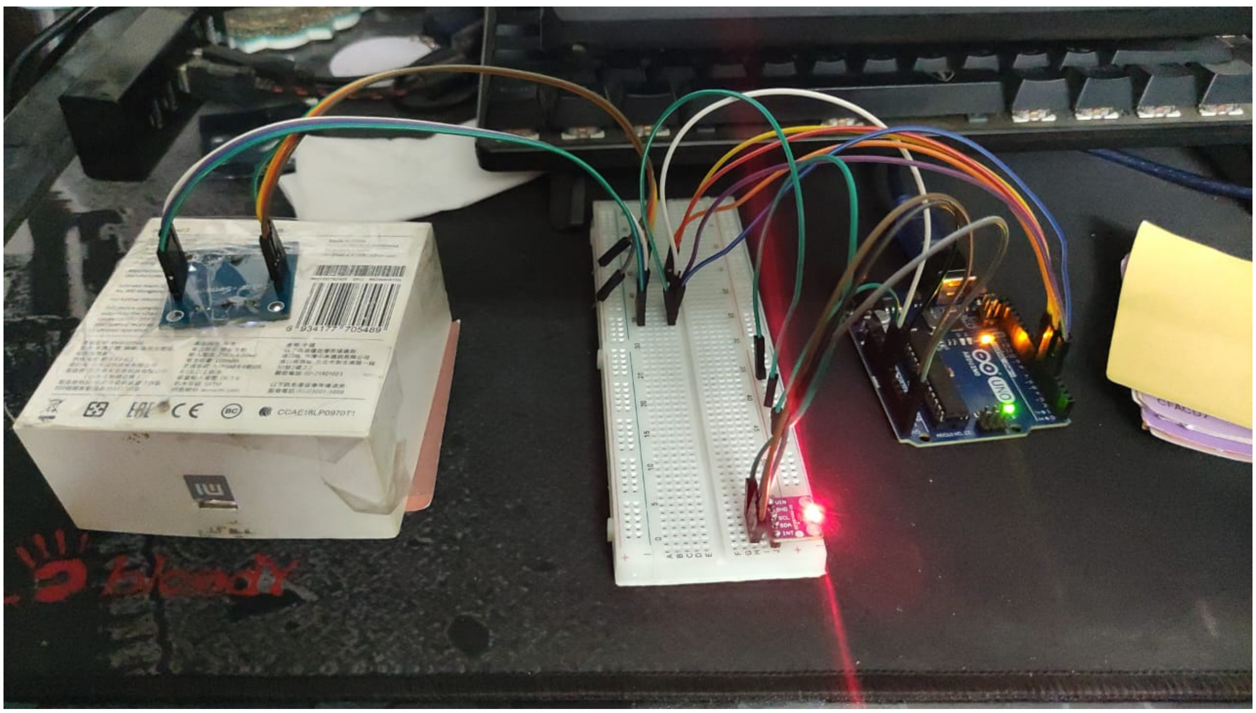
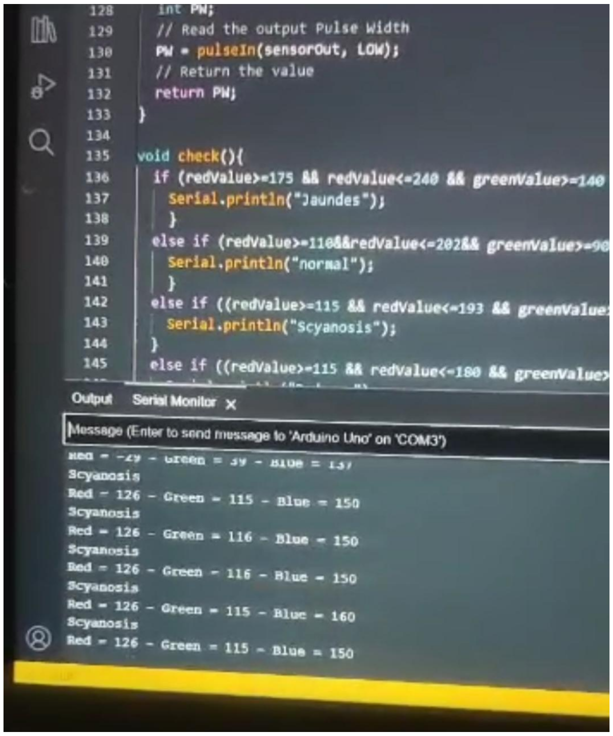
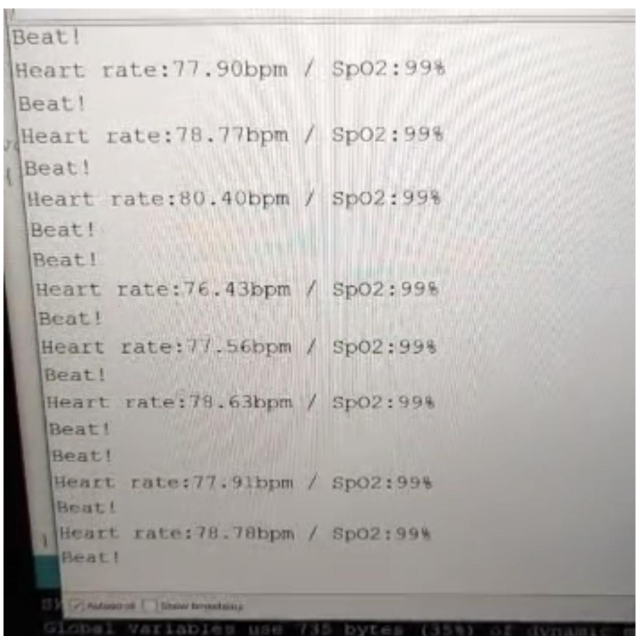


Output Screen Shots:





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