

Capstone Project – Introduction (PROJ2999), 7th Semester
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Project Title: Development of Finger PPG Sensor to Address Heart Rate Anomalies

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Abstract: (within 200 words)

A finger PPG (Photoplethysmography) sensor is a compact, non-invasive device that uses light to measure the flow of blood in the fingertip. In this project, we are designing and developing a finger-based PPG sensor that can be used to monitor heart rate and detect possible problems. Some of the heart issues that can be identified include irregular heartbeats (arrhythmia), unusually fast heartbeats (tachycardia), and very slow heartbeats (bradycardia). The working principle of the device is simple: an LED light shines on the finger, and a photodiode collects the light reflected from the blood vessels. As the amount of blood in the finger changes with every heartbeat, the light signal also changes. This signal is then filtered, converted into digital form, and processed using simple computer programs to find heart rate and check the shape of the pulse signal.

Compared to traditional methods like ECG machines, this sensor is low-cost, small in size, and easy to carry, which makes it suitable for daily use outside hospitals. With wireless features, the data can also be sent to smartphones or directly to doctors, supporting remote health monitoring. The expected result is a reliable, affordable, and user-friendly device that can help in the early detection of heart-related problems and improve preventive healthcare.

To build the sensor, the circuit was designed in KiCad EDA using LM324 and LM358 operational amplifiers to amplify and filter the weak PPG signal. Resistors and capacitors are arranged to form active filters that remove unwanted noise and highlight the clean pulse waveform. Feedback resistors are used in the op-amp stages to control gain, ensuring that the small signal is scaled to a measurable voltage level. The circuit design was tested and validated in KiCad before PCB development, ensuring reliable performance.

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