

The Heart of the Matter



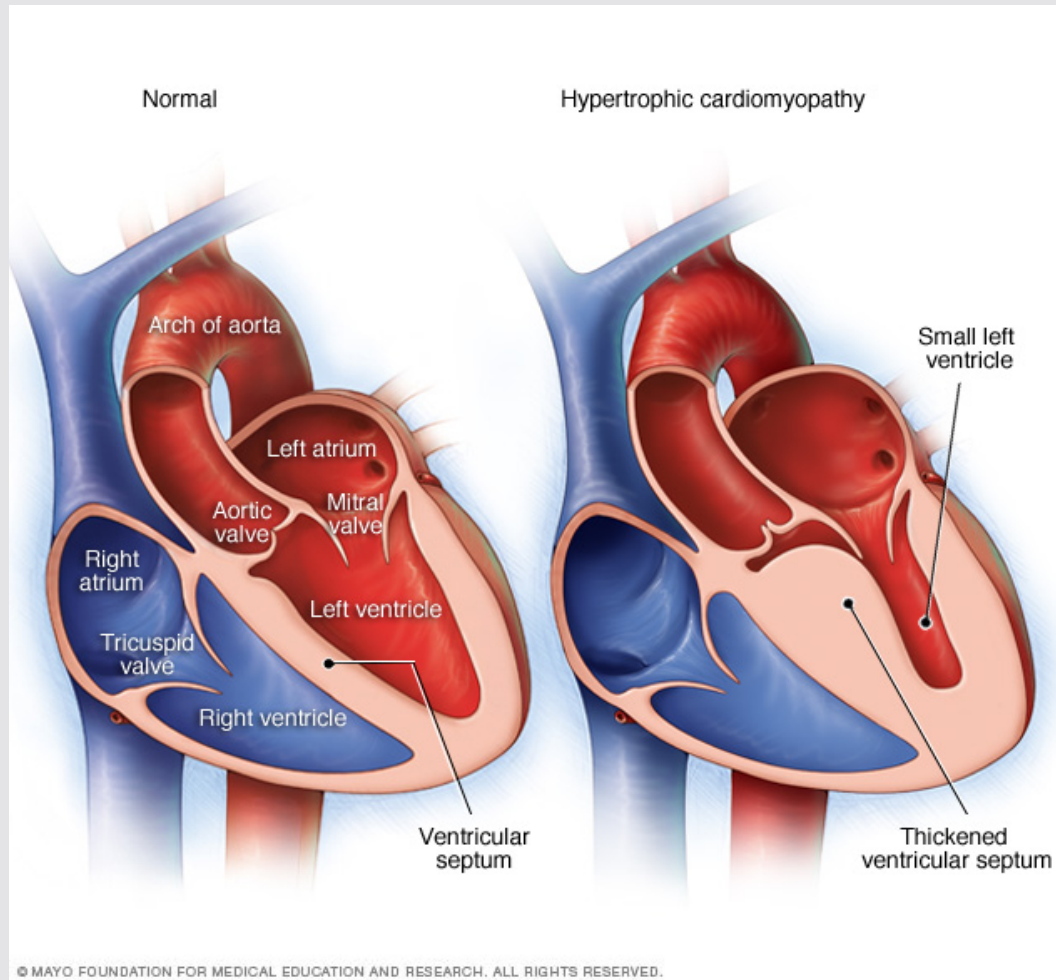
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Introduction



- **Cardiomyopathy**
 - Enlarged heart syndrome caused by the thickening of the heart wall
 - Blood unable to flow through ventricle
 - Common for young athletes: hypertrophic cardiomyopathy
- **Effects**
 - Arrhythmias
 - Cardiac arrest
 - Young athletes at a higher risk of severe effects due to the intense physical activity's strain on the heart

Introduction



Problem Description



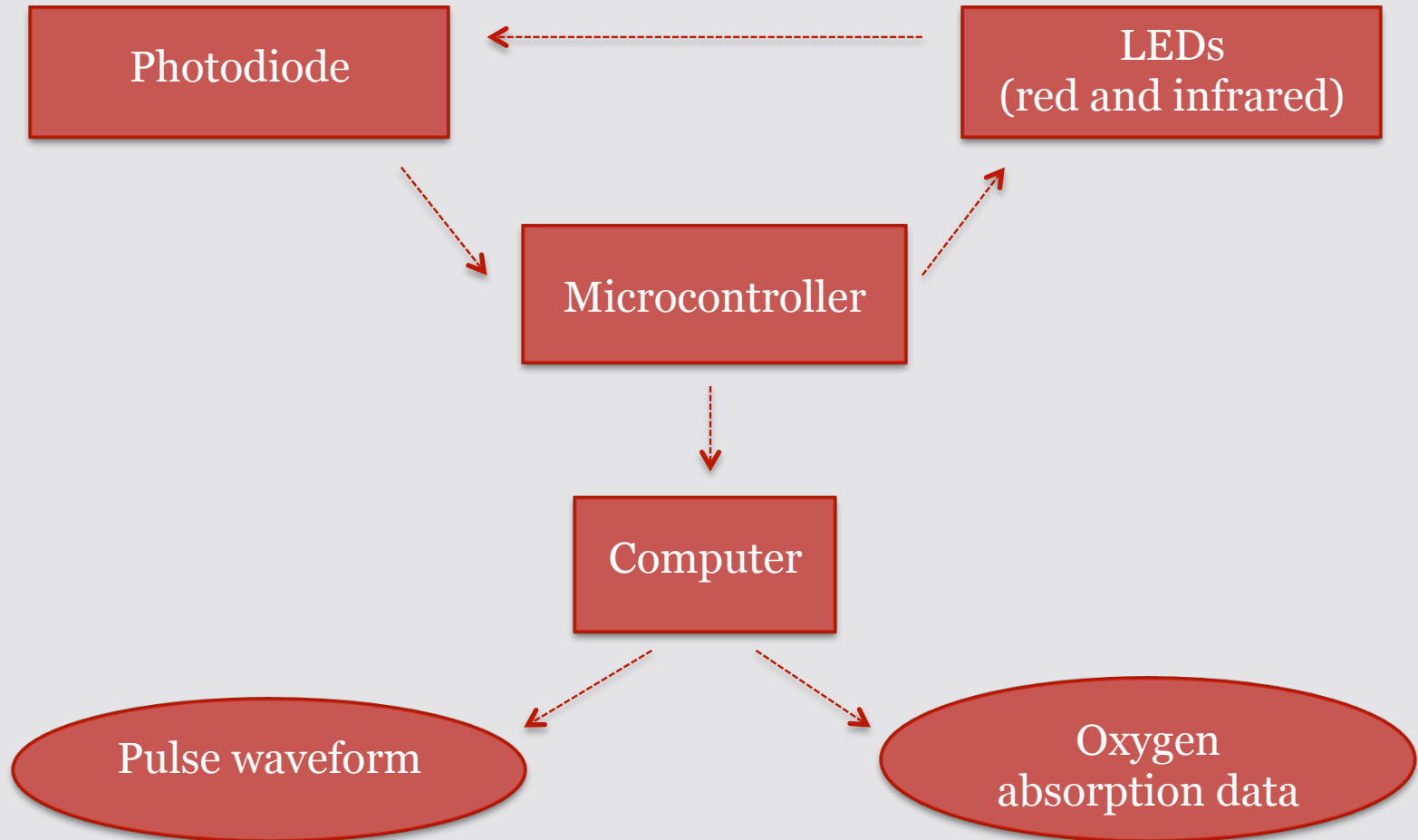
- Why doesn't everyone just get tested at a standard physical?
 - Disease is rare
 - X-rays and ultrasounds are very expensive
- Signs
 - “Twice beating” arrhythmias point toward a greater heart function
 - ✦ Sometimes difficult to detect by human touch or a stethoscope, which is how pulse is normally determined by a doctor
- Our Senior Design Project
 - Create a device to show abnormalities in pulse and oxygen levels that would prompt the patient to get further testing

Proposed Solution



- **Photoplethysmography (PPG) device**
 - Observed blood oxygenation levels and heartbeat regularity
 - Optical method using red and infrared light
 - Change in volume caused by the pressure pulse is measured according to the amount of light transmitted to the photodiode (or the amount of light not absorbed by the blood)

Proposed Solution



Demonstrated Features



- Microcontroller communication with LEDs
 - Power
 - Control alternate blinking
 - Rate
- Photodiode's ability to capture light and allow current to pass through
- If signal is small, may need an amplifier circuit to boost the signal before sending it to the microcontroller
- Signal sent back to microcontroller for processing
- Microcontroller sends data to the computer
- Computer will output data (possibly use MatLab for this)
 - Waveforms
 - Oxygenation levels
 - Pulse

Available Technologies



Part	Approximate price
Circuit board	\$50
Microcontroller	\$20
IR LED (940 nm)	\$0.75 each
Red LED (660 nm)	\$0.50 each
Plastic for finger clip	\$10
Spring for finger clip	\$1
Photodiode	\$1
Op amplifier	\$5

Engineering Content



- Microcontroller communication to LEDS
- Photodiode's light absorption
- Photodiode's output back to microcontroller
- Data from microcontroller to computer
- Creating a program that takes the outputted data and displays relevant waveforms

Conclusions



- **Cardiomyopathy is difficult to diagnose before it's too late**
- **Our Senior Design Project**
 - Create a photoplethysmographic device to monitor pulses and blood oxygenation levels
 - Abnormal results can encourage people to get more extensive testing