

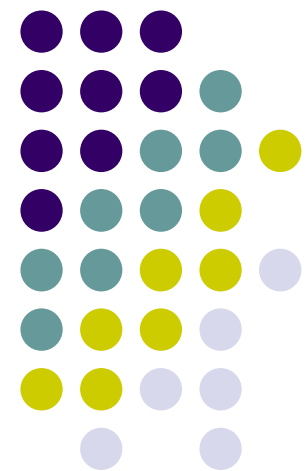
Ubiquitous and Mobile Computing

CS 528:Heartbeat Detector

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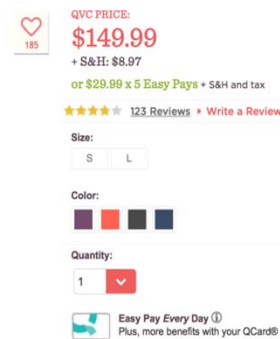
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Motivation

- Current wearable fitness device is popular but not cheap.
- Everyone has a smartphone, it's indispensable.
- Many people have heart disease and need to monitor their heartbeat.
- **Function:**
 - Monitor your heartbeat through smartphone camera.
 - Just cover the camera lens with your fingertip and you'll know heartbeat.



Vision



- Use smartphone to monitor heartbeat rate and blood pressure. Compare our heartbeat, blood pressure with normal range.
- Acquire PPG signal from two different positions such as fingertip and forehead, blood pressure estimated by the PPG phase delay.
- Work together with steps counting, add your diet to calculate calories and build all these functions in a same app to monitor our health.
- Give suggestions based on daily, monthly personal health report.

Related Work



- Instant Heart Rate
- Unique Heart Rate Monitor



Instant Heart Rate

Azumio Inc. Health & Fitness

Everyone



- They can show your heartbeat value, but they don't have the camera view, and the second one doesn't have waveform.



Unique Heart Rate Monitor

Meet Your Need Production Health & Fitness

Everyone



Add to Wishlist

- Our app shows a camera view through which you can see dynamic brightness change from camera view. And we can also show the waveform of your heartbeat pulse.

Methodology



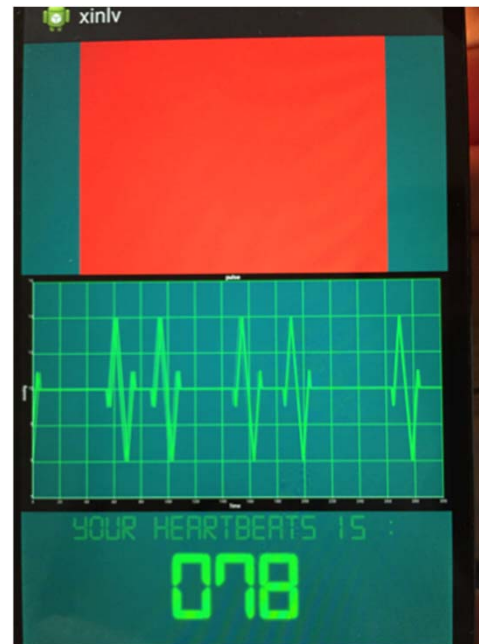
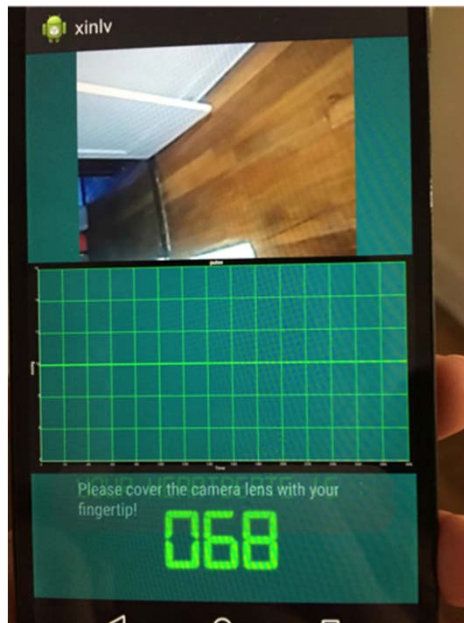
- Part1: Image processing
 - YUV420sp to RGB, get average pixels
- Part2: Heartbeat calculation
 - Light – Dark – Light – Dark, if detect light, heartbeat + 1
- Part3: Draw waveforms for heartbeat
 - Use library achartengine
- Part4: Show heartbeat value in digital format



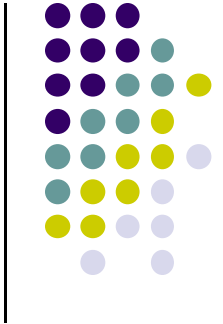
Implementation

- MainActivity.java: present the main screen. Using handler to update camera and number of heartbeat.
- CameraHelper.java : Control the camera and Calculate the heartbeat.
- Chart.java: Set the style of the heartbeat waveform
- ChartHelper.java: Generate and update the waveform.
- LedTextview.java: To show the led digital clock format.
- Type.java: Contains two states.

Application UI



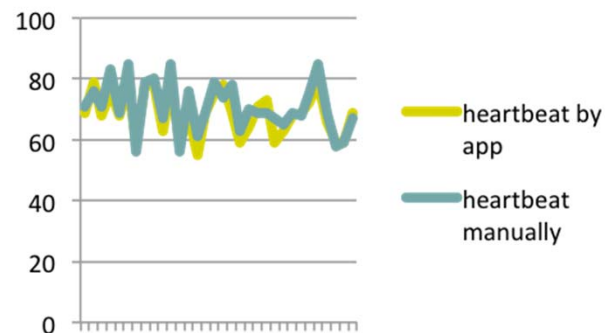
Demo





Evaluation

- Participants: 16 master or phd students aged between 23 and 39 from WPI, 6 men, 10 women.
- Result:



- Standard error:4.4
- **Pre-study and Post-study:** Ask them whether they want an app like this in daily life, what features they like, and what they like and dislike about our app.



Limitation

- We compare heartbeat value detected by our app with heartbeat value detected by manually count. Not in the same time, not accurate.
- Our waveform is not a real-time electrocardiography (ECG), it can only see the frequency of your heartbeat.
- Our app is not very steady, it requires some time to let heartbeat value become steady.



Thank you!