Ubiquitous and Mobile Computing
CS 528: Heartbeat Detector

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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 forhead, 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**

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

- Part 1: Image processing
  - YUV420sp to RGB, get average pixels
- Part 2: Heartbeat calculation
  - Light – Dark – Light – Dark, if detect light, heartbeat + 1
- Part 3: Draw waveforms for heartbeat
  - Use library achartengine
- Part 4: 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!