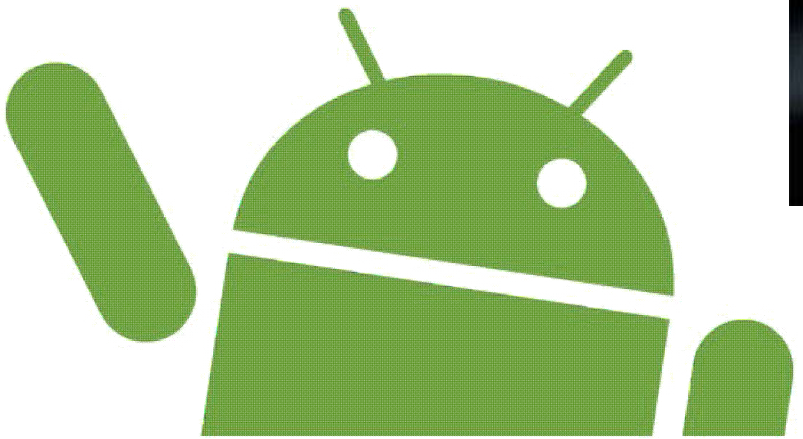
Android Pulse

Risto Muchev

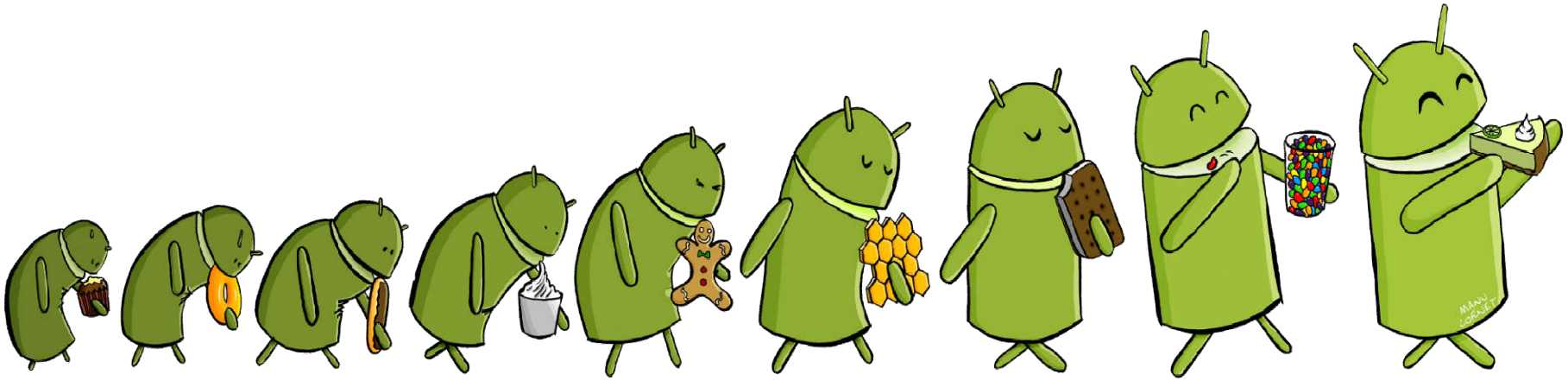
@rmuchev

About me

- Senior Android Engineer
- 2008



Android evolution



THE HISTORY OF ANDROID

The brain child of Andy Rubin, Rich Miner, Nick Sears and Chris White, Android was created to develop "Smarter Mobile Devices That Are More Aware of it's Owner's Locations & Preferences".

The early intentions of Android was to be an advanced operating system for Digital Camera's. However upon realising the market wasn't big enough for this in 2003, they turned their attentions to producing a system to rival Symbian and Microsoft Windows Mobile.

So successful was the transition, that Google acquired Android Inc. on August 17th 2005 and the rest is very much history.

Release Date

SEP
23
2008

ANDROID 1.0

BASED ON **MODIFIED LINUX 2.6.25**

The first instalment of the Android Operating system was launched on the HTC Dream, relying heavily on the hardware provided by the phone, with use of it's many buttons.

FLAGSHIP PHONE
HTC DREAM/G1

Notifications appear in the

Gmail synchronization

Home Screen Widgets

Android Market

- Android Market App
- Full Web Browser Experience
- Camera support
- Application Folder Grouping
- Access to web email servers
- Gmail sync Gmail application
- Google Contacts & calendar Sync
- Google Maps with Street View & Directions
- Google Search
- Google Talk instant messaging
- Instant messaging, text messaging, & MMS
- Media Player – No Video or Bluetooth
- Notification Updates
- Voice Dialler
- Set Your Own Wallpaper
- YouTube video player
- Other applications include: Alarm Clock, Calculator, Dialler (Phone), Home screen (Launcher), Pictures (Gallery), & Settings
- Wi-Fi & Bluetooth support

FLAGSHIP PHONE
HTC DREAM/G1

ANDROID 1.1

BASED ON **MODIFIED LINUX 2.6.25**

Release Date

FEB
09
2009

A couple of months after the initial launch, Android created an update to resolve the bugs found when the OS first launched. It helped to flesh it out adding to the already long list of features offered.

Business Details on Maps

Longer in-call screen timeout

Save attachments in messages

- Show/hide dial pad
- Support added for marquee in system layouts

Release Date

APR
27
2009

CUPCAKE

ANDROID 1.5

BASED ON **LINUX KERNEL 2.6.27**

A couple of months after the initial launch, Android offered an update to resolve the bugs found when the OS first launched. It also added a few features including...

On Screen Keyboards

Copy and paste features in web browser

Video recording and playback

Support for Widgets –Interchangeable & personalised homepage ×

User pictures shown for Favourites in Contacts ×

Specific date/time stamp shown for events in call log ×

One-touch access to a contact card from call log event ×

Animated screen transitions ×

Auto-rotation option ×

New stock boot animation ×

Ability to upload videos & photos to YouTube & Picasa ×

FLAGSHIP PHONE
HTC DREAM/G1

FLAGSHIP PHONE
HTC MAGIC

DONUT
ANDROID 1.6
BASED ON **LINUX KERNEL 2.6.29**

Release Date
SEP
15
2009

Appearing five months after the "Cupcake" update, Android released "Donut" with a focus around aesthetic tweaks. However, it was the changes to the resolution independence which had the most profound effect, allowing android to work across a variety of screen resolutions and aspect ratios.

Running a variety of Screen Resolutions

More powerful Android Market

Quick search box works across entire phone

✕ Fully integrated Gallery, Camera & Camcorder

Release Date

OCT
26
2009

ECLAIR

ANDROID 2.0

BASED ON **LINUX KERNEL 2.6.29**

Forty-one days after the last update, 'Éclair' was released on the Motorola Droid – "the first 'second generation' Android Device. It offered huge hardware updates on the HTC Dream/G1 & Magic, something the Éclair made full use of.

FLAGSHIP PHONE
MOTOROLA DROID

Multiple account support

Updated Maps includes support for Layers

Improved Browser

- Native Microsoft Exchange Support ✕
- Integrated Facebook, Facebook friends syncs to your contacts ✕
- Speech-to-text ✕
- New YouTube widget for superfast uploads ✕
- 'Car Home' application that gives big and bright icons for features used while driving ✕
- A new lock screen ✕

FLAGSHIP PHONE
NEXUS ONE

FROYO
ANDROID 2.2

BASED ON **LINUX KERNEL 2.6.32**

Release Date

MAY
20
2010

Froyo represented a refresh in the UX of the Android OS and take full advantage of the Nexus programmes first instalment, the Nexus One. Major changes were made under-the-hood - all in the name of speed, making it slicker and easier to use.

Updated 5 Panel Home Page

Improved Browser functionality

USB tethering and Wi-Fi hotspot functionality

- Speed, memory, & performance optimizations
- Additional application speed improvements
- Support for push notifications
- Improved application launcher
- Option to disable data access over mobile network.
- Updated Market application
- Quick switching between multiple keyboard languages & dictionaries.
- Support for Bluetooth-enabled car & desk docks
- Support for numeric & alphanumeric passwords
- Support for file upload fields in the Browser application
- Support for installing applications to the expandable memory
- Adobe Flash support
- Gallery allows users to view picture stacks using a zoom gesture
- Bug fixes, security updates & performance improvements (2.2.1)
- Minor bug fixes (2.2.2)
- Security Patches (2.2.3)

Release Date

DEC
06
2010

GINGERBREAD
ANDROID 2.3

BASED ON **LINUX KERNEL 2.6.35**

Coinciding with the launch of the second instalment of the Nexus programme - the Nexus S, Gingerbread was seen as a relatively minor update. However, there were enough minor changes to the platform, for a large improvement to be seen. The general consensus was that Gingerbread was a more refined and matured update to Android, providing a springboard for future iterations to truly challenge iOS.

FLAGSHIP PHONE
NEXUS S

Improved virtual keyboard

Support for front-facing camera

Improved power management

- Updated user interface design with increased simplicity & speed
- Support for extra-large screen sizes & resolutions (WXGA & higher)
- Native support for SIP VoIP internet telephony
- Support for Near Field Communication (NFC)
- New audio effects such as reverb, equalization, headphone virtualization, & bass boost
- New Download Manager
- Enhanced copy/paste functionality
- Support for WebM/VP8 video playback, & AAC audio encoding
- Improved power management
- Enhanced support for native code development
- Switched from YAFFS to ext4 on newer devices
- Audio, graphical, & input enhancements for game developers
- Concurrent garbage collection for increased performance
- Native support for more sensors (such as gyroscopes & barometers)

HONEYCOMB
ANDROD 3.X

BASED ON **LINUX KERNEL 2.6.36**

Release Date

FEB 22 2011

Honeycomb is a slight outlier in the history of Android. This incarnation of Android was created exclusively for use on tablets and didn't quite hit the levels of popularity google had forecasted. It featured redesign of the menu buttons which would be further improved on in future versions of android.

Improved multitasking

Redesigned keyboard

Added Action Bar

FLAGSHIP PHONE
MOTOROLA XOOM

- Optimized tablet support with a new "holographic" user interface
- Added System Bar - quick access to notifications, status, & soft navigation buttons
- Multiple browser tabs replacing browser windows, plus form auto-fill
- "Incognito" mode allowing anonymous browsing
- Simplified copy/paste interface
- Quick access to camera & features
- Ability to view albums & other collections in full-screen mode in Gallery
- New two-pane Contacts UI & Fast Scroll letting users easily organize & locate contacts
- New two-pane Email UI to make viewing & organizing messages more efficient with multi-e-mail select
- Hardware acceleration
- Support for multi-core processors
- Ability to encrypt all user data
- HTTPS stack improved with Server Name Indication (SNI)
- Filesystem in Userspace (FUSE; kernel module)
- Applications' write access to secondary storage is disabled outside of designated app
- UI refinements
- Connectivity for USB accessories (USB On-The-Go)
- Expanded Recent Applications list
- Resizable Home screen widgets
- Support for external keyboards & pointing devices
- Support for joysticks & gamepads
- Support for FLAC audio playback
- High-performance Wi-Fi lock
- Support for HTTP proxy for each connected Wi-Fi access point

Release Date

OCT
19
2011

ICE CREAM SANDWICH
ANDROID 4.0
BASED ON **LINUX KERNEL 3.0.1**

Following Androids initial foray into a Tablet-only operating system, Android turned their attentions to creating multi device system to perform across both Smartphones and Tablets. This update further developed many of the new features and design elements that had first been trialled in Honeycomb

Notifications Swipe

Major Refinement of Design

Data Usage control

FLAGSHIP PHONE
GALAXY NEXUS

DESIGN REFINEMENTS

- Major refinements to the "Holo" interface with new Roboto font family
- Soft buttons from Android 3.x are now available for use on phones
- Separation of widgets in a new tab, listed in a similar manner to applications
- Easier-to-create folders, with a drag-and-drop style
- Pinch-to-zoom functionality in the calendar
- New gallery layout, organized by location & person

- Improved visual voicemail
- Integrated screenshot capture
- Improved error correction on the keyboard
- Ability to access applications directly from lock screen
- Improved copy & paste functionality
- Better voice integration & continuous, real-time speech to text dictation
- Face Unlock – Facial Recognition Unlock Screen
- Automatic syncing of browser Chrome bookmarks
- Shut down applications from recent apps with a swipe.
- Improved camera application with zero shutter lag, time lapse settings, panorama mode, & the ability to zoom while recording
- Built-in photo editor
- Refreshed "People" application with social network integration, status updates & hi-res images
- Android Beam
- Support for the WebP image format
- Hardware acceleration of the UI
- Wi-Fi Direct
- 1080p video recording for stock Android devices
- Android VPN Framework (AVF), & TUN kernel module. Prior to 4.0, VPN software required rooted Android.

JELLY BEAN
ANDROID 4.1 4.2 4.3

BASED ON **LINUX KERNEL 3.0.31 - 3.4.0**

Release Date

JUL 09 2012

Jelly Bean was the update where Google really stepped up the design and overall user experience of Android. The driving force behind this was Project Butter; implemented to eliminate all lag and make the operating system quicker and more responsive for users.

Google Now

Smoother UX - Project Butter

Expandable notifications

FLAGSHIP PHONE
NEXUS 7 TABLET

DESIGN REFINEMENTS

- Smoother user interface
- Vsync timing across all drawing & animation done by the Android framework, including application rendering, touch events, screen composition & display refresh
- Triple buffering in the graphics pipeline
- Tablets with smaller screens now use an expanded version of the interface layout & home screen used by phones
- All devices now use the same interface layout, previously adapted from phones on 4.1 for smaller tablets (with centred software buttons, the system bar at the top of the screen, & a home screen with a dock & centred application menu), regardless of screen size

- Enhanced accessibility
- Bi-directional text & other language support
- User-installable keyboard maps
- Ability to turn off notifications on an application-specific basis
- Shortcuts & widgets can automatically be re-arranged or re-sized to allow new items to fit on home screens
- Bluetooth data transfer for Android Beam
- Improved camera application
- Multichannel audio
- The Fraunhofer FDK AAC codec becomes standard in Android, adding AAC 5.1 channel encoding/decoding.
- USB audio (for external sound DACs)
- Audio chaining (also known as gapless playback)

Release Date

OCT
31
2013

ANDROID 4.4 KITKAT

BASED ON **LINUX KERNEL 3.4.0**

Initially known as Key Lime Pie, Android decided to change the name as "very few people actually know the taste of a Key Lime Pie". As an alternative Android partnered with an outside brand for the Android mascot, and the company launched a massive marketing campaign with Nestle for it. KitKat also represented the biggest visual change the platform since the Ice Cream Sandwich update.

FLAGSHIP PHONE
NEXUS 5

Refreshed interface

Compatible with Android Wear

Productivity Enhancements

DESIGN REFINEMENTS

- Clock no longer shows bold hours; all digits are thin. The H, M, & S markings for the stopwatch & timer have been removed.
- Ability for applications to trigger translucency in the navigation & status bars
- Ability for applications to use "immersive mode" to keep the navigation & status bars hidden while maintaining user interaction
- Action overflow menu buttons are always visible, even on devices with a "Menu" key, which was officially deprecated by Android 4.0.
- Settings application no longer uses a multi-pane layout on devices with larger screens

- External Storage Restrictions for apps, except for their own directories
- Optimizations for performance on devices with lower specs, including zRAM support & "low RAM" device API
- Wireless printing capability
- NFC host card emulation, enabling a device to replace smart cards
- WebViews now based on Chromium engine
- Expanded functionality for notification listener services
- Public API for developing & managing text messaging clients
- Storage Access Framework, an API allowing apps to retrieve files in a consistent manner.
- New framework for UI transitions
- Sensor batching, step detector & counter APIs
- Settings application now makes it possible to select default text messaging & home (launcher) application
- Audio tunnelling, audio monitoring & loudness enhancer
- Built-in screen recording feature
- Native infrared blaster API
- Expanded accessibility APIs & system-level closed captioning settings
- Android Runtime (ART)
- Bluetooth Message Access Profile (MAP) support
- Disabled access to battery statistics by third-party applications

KITKAT

ANDROID 4.4W

BASED ON **LINUX KERNEL 3.4.0**

Release Date

JUN
25
2014

Released on June 25th 2014, followed up by version updates on September 6th and October 21st, this was the first update tailored for the Android Wear devices. It was very much the same as KitKat, however featured wearable extensions, UI updated for Google Maps, Offline Music Playback & GPS Support.

FLAGSHIP PHONE
ANDROID WEAR SMARTWATCHES

Release Date

NOV
12
2014

ANDROID 5.0 5.1 LOLLIPOP

BASED ON **LINUX 3.4.0**

Lollipop was another huge design change to the Android OS. The redesign was built around the new "Material Design"

Material Design

Improved Battery Saving Settings - Project Volta

Refreshed notification tray

FLAGSHIP PHONE
NEXUS 6

DESIGN REFINEMENTS

- Vector drawables, which scale without losing definition
- Lock screen provides shortcuts to application & notification settings
- Refreshed lock screen, no longer supporting widgets
- User-customizable priorities for application notifications

- ART runtime replaces Dalvik as the platform default
- Support for 64-bit CPUs
- OpenGL ES 3.1 & Android Extension Pack (AEP) on supported GPU configurations
- Recent activities screen with tasks instead of applications, up to a configured maximum of tasks per application
- Support for print previews
- Third-party applications regain the ability to read & modify data
- Pinning application's screen for restricted user activity.
- Recently used applications are remembered.
- WebViews receive updates independently through Google Play for security reasons
- Tap & Go allows users to quickly migrate to a new Android device, using NFC & Bluetooth.
- A flashlight application is included.
- Smart lock feature

ANDROID M

Release Date

MAY
28
2015

Unveiled to the world at Google I/O on 28th May 2015, Android M has been released with a Developer Preview, before general release alongside the new flagship Nexus device, somewhere between late August and early September 2015.

The update focussed on incremental improvements on other feature additions, such as Google Now and App Permissions.

FLAGSHIP PHONE
2ND GENERATION NEXUS 5

MAIN HIGHLIGHTS

App Permissions

One of the biggest additions to this update is the ability individually and easily control the apps permissions. One of the awesome new features means the apps ask the user for permission at the time access to a feature is required.

Web Experience

Following years of exploring trends, google have come up with a way to improve Web Experience on Mobile. They've labelled it "Chrome Custom Tabs" in short it allows apps to open a custom chrome window on top of the active app, giving "developers a way to harness all of Chrome's capabilities, while still keeping control of the look and feel of the experience."

Mobile Payments

Android Pay is Google's new Payments System designed to optimise the checkout process, providing "simplicity, security, and choice". Only available in the US at the time of release, it allows existing credit cards to work in over 700,000 stores.

Power and Charging

Using motion detectors, Android have introduced a new function called "Doze" to improve battery life and standby time. This allows the device to recognize when it hasn't been interacted with in a little while e.g. when a person is asleep, therefore reducing the background processes.

Google Now

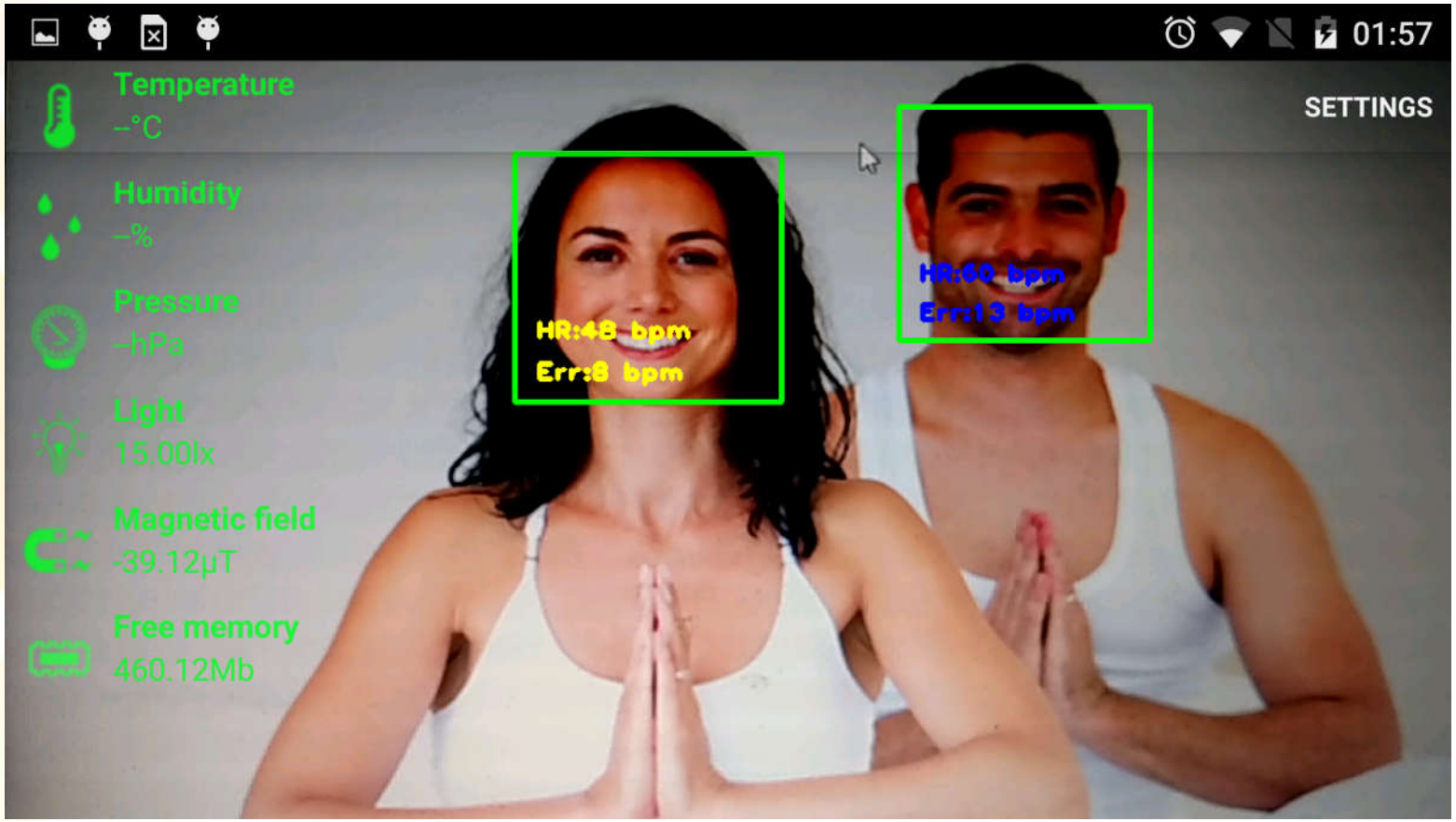
Android M, saw a major revamp of Google Now with the "Now on Tap". This feature completely overhauls the way in which your device will provide contextual information with an app itself. It works within any app, automatically searching for the context present on the screen by pressing the home button.

- A new App Drawer
- RAM Manager
- Adoptable Storage Devices
- Google Chrome
- Google Photos
- Fingerprint Support
- Greater distinguishes from in App Links and
- Improved Volume control
- 4K Display
- Low Energy Scanning
- 4k Display Mode
- Improve USB On the go support
- SD Card Support
- Google Voice Search Lockscreen Access
- Support for USB 3.1 Type C

Mobile application for non contact heart pulse measurement on multiple people

Non invasive video method for simultaneous heart pulse measurement on multiple people in real time

Main Screen


01:57
SETTINGS
Temperature
–°C
Humidity
–%
Pressure
–hPa
Light
15.00lx
Magnetic field
-39.12μT
Free memory
460.12Mb
HR:48 bpm
Err:8 bpm
HR:60 bpm
Err:13 bpm

Multi Heart Rate

Google Play (Multi Heart Rate)

http://bit.do/mhrate

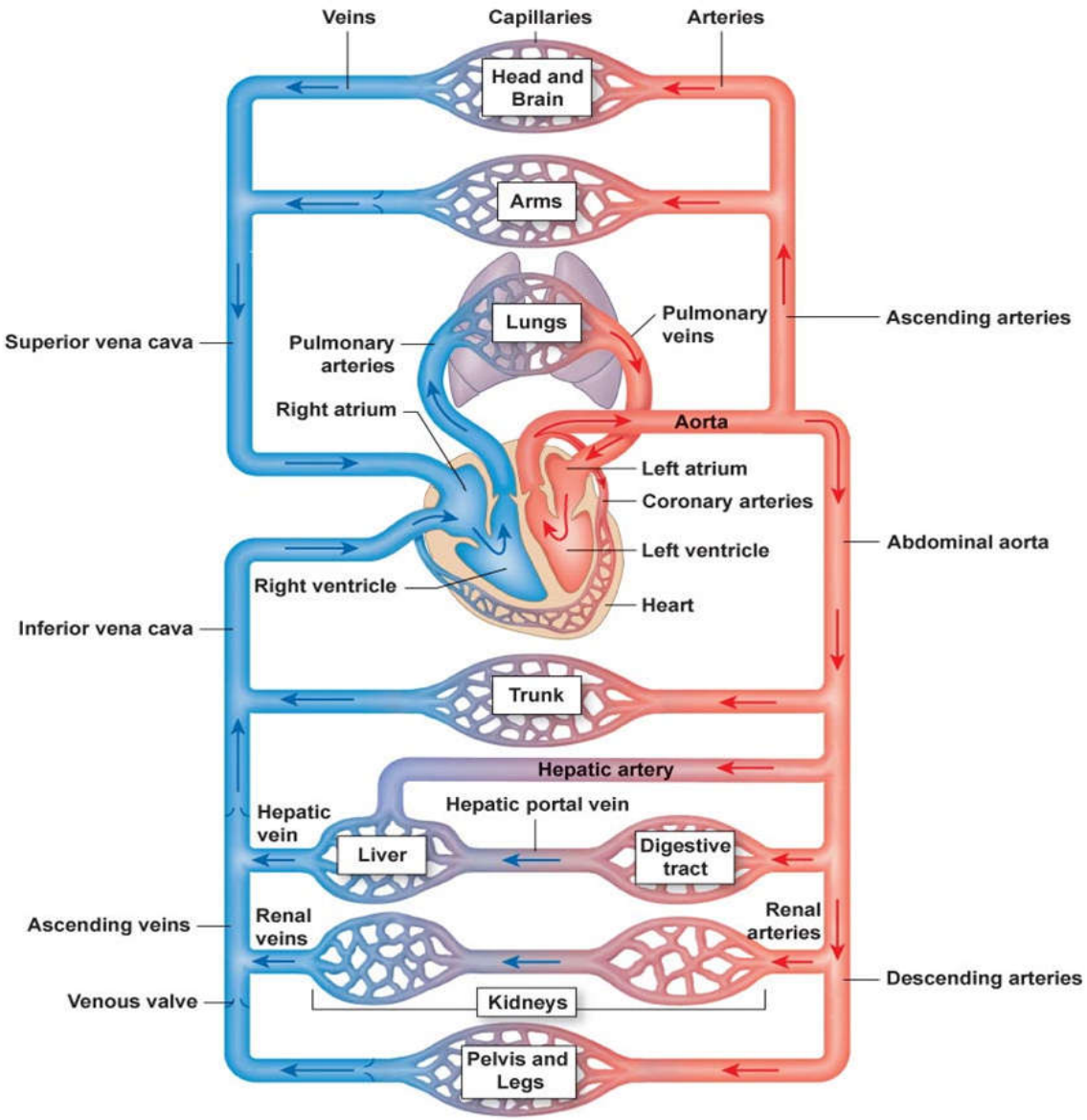
https://play.google.com/apps/testing/com.muchev.rate.heart.multi

Google Plus Group (Multi Heart Rate testers)

http://bit.do/mhrtest

https://plus.google.com/communities/103049212222286143812

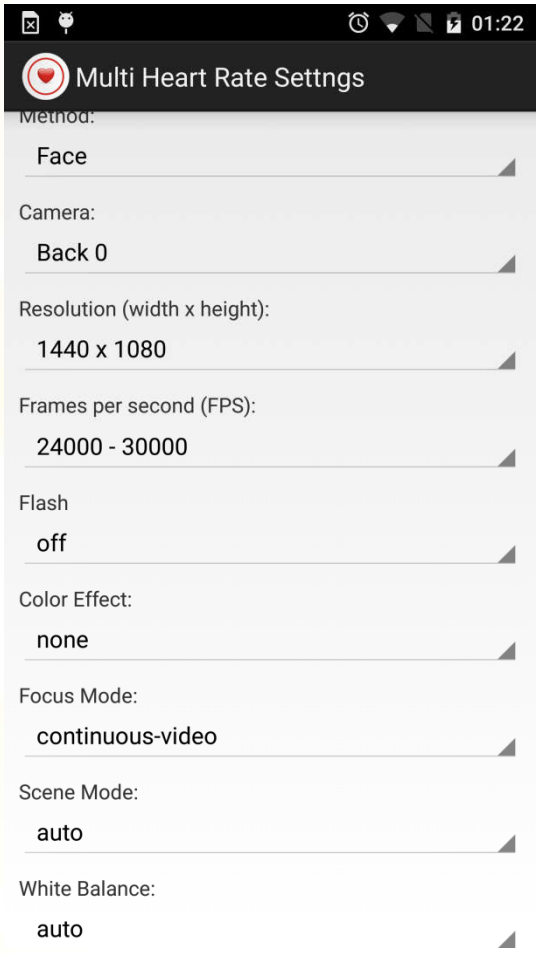
Cardiovascular system

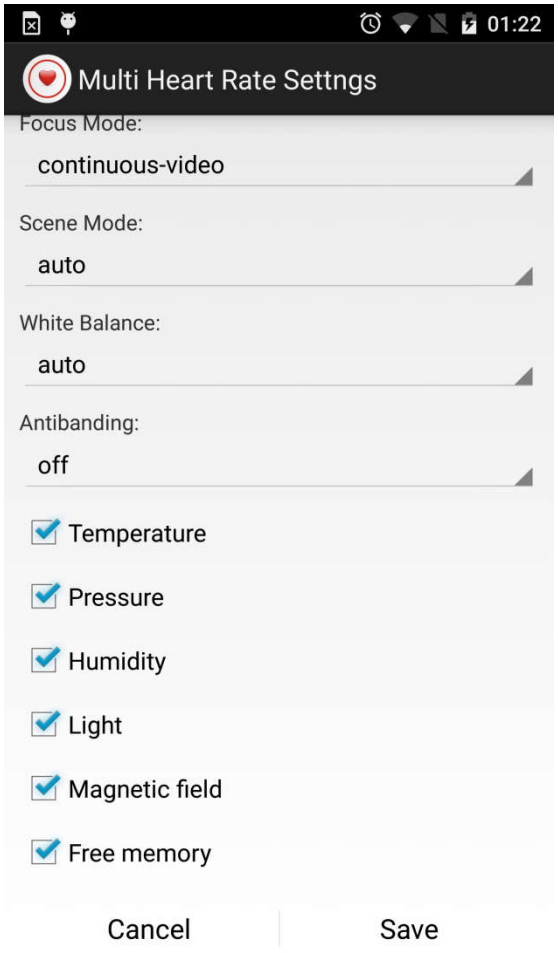


1. High heart rate
- Presence of abnormality (anxiety, anger, excitement, emotion, heart condition, asthma, big meal, etc…)

2. No heart rate
- death

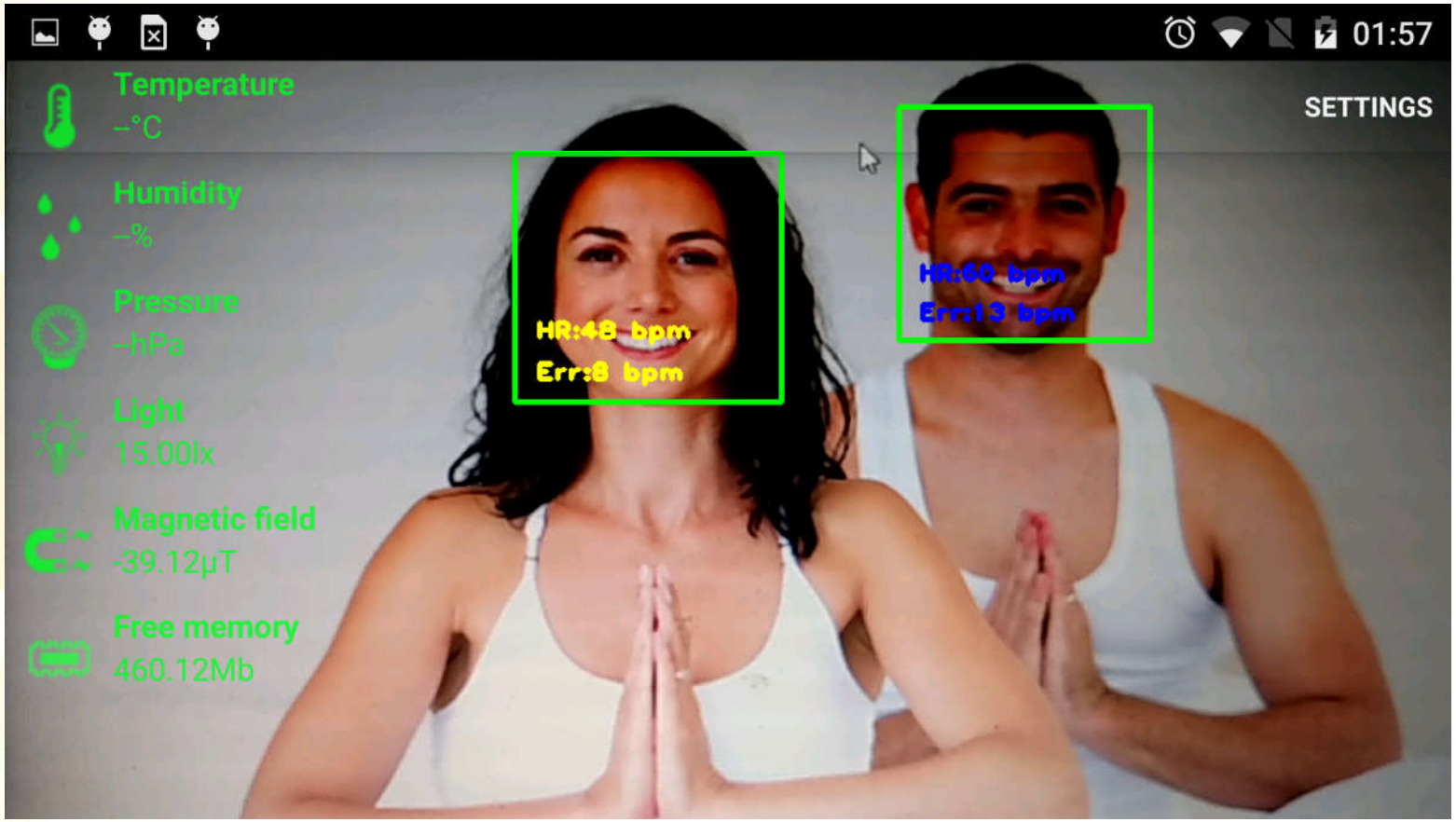
Settings Screen



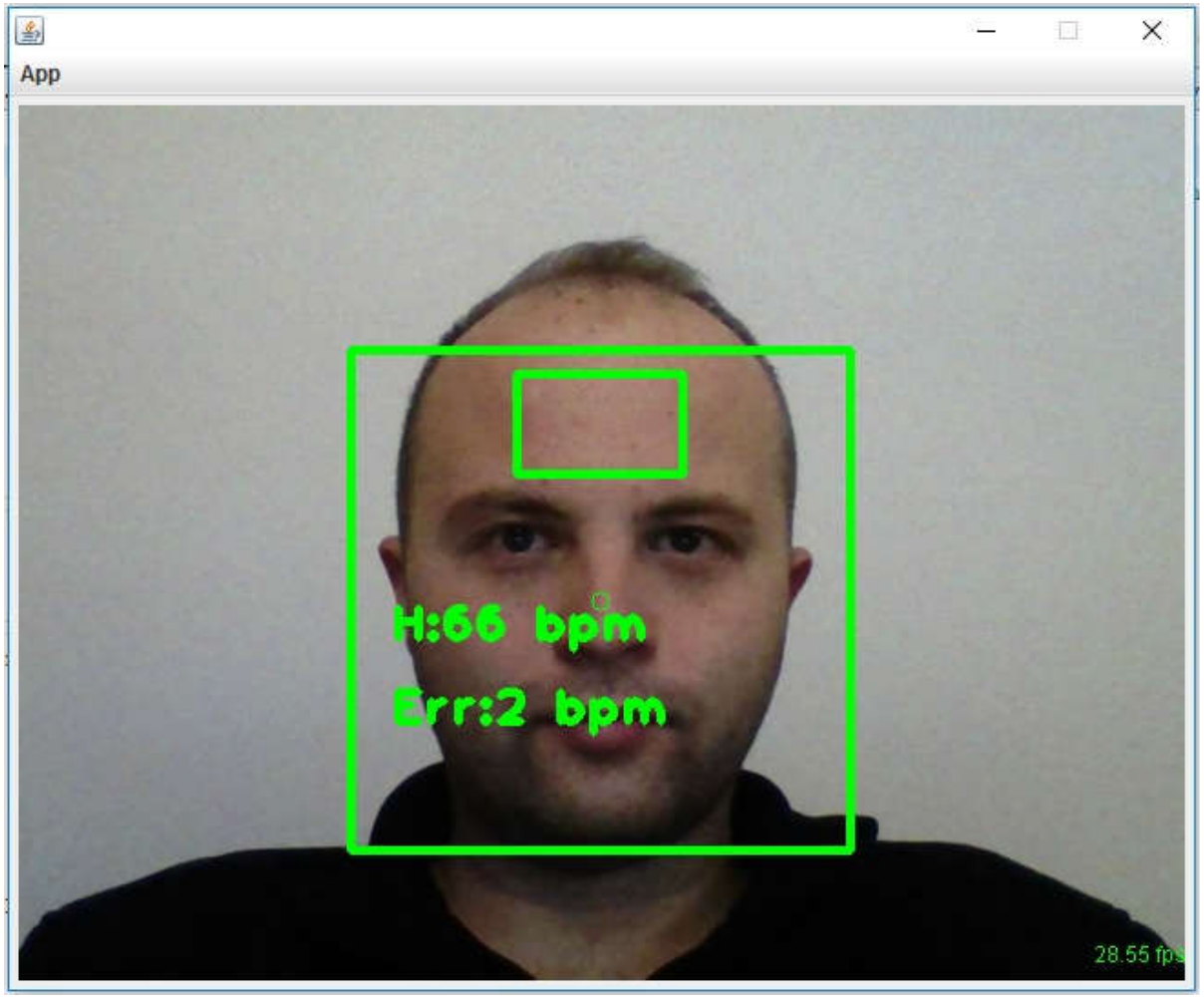


(Shared Preferences)

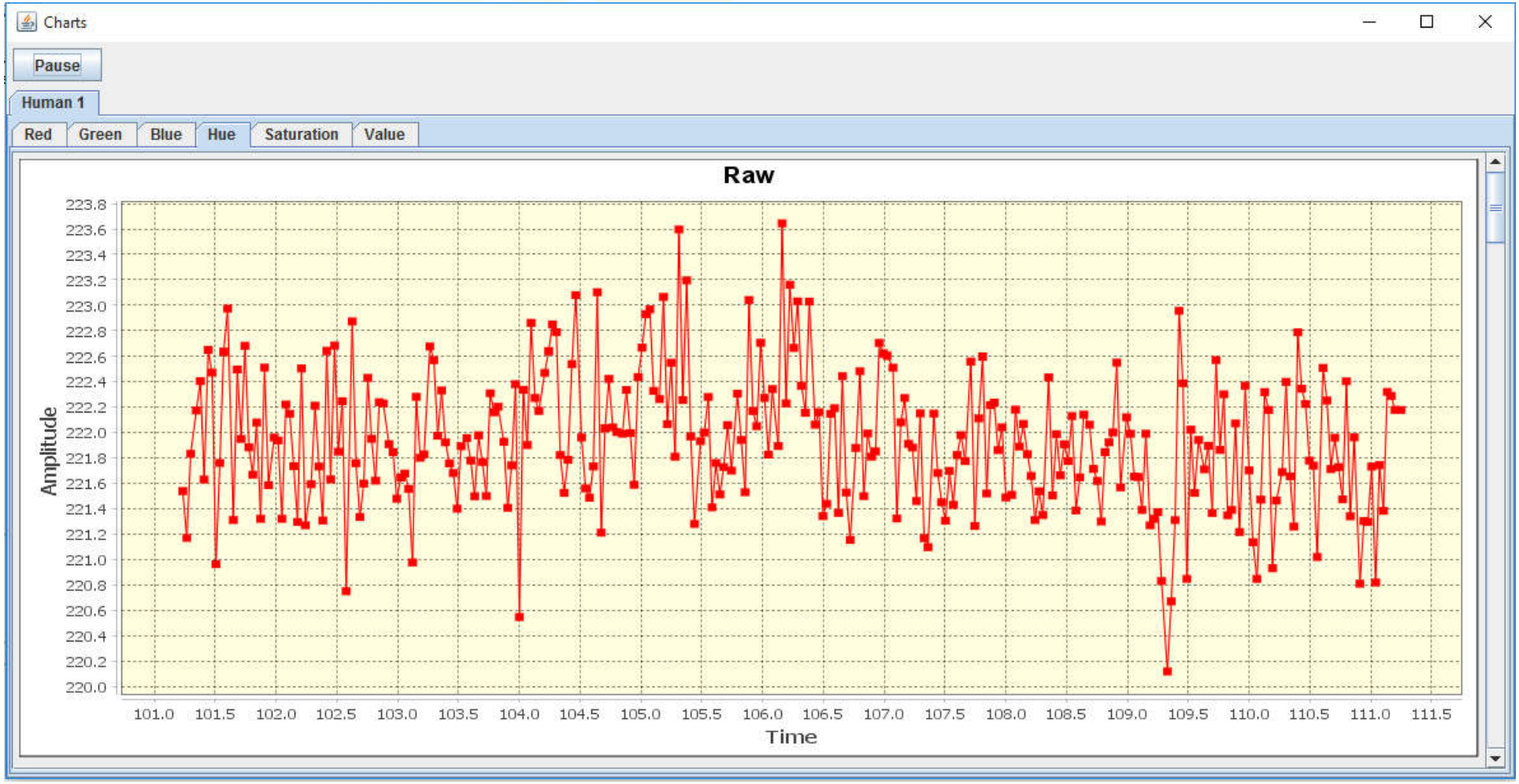
Main Screen


01:57
SETTINGS
Temperature
–°C
Humidity
–%
Pressure
–hPa
Light
15.00lx
Magnetic field
-39.12μT
Free memory
460.12Mb
HR:48 bpm
Err:8 bpm
HR:60 bpm
Err:13 bpm

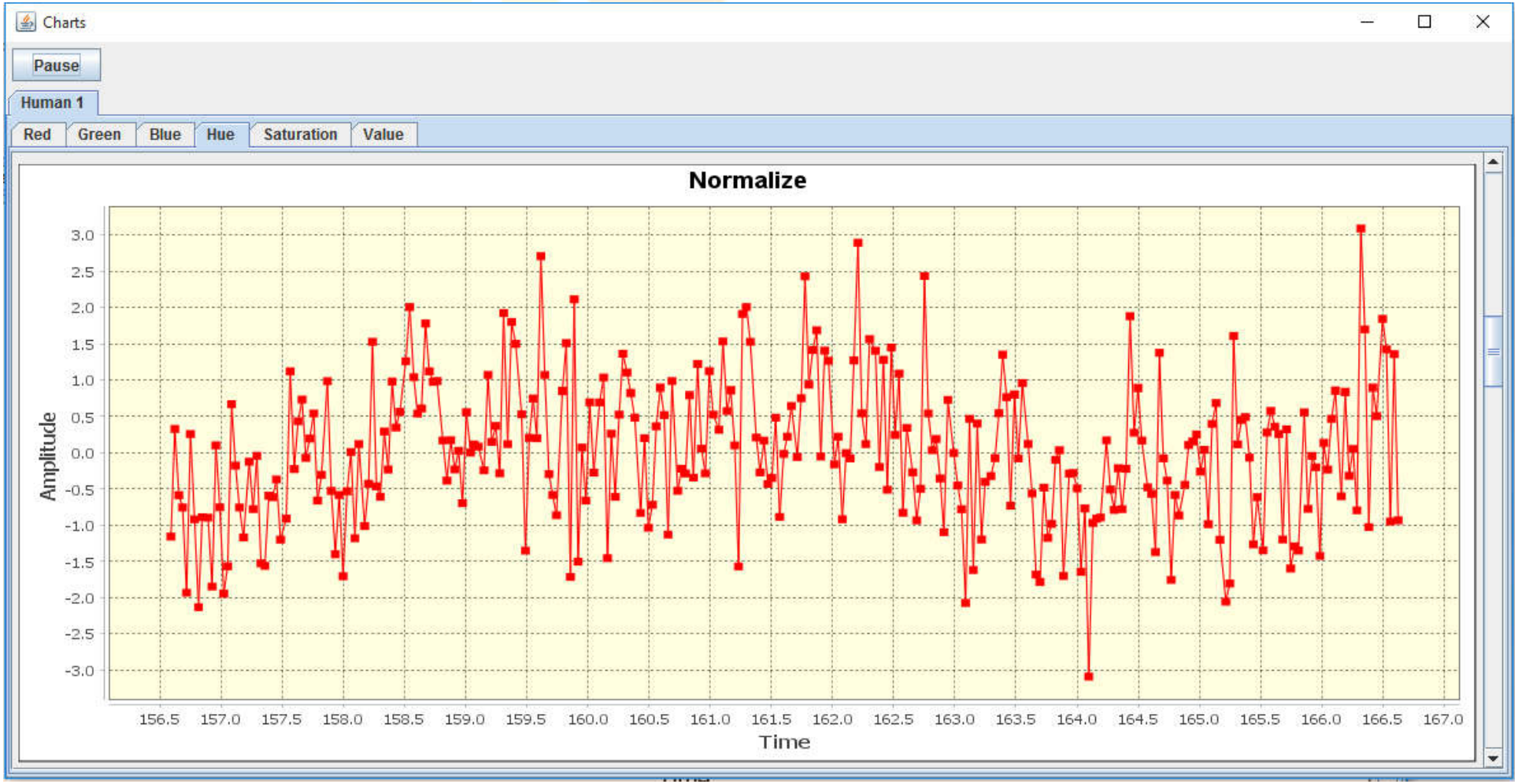
Desktop app



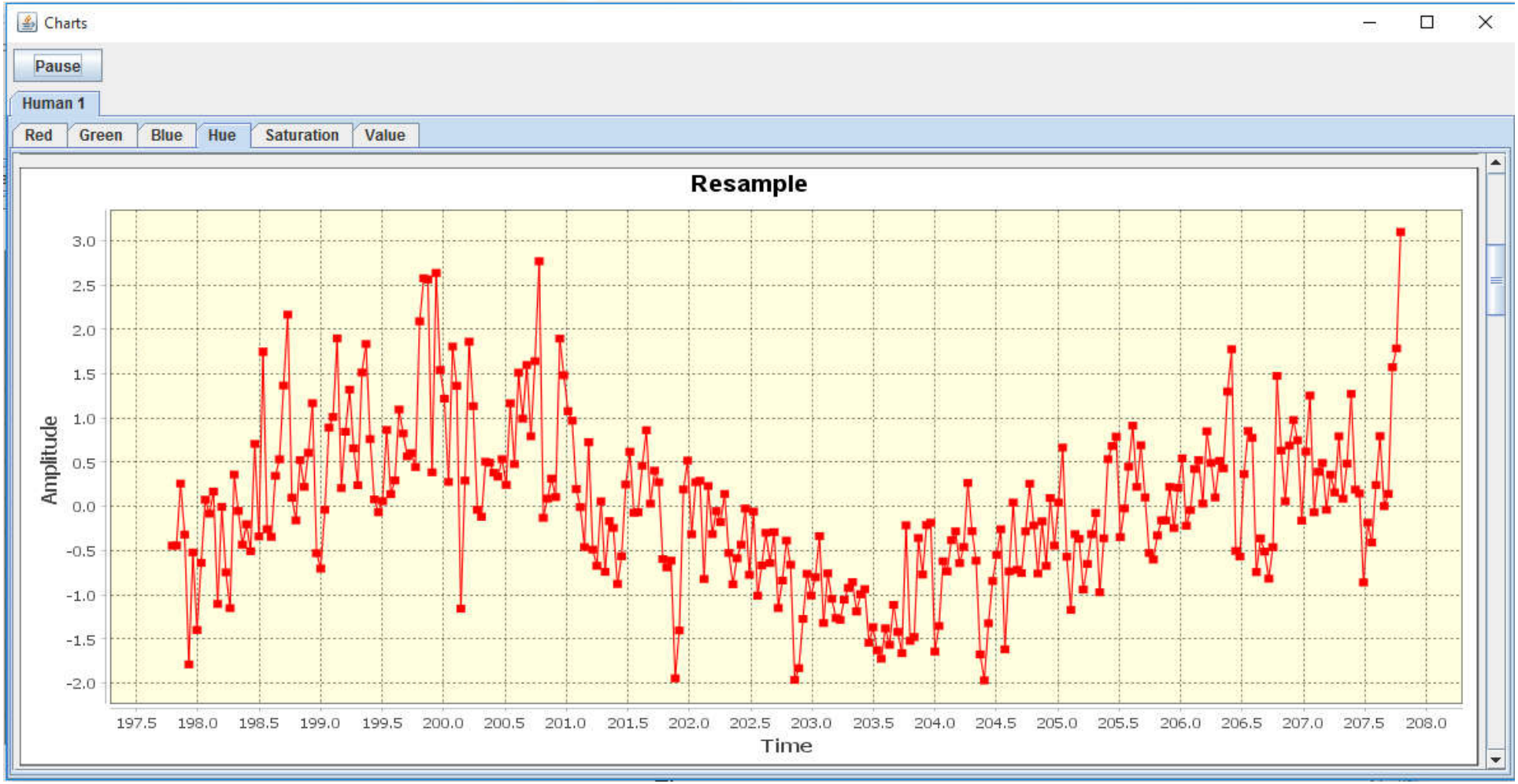
Raw data


Charts
Pause
Human 1
Red
Green
Blue
Hue
Saturation
Value
Raw
Amplitude
223.8
223.6
223.4
223.2
223.0
222.8
222.6
222.4
222.2
222.0
221.8
221.6
221.4
221.2
221.0
220.8
220.6
220.4
220.2
220.0
101.0
101.5
102.0
102.5
103.0
103.5
104.0
104.5
105.0
105.5
106.0
106.5
107.0
107.5
108.0
108.5
109.0
109.5
110.0
110.5
111.0
111.5
Time

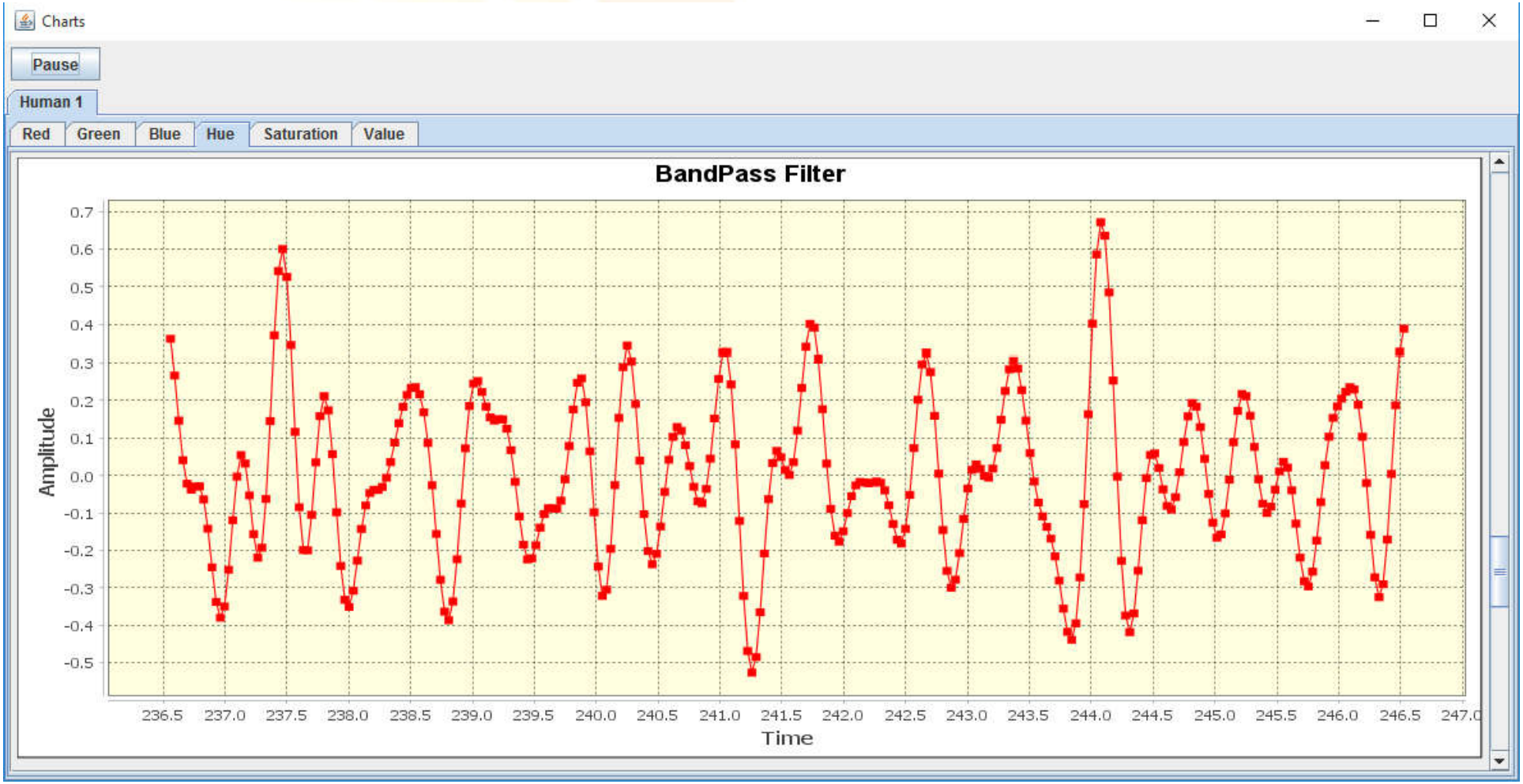
Normalize


Charts
Pause
Human 1
Red
Green
Blue
Hue
Saturation
Value
Normalize
Amplitude
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
156.5
157.0
157.5
158.0
158.5
159.0
159.5
160.0
160.5
161.0
161.5
162.0
162.5
163.0
163.5
164.0
164.5
165.0
165.5
166.0
166.5
167.0
Time

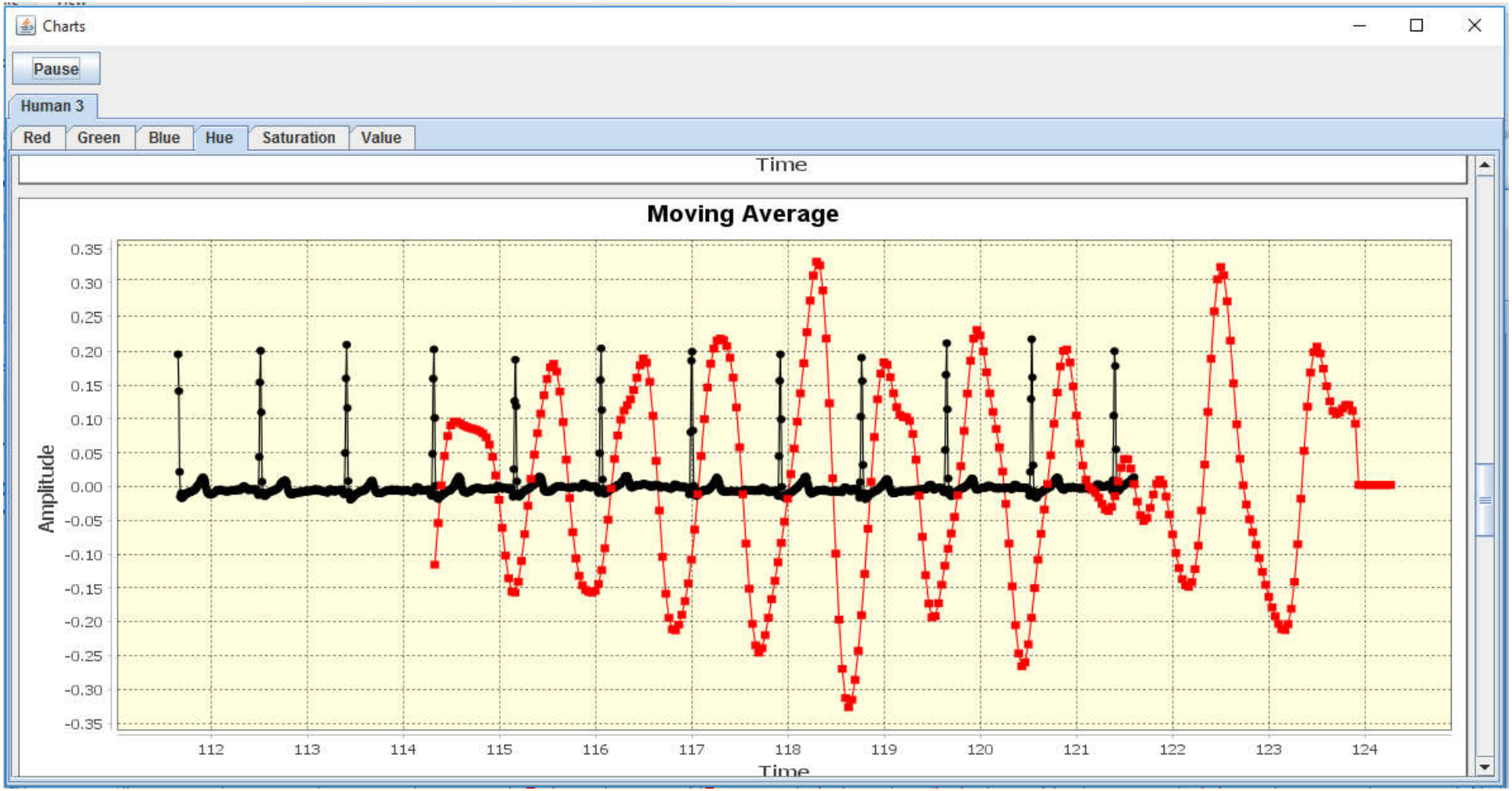
Resample


Charts
Pause
Human 1
Red
Green
Blue
Hue
Saturation
Value
Resample
Amplitude
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
197.5
198.0
198.5
199.0
199.5
200.0
200.5
201.0
201.5
202.0
202.5
203.0
203.5
204.0
204.5
205.0
205.5
206.0
206.5
207.0
207.5
208.0
Time

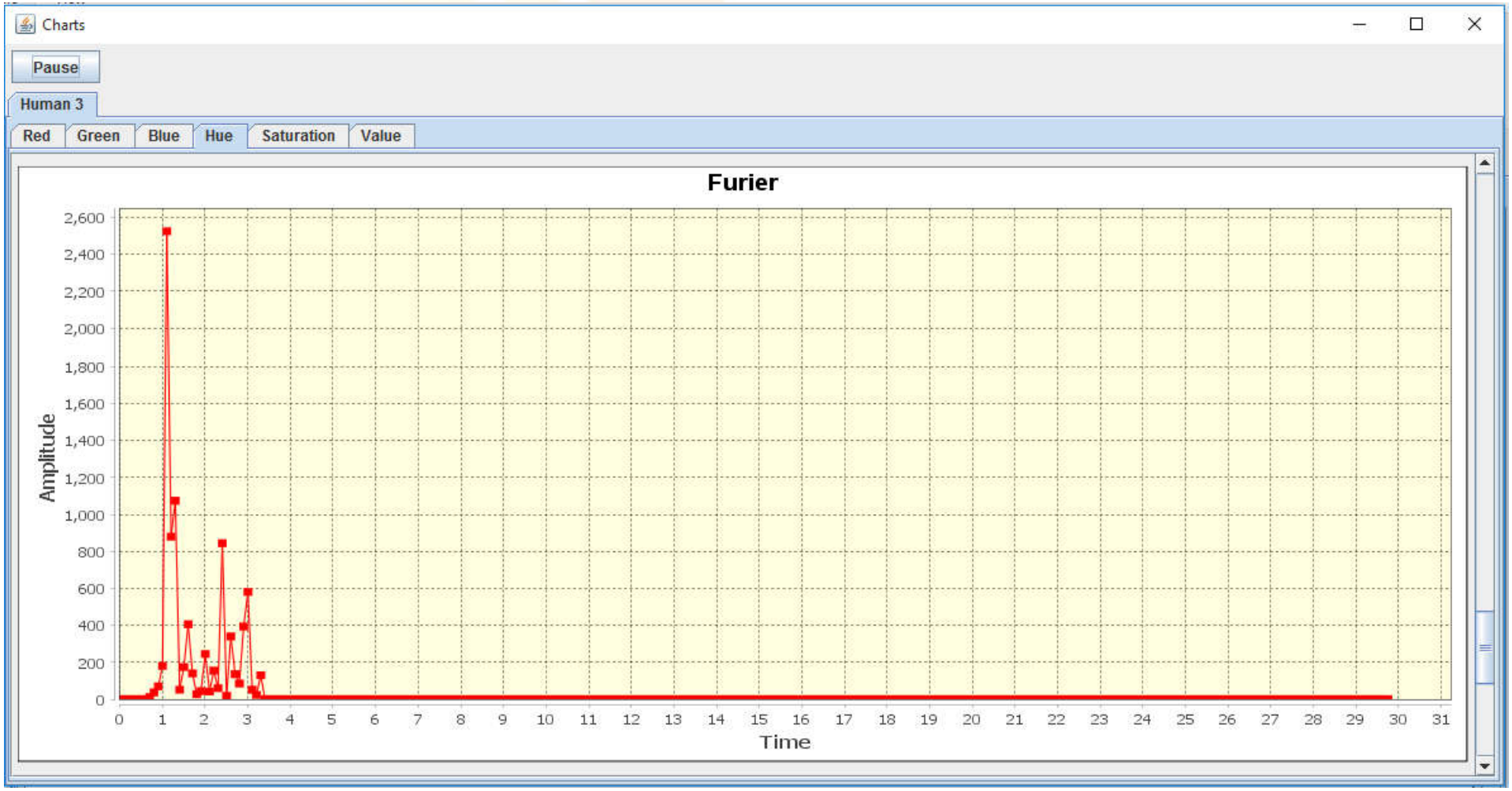
Bandpass filter



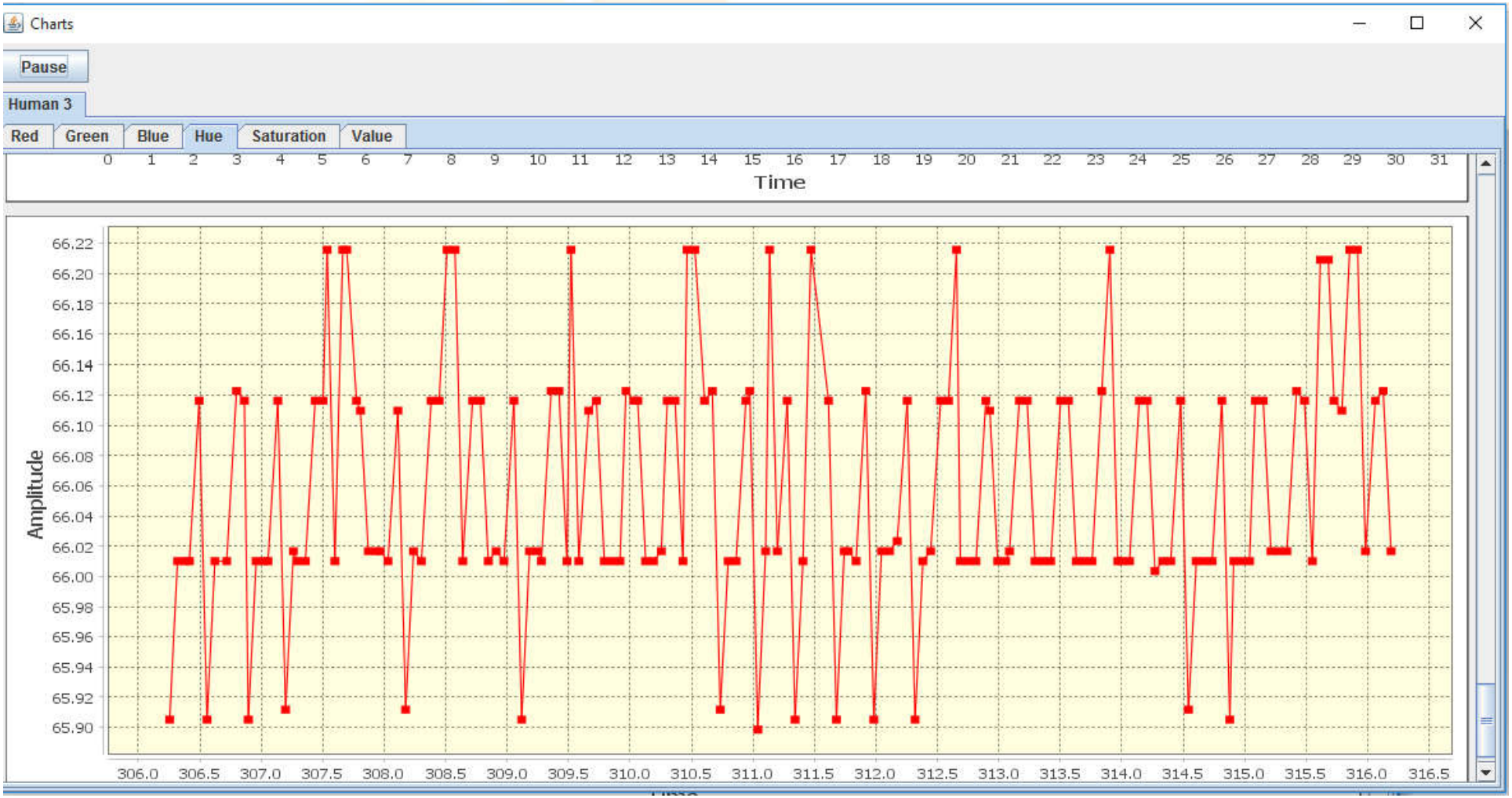
Moving average



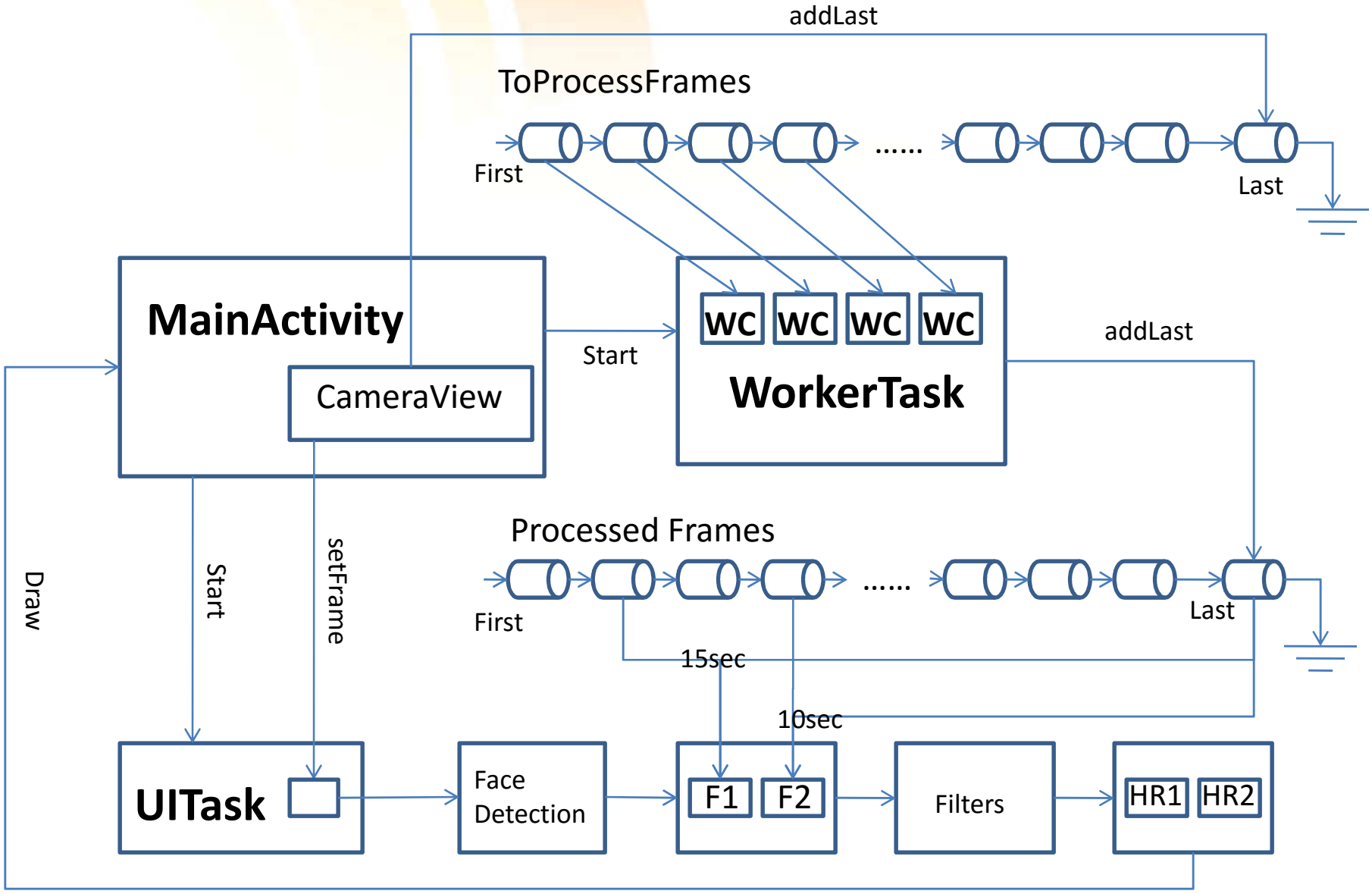
Fourier transform



Error


Charts
Pause
Human 3
Red
Green
Blue
Hue
Saturation
Value
Time
Amplitude

Multi Heart Rate



Use cases

- **Medicine**
- primary health care (no sensors, cables, maintenance)
- newborns, patients with burns or traumas, studying sleeping habits
- where continuous heart pulse measurement is important.
- **Sport**
- Optimal exercising and use of energy
- Attacking when opposite players are tired can give you advantage to win.

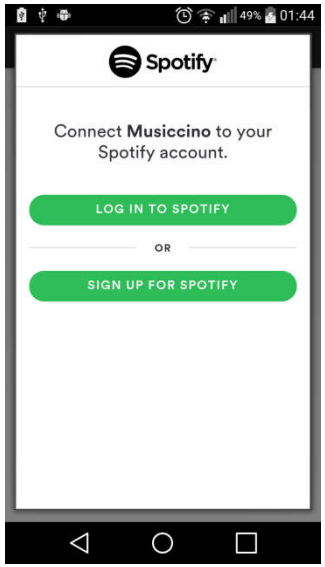
Use cases

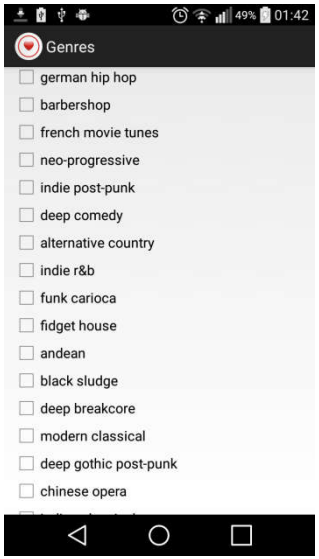
- **Security**
- Driver and passengers
- Airports, malls, universities, etc…
- People working at high places or mines where first help is not available
- **Sales and marketing**
- Notification where to buy coffee if low heart rate is detected for some time
- Better marketing campaigns
- **Video games and applications**
- No physical controllers or difficulty level – control by users heart rate change

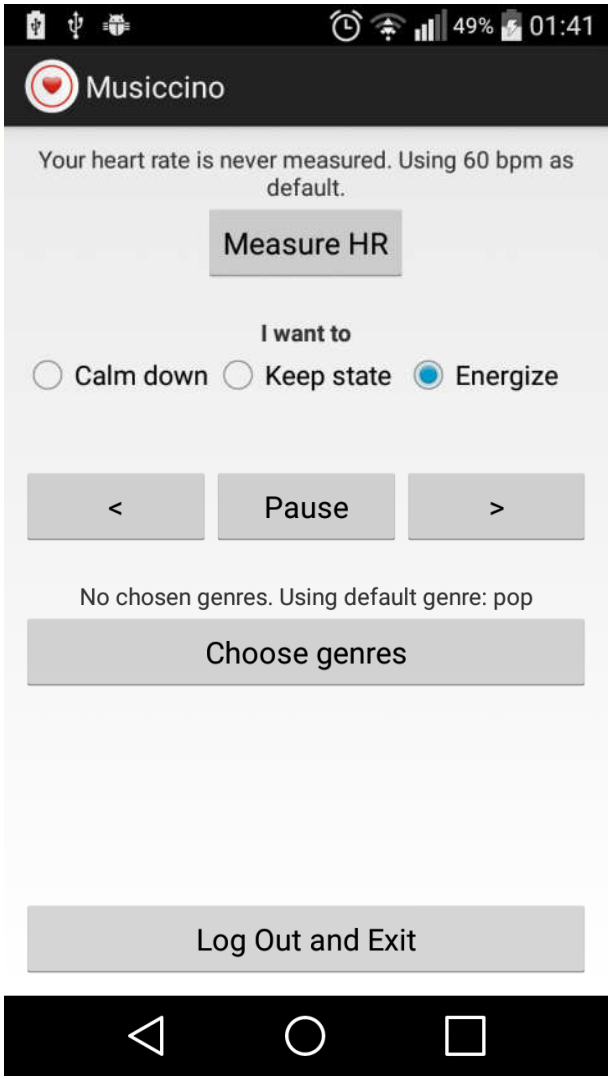
Musiccino

Combine

- Multi Heart Rate
- Spotify Android SDK
- Echo Nest API







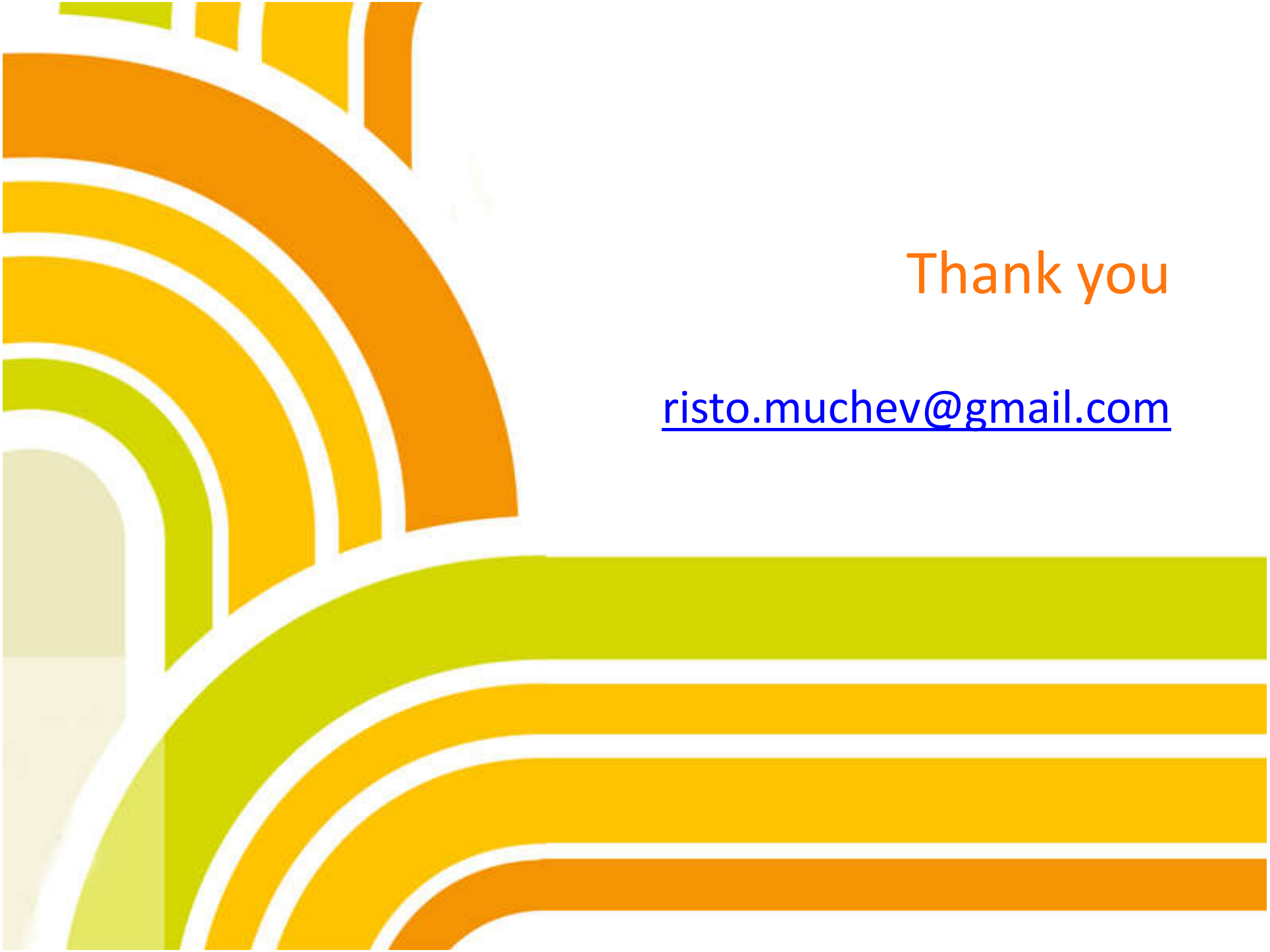
FAQ

1. Does it work with dark skinned people?
Yes and I need more test subjects, so if you know some willing to test please share.

2. Does it work if my forehead covered by something (ex.hair)?
This is a limitation. Luckily usually males do not have much hair covering the forehead.

3. Why the app is big (~19 megabytes)
The apk contains libs to support multiple hardware architectures (x86,ARM,MIPS,etc.).

Questions?



Thank you

risto.muchev@gmail.com