



# PineTime

A Programmer's Toy and Beyond

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# Who I am?

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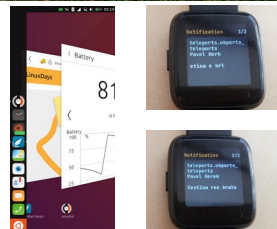
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**DEVCONF.cz**  
open source community conference

**June 13-15, 2024**  
📍 Brno, Czech Republic

**Call for Proposals**

Submit your proposals by March 3, 2024.

Who am I, and why should you listen to me?

- I'm from **Brno**, Czech Republic, known for landmarks like Petrov Cathedral, the Astronomical Clock at Freedom Square, and the Jost statue.
- I volunteer and organize the largest Czech Open-\* conference, OpenAlt.
- I invite you to DevConf (organized by Red Hat), and CfP is still open.
- I'm involved in developing NemoMobile.
- I worked on Amazfish for Ubuntu Touch and aim to contribute to InfiniTime.

Now, let's talk about you. Who are you? Do you have PineTime at home? Are you developing something for it? Do you have experience in embedded development, microcontrollers, or have you developed for Ubuntu Touch or SailfishOS?

# What smartwatch you want?

- Zephyr ZSWatch

[https://www.pcbway.com/project/shareproject/ZSWatch\\_Open\\_Source\\_Smartwatch\\_4ca3bcf6.html](https://www.pcbway.com/project/shareproject/ZSWatch_Open_Source_Smartwatch_4ca3bcf6.html)

- Bangle.js 2

<https://banglejs.com/>

- SQFMI Watchy

<https://watchy.sqfmi.com/>

- AsteroidOS

<https://asteroidos.org/>

- Pine64 PineTime

<https://wiki.pine64.org/wiki/PineTime>



Not representing Pine64 here. If you're a hacker seeking a device for hacking, numerous options are available.

However, if hacking isn't your aim, consider commercial alternatives like the Amazfit GTS

Check My or Nico Cartoons blog for features

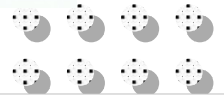
<https://www.ncartron.org/review-of-amazfish-on-sail-fishos.html>

AsteroidOS:

- It requires a powerful device as it runs a full-blown Linux system.
- similar to mobile phones
- runs mostly on older device for example: (LG Watch Urbane “bass” 2015 = ebay + new battery)

# Specifications

- Nordic Semiconductor nRF52832 with 64 MHz ARM Cortex-M4F
- 64 KB RAM
- 512 KB ROM + 4 MB SPI Flash
- ST7789 Display (240x240, RGB 65K) + CST816S Touch Panel
- BMA421, HRS3300, Vibration motor
- BT 5.0 including BLE
- 180 mAh 3.8V LiPo



Let's discuss hardware specifications.

- Sealed Edition versus the Dev Kit.

## InfiniTime

Firmware for Pinetime smartwatch written in C++ and based on FreeRTOS

## Wasp OS

A MicroPython based development environment for smart watches (including Pine64 PineTime)

## Rust Riot

Rust on RIOT Firmware for PineTime Smart Watch with NimBLE and LVGL

## GadgetBridge

Android App for Pebble, Mi Band, Amazfit Bip (and more) without the vendor's closed source application and without the need to create an account and transmit any of your data to the vendor's servers.

## Amazfish

SailfishOS, Ubuntu Touch, Kirigami, Controls smartwatch companion app

## Others

Siglo – gtk based companion app  
ITD – go companion app  
Watchmate – rust companion app  
InfiniLink - iOS app

## Software:

- Left side – OSs for PineTime
- Right side – Companion apps

- **InfiniTime**: Regarded as the most mature OS for daily use.

- **GadgetBridge**: Recognized as the most mature companion app, but it requires Android. I am interested in Amazfish.

There are also other options. Here, I would like to mention some random features of each solution.

# InfiniTime

## Vision

InfiniTime is a community-built smartwatch firmware. It offers freedom and privacy advantages unavailable to users of proprietary wearable technology.

InfiniTime is not to be used for medical or other health tracking purposes.



Let's take a look on InfiniTime.

The motto expresses core aspects of the project:

- Emphasis on **freedom and privacy**.
- Explicit exclusion of health tracking.

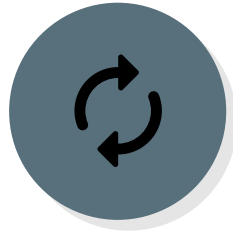


## Why you need smartwatch?



### Health monitoring

Steps counter  
Heart rate  
Sleep



### Notifications

Phone calls  
Emails, Chats  
Alarms  
Calendars



### Activities

Weather forecast  
Music remote control  
Navigation  
Apps/Games (2, pong, calculator, QR/bar codes)

Here, I'd like to highlight the current status and limitations of some features while also opening up the discussion to understand what is important for others.

(Let's pause and allow some time for interaction)

**Step counter + HRM** – Provides real-time data only.

**Sleep monitoring** – Currently not available.

**Notifications** – Lack of notification suppression on phone call ended, utilizing Alert Notification Service, issues with header (2/3 bytes), actually 16-bytes payload in the spec.

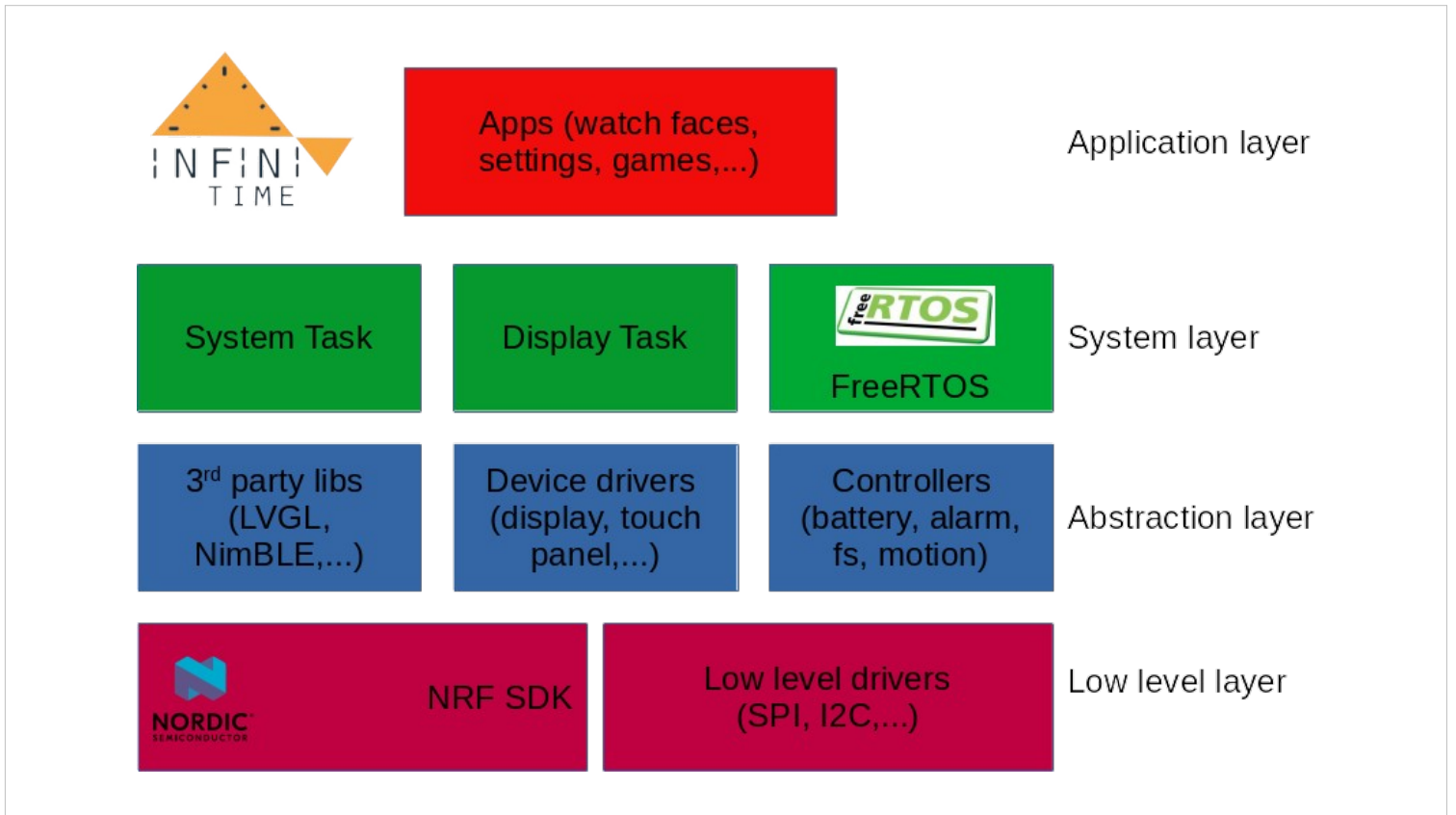
**Calendar** – Currently available only as a notification. Other vendors allow offline/syncing of calendars.

**Weather** – new weather feature \o/

**Navigation** – IDK

**Apps** – New interface allows adding/removing apps in compile-time (CMake flags).

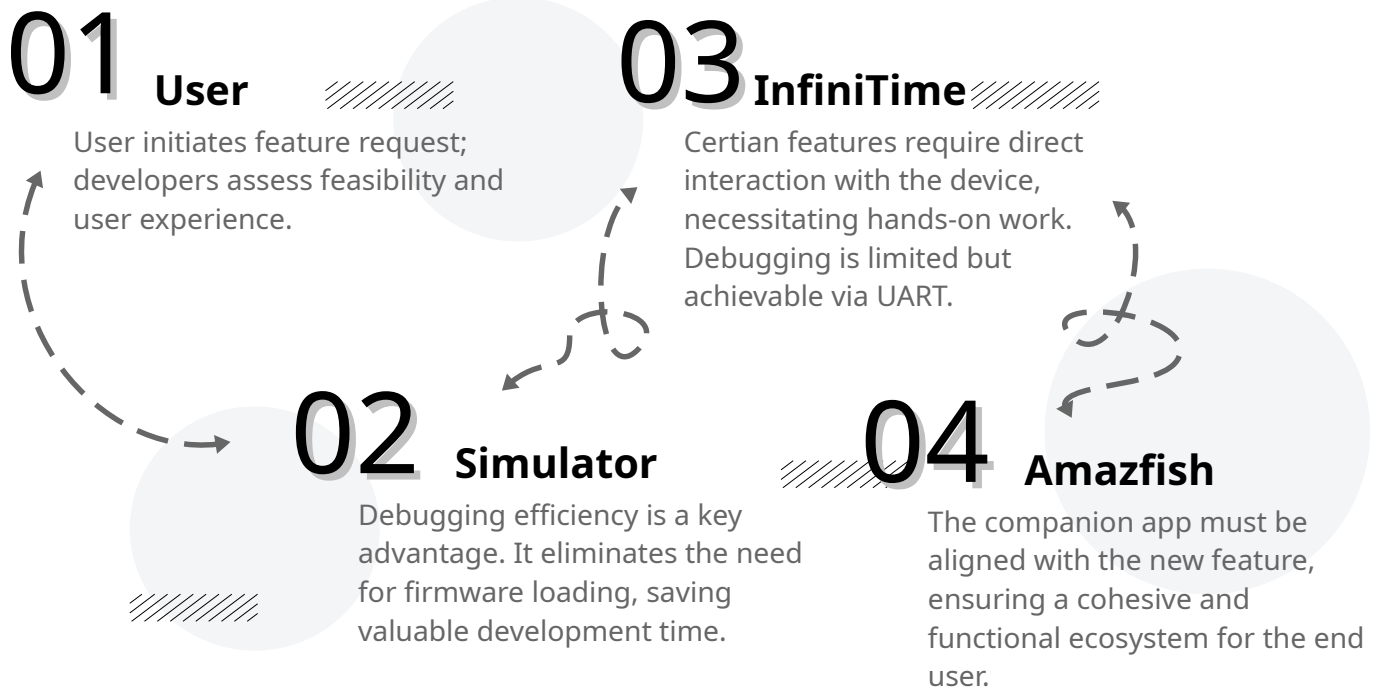
**Watchfaces** – Significant interest was expressed in my last talk about PineTime.



This is a tricky picture:

The abstraction layer facilitates interaction with a generic MotionController, while the driver is implemented in the low-level layer. This design enables porting to other devices, and there have been successful ports already.

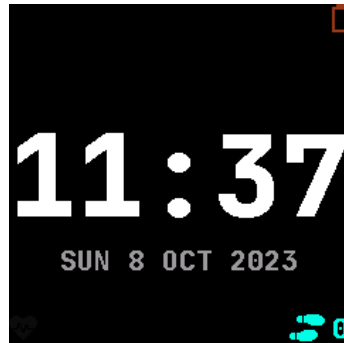




If you want a certain feature, updating InfiniTime and the companion app together is likely necessary.

Development with InfiniSim is considerably faster, but it may not be suitable for every use case.

# Simulator



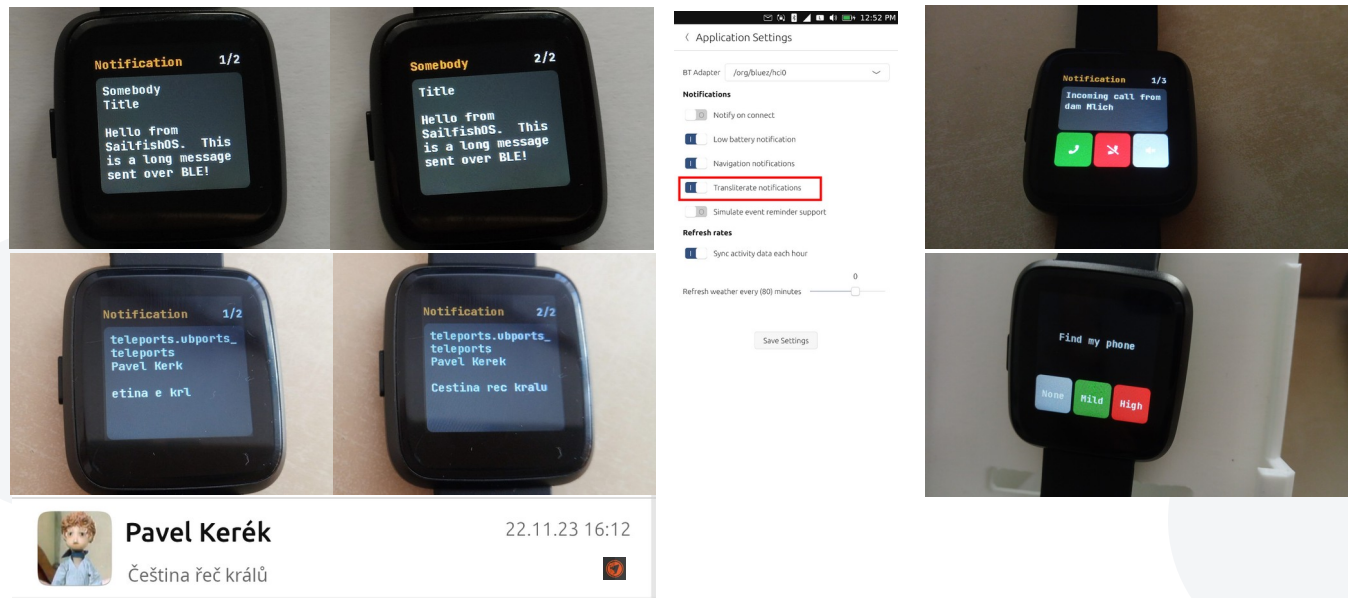
Demo time.

I'd like to showcase something I'm working on:

<https://github.com/InfiniTimeOrg/InfiniTime/pull/1884>

- switch to terminal
- start InfiniSim
  - recording
  - fake HR
  - fake steps
  - fake battery

# Amazfish Notifications

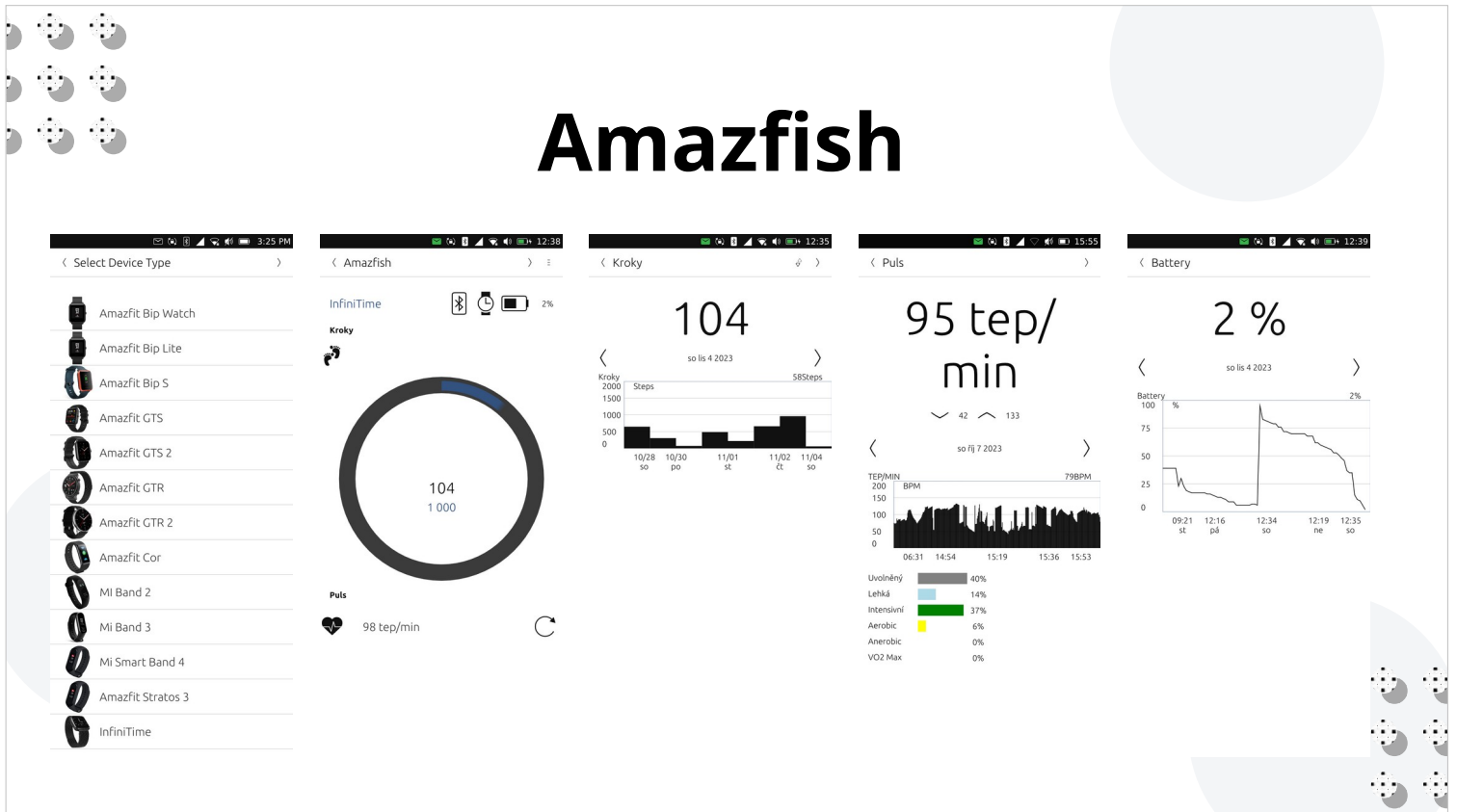


My contributions to Amazfit

- title/message separation
- resolving of application name
- transliteration (downstream projects with more UTF-8 characters compiled in – not included by default because of size of the image)

I worked on these contributions with Ubuntu Touch/Volla Phone, but I believe the SailfishOS community does also benefit from this work.

# Amazfish



## Amazfish Bugs in Detail and Journey of Porting to Ubuntu Touch

The initial step was compilation, utilizing the UBports SDK and bundling dependencies.

The universal components, the same as in PureMaps, were already present. They function as a wrapper (child class) around native components, including generic controls, UBports, SFOS, and Kirigami.

It wasn't tested, requiring some adjustments, such as single-item MenuBars and icon size.

I also discovered a few bugs in pairing; specifically, AttachedPage wasn't properly utilized, causing issues with the back button.

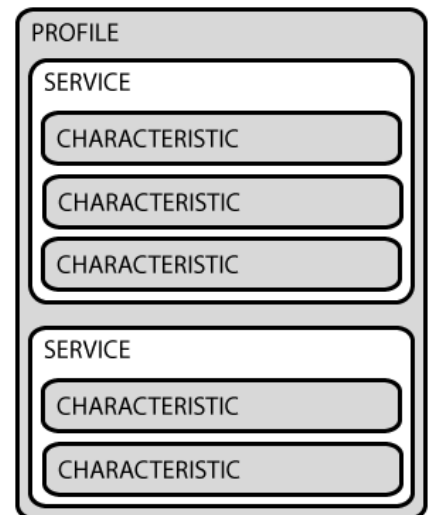
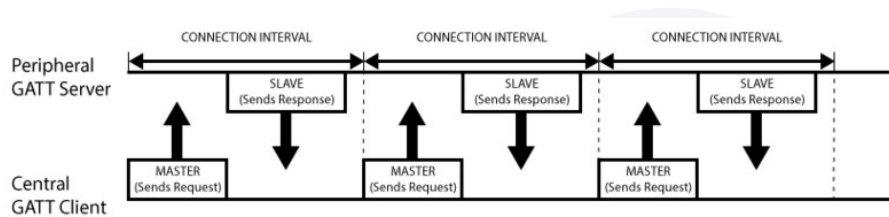
Real-time steps weren't being passed to the UI due to a wrong type.

Added sampling.

There is an HRM patch in InfiniTime that allows streaming data even when the screen is turned off.

# Bluetooth low energy

## General attribute profile



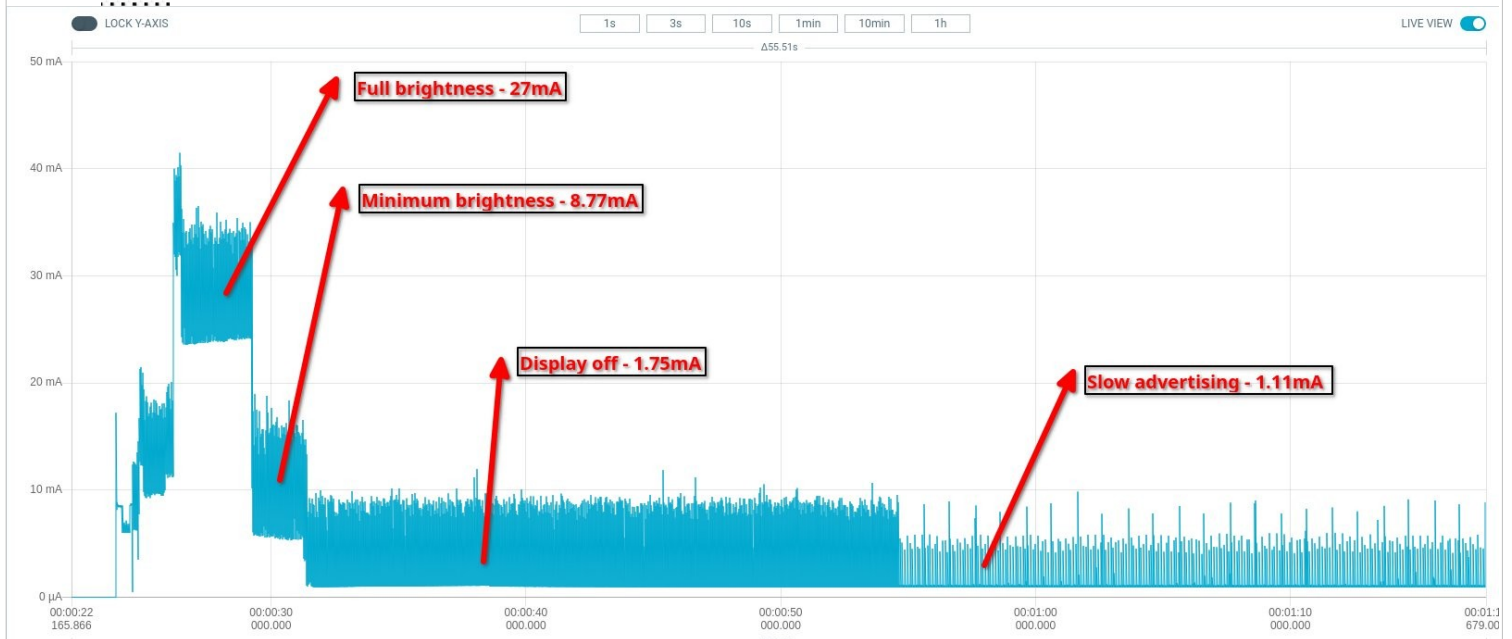
I attempted to create a "Find My Phone" feature using the immediate alert service, but it requires more time. Debugging with a sealed device is challenging, although it's possible due to the recovery firmware.

The use of BLE is advantageous for battery efficiency.

- GATT profile
- ANS Service
- ImmediateAlertService
  - Characteristics
  - Characteristics
  - Descriptors
  - Descriptors

Amazfit (qble) interacts with BlueZ via D-Bus, with no low-level interaction. Limited API: the app can't effectively handle unstable or unreliable Bluetooth.

# Battery life



A significant distinction in embedded development compared to desktop computers is the need to focus on power consumption.

PineTime, equipped with a 180mAh battery, can last for over 7 days.

I've incorporated a battery log into Amazfish, enabling you to monitor the impact of your changes on power consumption.

# PineTime + Amazfish Features

Pairing	✓*
Notifications	✓
Calls	✓*
Settings	x
Alarms	x
Sync steps/Heartrate	✓
Sync Activities	x
Calendar sync	x
Firmware upload	✓
Battery status	✓
Navigation notifications	~
Music control	✓
Sync time	✓
Sync weather	✓
Gallery app	Desired
Remote (camera) control	Desired
OTP	Desired

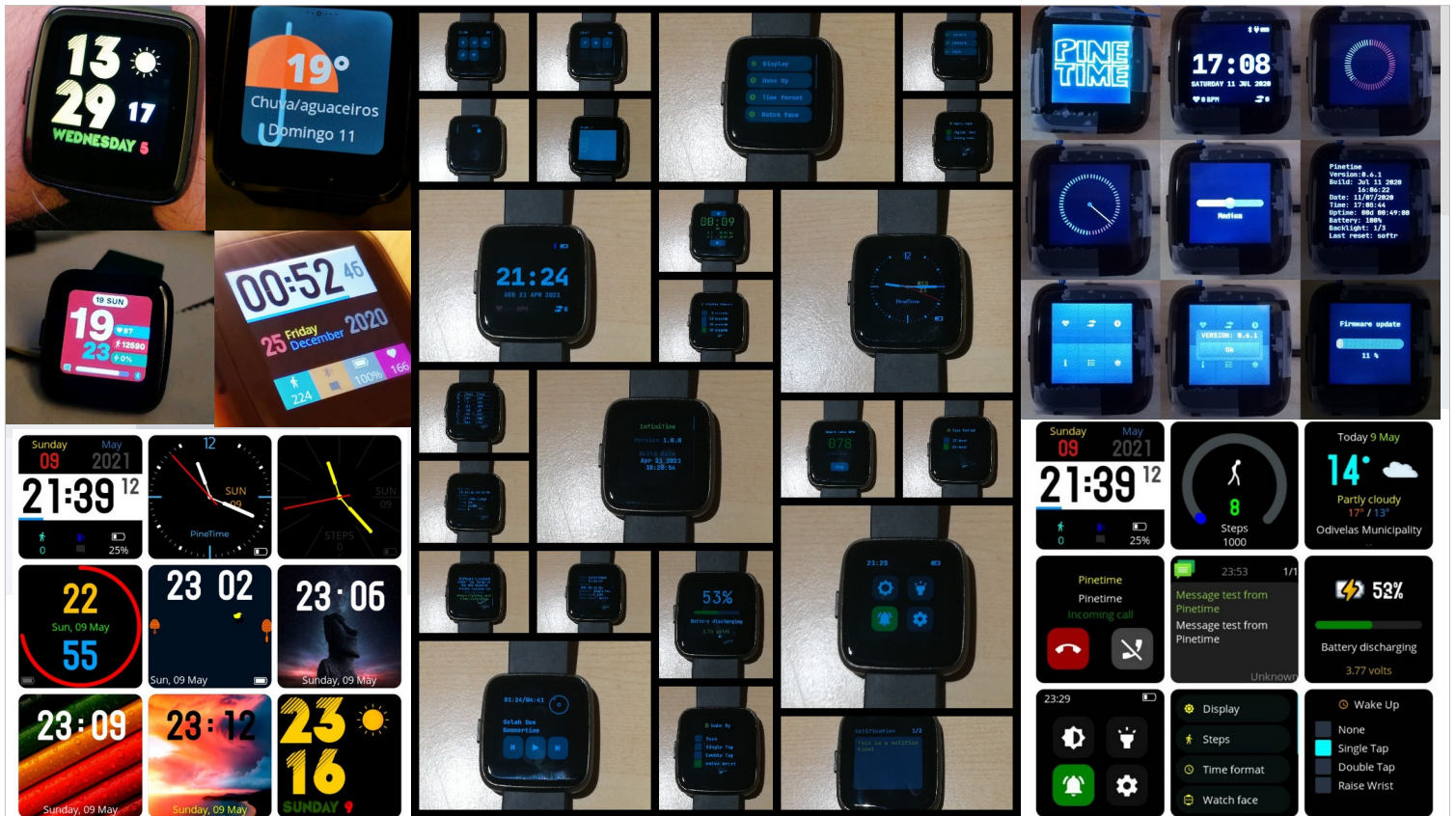


People used to say something like this when I was young, and I've attempted to capture that sentiment using midjourney AI:

- 'I want to be a billionaire' (a challenging goal)
- 'Yes, yes, and I want a watch with a fountain' (highlighting the perceived impossibility of the request)"

This is another opportunity to go through the feature list and discuss the details.





It is free software or open source. There are many forks.

There were rumors about PineTime 2. Joachim from Portugal used the next-gen (current+1) Nordic Semiconductor with 2 times bigger memory.

State-of-the-art smartwatches have stronger hardware and more peripherals (oximeter, NFC, speaker/mic, GSM, e-ink). With those, it will be a completely different product.

There is a lot of space in software development. We can discuss how to improve/accelerate the review process, etc.