

TM

Community Built E- ink Laptop Project

Sunday, 28th March 2021, at 11 am PST



Alexander Soto
Boston, MA
(aka "alexsotodev")
Project Lead
Core Team

I'm a community organizer, educator, software engineer, hacktivist, and agent of social change.

My interests are in exploring community-building, social justice, education, and leveraging technology to address social problems.

In the past, I've worked as a labor rights organizer, a teacher, and I'm currently an Expert In Residence at [Resilient Coders](#).

[@alexsotodev](#)

[alexsoto.dev](#)

contact@alexso.dev



Giovanni Lostumbo
Chicago, IL
(aka "initrd")
Core Team

I'm an independent contractor- I provide tech support services to IT companies.

My hobby interests are in building technology (e.g. FOSS hardware & software) and making it easier to use and more accessible.

In the past, I have worked in technical support roles for IT companies in wireless networking, help desk, and hardware repair.

[@techrecount](#)

hackaday.io/initrd

[Github](#)

giovanni.lostumbo@gmail.com



Manuel Zeiler
Munich, Germany
(aka "m10r-vc")
Core Team

Manuel is responsible for various marketing and community management activities across the whole EI2030 initiative. He's been an early adopter and big proponent of emerging technologies including electronic paper as well as cryptocurrencies. His work setup and station is designed around paperless eink devices. On his day job Manuel works as an Account Executive at a German publishing house. He has also been an IT Specialist and Network Administrator with the German government and the automotive industry with a stint in New York. He has also served as Marketing Manager at various startups.

@EI2030_official

ei2030

manuel@manuelzeiler.com



Resilient Coders



Our students spend 20 weeks with us, learning object-oriented programming principles, through the vehicle of full stack javascript; that's vanilla JS, React, Express, Node, and PostgreSQL.

HIKE

DONATE

Objectives

- To generate interest in the idea of creating an e-ink laptop.
- To unite and increase our numbers.
- To iterate, test ideas, document, and show our work.
- Create a crowdsource campaign after the successful creation of a minimum viable product.
- Bring the MVP to a manufacturer and build at scale.

Working Groups



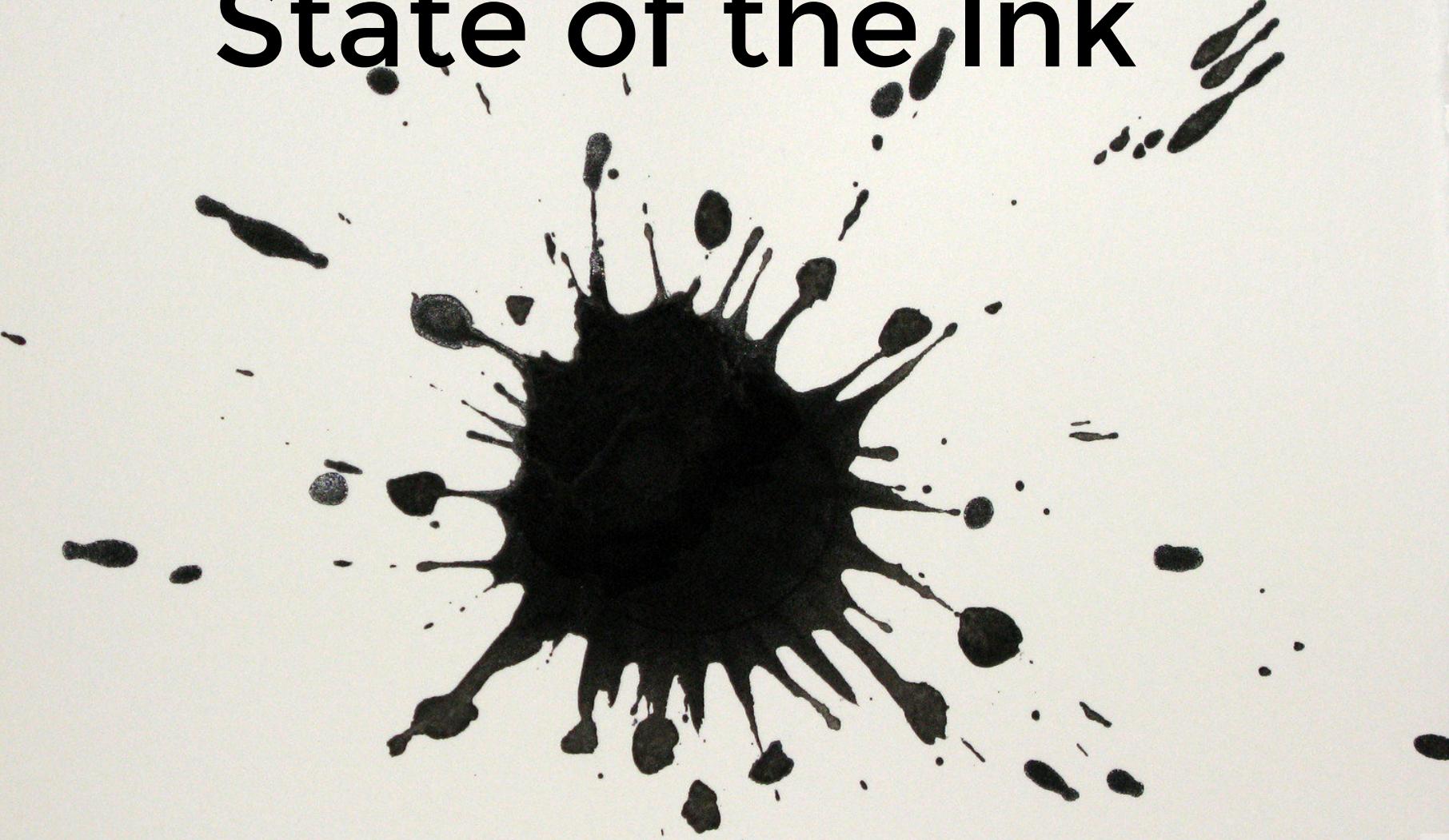
- Led by one or two people as leads.
- Research focused or revolve around a deliverable.
- Defines a metric/cost for who the device is for.
- Working groups are time-boxed defined.
- A "template" provided for the working groups to start and self-organize.

Working Groups Contd.



- The working group documents its process in a designated website, forum, Github, a build log.
- Share resources/knowledge/material/monetary.
- Generate interest, share our work with others.
- Iterate, iterate and iterate.

State of the Ink



Speaker notes

Overview of e-ink based devices and difficulties faced.

What we have done
so far...



We are growing!

- We've had **42** new members join our community!
- More people are viewing our forums, in particular the working groups.
- Continuously engaging people and communities in social media platforms, Twitter, Reddit.

Thank you for joining our community!



We are growing!



Electrophoretic Ink Working Group (EI2030) Retweeted

Alexander Soto @alexsofodev · Mar 26
I had a great time at this month's pi-top session, saw so many great projects and conversations! Thank you!

@GetPiTop #raspberrypi #pitop

pi-topTEAM @GetPiTop · Mar 25
Join us tomorrow at 5 pm GMT for our next pi-top Sessions!

We've got some new content to share, and new members of the community who have some exciting material joining the call! Sign up now: hubs.ly/H0JQX610

#RaspberryPi #IoT



1 2 11

#2 Join our Second EI-2030 Monthly Community Call - Sunday, March 28th, 11am PST	 1 83 22h
■ Announcements	
Low-power E-Paper OS	 1 167 8d
■ Working Groups	
Proposal: el-2030 - The Community Built E-Ink Laptop Project	 10 667 8d
■ Project Introduction	
Research: Laptop case design	 1 67 10d
■ Working Groups	
PaperTop Laptop	 6 1.8k 11d
■ Working Groups	

Hi Pi-Top community, we are EI-2030! 📝



EI2030

3 11d

Hi Pi-Top community,

At EI2030 1, we've started a community effort to promote the use of alternative displays to blue-light emitting screens in our devices. The objective of one of our working groups, the PaperTop 4, is to explore creating an e-ink laptop using a Raspberry Pi 3B+, Pi-Top and an e-ink panel.

Another of our working groups seeks to utilize ultra low power microcontrollers & microprocessors to design solar powered laptops. We thank the invitation by the Pi-Top CTO to post on this forum as well as offering to provide technical support. We also will be attending the next monthly Pi-Top Session and look forward to sharing more of our progress! 😊

Sincerely,

EI2030 Working Groups Core Team

2 11d 2d 21 112 6 27 12 7 17 3 Reply

created last reply 21 replies 112 views 6 users 27 likes 12 links 7 17 3

A structure is emerging!

- Working Group Categories in forum.
- Templates for starting a working group.
- EI2030 Github organization.
- Github repository for each working group.
- New channels in Discord for working groups.

The screenshot shows the EI-2030 forum interface. At the top, there's a header with the logo and URL (<http://ei2030.org/>) and a Twitter handle (@EI2030_official). Below the header, there's a navigation bar with links for Repositories (4), Packages, People (2), Teams, Projects, and Settings. A search bar with placeholder text 'Find a repository...' is followed by 'Type' and 'Sort' dropdowns, and a 'Customize pins' button. A green 'New' button is also present. The main content area displays four repository cards:

- Low-power-E-Paper-OS**: CC-BY-SA-4.0 license, 0 stars, 1 issue, 0 pull requests, updated 1 hour ago.
- awesome-eink**: CC-BY-SA-4.0 license, 0 stars, 0 issues, 0 pull requests, updated 7 days ago.
- PaperTop**: CC-BY-SA-4.0 license, 0 stars, 0 issues, 0 pull requests, updated 11 days ago.
- working-group**: CC-BY-SA-4.0 license, 2 stars, 0 issues, 0 pull requests, updated 19 days ago.

Each card has a small profile picture and an 'Invite someone' button.

The screenshot shows the GitHub interface for the 'Template for EI2030 Working Groups' repository. At the top, there's a header with the GitHub logo and links for Team, Enterprise, Explore, Marketplace, and Pricing. A search bar, notifications icon, sign in, and sign up buttons are also present. The main content area shows the repository details:

- alex-a-soto** updated README.md 19 days ago (10 commits)
- agendas**, **notes**, **wiki** added README.md to agendas, notes, and wiki 20 days ago
- README.md** updated README.md to agendas, notes, and wiki 20 days ago
- README.md** updated README.md 19 days ago

The repository has no description, website, or topics provided. It includes sections for **About** (no description), **Releases** (no releases published), and **Packages** (no packages published). A sidebar on the right lists collaboration tools.

A structure is emerging!

The screenshot shows a forum interface with a navigation bar at the top. The 'Latest' tab is selected. Below the navigation bar, there is a search bar and a 'Topic' filter. The main area displays a list of topics:

- Low-power E-Paper OS (1 reply, 167 views, 8d ago)
- Research: Laptop case design (1 reply, 67 views, 10d ago)
- PaperTop Laptop (6 replies, 1.8k views, 11d ago)
- About El2030 Working Groups (0 replies, 84 views, 18d ago)
- Template: Propose for a working group (2 replies, 56 views, 20d ago)

The screenshot shows a Discord server interface. The left sidebar lists the following channels:

- WORKING GROUPS
 - # general
 - # proposals
 - # join
 - # papertop (with member and settings icons)
 - # low-power-solar
 - # laptop-case-design
- VOICE CHANNELS
 - general
 - papertop
 - low-power

The screenshot shows a GitHub issue thread titled "OS Options #1". The thread has one comment from "alistair23" and one reply from "hatonthecat".

OS Options #1

alistair23 opened this issue 12 days ago · 6 comments

alistair23 commented 12 days ago • edited

I wanted to point out Tock as an OS option.

It supports the Redboard Artemis, STM32 and a range of other MCUs you listed as potential options. It includes basic screen support as well (although not e-paper).

If you are running on larger hardware (with an MMU) xous is another option. They are working heavily on screen support, although again not e-paper.

If you are able to run Linux then everyone seems to use NXP chips as they have pretty good e-paper support. For example there is work to upstream the iM2 kernel and the rM1 even ran a standard distro.

alistair23 changed the title OS Option OS Options 12 days ago

hatonthecat commented 10 days ago • edited

Thank you for these suggestions! Sorry I didn't see this comment earlier- I am new to Github and signed up for notifications just now but I welcome these suggestions and feel free to check out our [Discord](#) as well.

The Redboard Artemis seems a great option due to its low power- the other day I made a more in-depth video on solar powering it: <https://www.youtube.com/watch?v=428cgrpPR0w> Alternatively, the module or even the MCU could be sourced without the extra power consumption of the LEDs. Their A la carte design could potentially do away with the extra components that use power, such as the red power & blue activity indicator LEDs, which could use as much as 40% less of the 5mW it is said to use (features tab).

While it uses the Apollo3, it only has 384K RAM. The Apollo3 Blue Plus has 768K RAM, and Apollo4 has nearly 4MB (3.8MB counting SRAM & MRAM). While it doesn't have an MMU, it would be interesting to see what could run without external SPI RAM added. That said, there have been some attempts to run linux w/o MMU, such as the <https://www.cnx-software.com/2019/12/03/western-digital-risc-v-linux-busybox-boot-spared-maix-go-board/> and it would be interesting to see how Tock could be used to run apps the way uclinux does in [limited] and low power/tickless (<https://www.electronicdesign.com/embedded-revolution/article/21795660/practical-advice-on-running-uclinux-on-cortexm3n4>) memory, since stack overflow would be a potential issue.

Reflective displays are an alternative to e-paper that some in our El2030 are also very interested in. They have low power (such as SHARP Memory display) consumption, and perhaps xous could be used with that since it is not e-paper. Also, memory in pixel has some MbedOS support, which the Artemis Dev Kit is supposed to support fully.

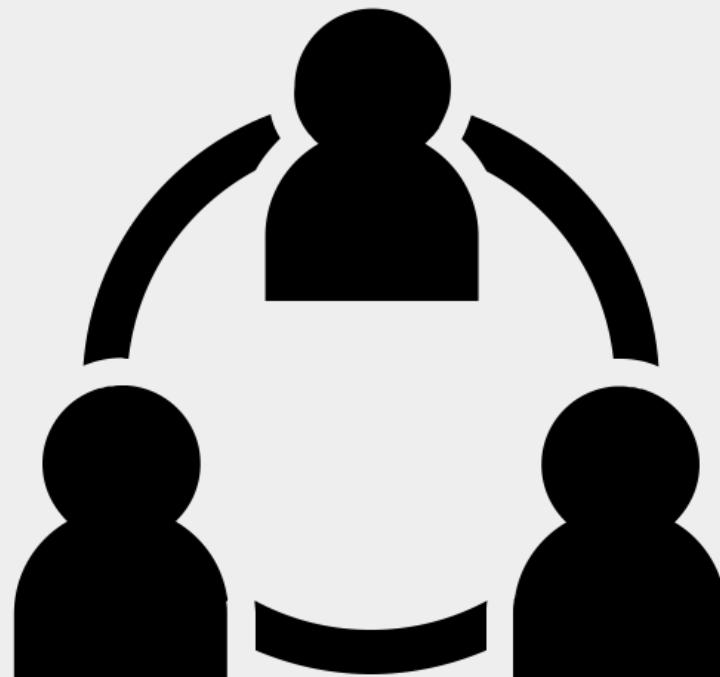
There are some interesting Epaper software/drivers, such as PaperTTY & EPDiY, though it seems I am not sure as to the memory constraints, which is why I'd like to focus on monochrome drivers/conversion software like this GPS e-paper display

-Giovanni

Outreach Efforts

- Ambiq Micro
- Northwestern University
- TU Delft
- Emcraft
- Greenwaves Technologies
- PULP Platform/ ETH Zurich
- SiFive
- ARM
- Norcott.co.uk
- Samsung
- Intel
- Dreamchip.De
- Rdot Displays/Ynvisible
- Micromagic
- IMEC
- Sparkfun
- GroupGets
- Embox
- E-peas
- Epishine
- Powerfilm
- Cap-XX
- Bootlin
- Konsulko
- E-ink
- Astrohaus
- beck-elektronik
- Variscite
- Toradex
- Boundary Devices
- Pi-Top
- Slimbook
- XY Tech

ACTIVE Working Groups



Speaker notes

- People self-organize into working groups.
- Some categories for the working groups:
- low power, high power, sub \$500, \$500-800, SBC, microcontrollers, general purpose.

PaperTop



- PaperTop as an initial prototype for an eink laptop.
- [Working Group: PaperTop thread](#)
- Presented PaperTop at the Monthly Pi-Top Session.
- Next Steps
 - Extending the cables of the ES133TT3 panel
 - Connecting and fitting everything to the Pi-Top
 - Working with Pi-Top team to complete the prototype

PaperTop



duwudi

11d

Hi @alexstotodev , pi-top co-founder/CTO here - just wanted to say I absolutely love this project! 😊 I'd be happy to help support from a technical standpoint if you need any more details than what you can find online, but it seems you've made a pretty good start already!

It's interesting that you mention a solar-powered laptop as a possible use-case, the genesis of pi-top 1 was actually a solar-powered Raspberry Pi laptop powered by supercapacitors! An e-ink display certainly would have increased the 2 minute runtime I had with those supercaps powering an LCD panel 📸 I posted some info on that [here over on our forum](#) if you're interested 👍

We have a monthly community meeting on the last Friday of every month called pi-top Sessions, it would be great if you could attend and do a 5-minute talk on PaperTop. Also, you could post this project on our forum as I'm sure our community would love it as much as I do!



alexstotodev

4 15d

Introduction: PaperTop

The objective of the PaperTop is to explore creating an e-ink laptop using a Raspberry Pi 3B+, Pi-Top, and an e-ink panel. Explore what other single-board computers could be supported with the chassis. Explore what modifications to the Pi-top and what is and is not possible.



The first pi-top started as part of an IndieGoGo campaign in 2014. Since then, there have been different iterations of the pi-top. The v1 to v3 of the pi-top is of particular interest since they share a similar design. The pi-top we are using, v2, is available on eBay for about \$50-80 dollars; the one shown here was purchased for \$30.



Alexander Soto @alexstotodev · Mar 26

I had a great time at this month's pi-top session, saw so many great projects and conversations! Thank you!

@GetPiTop raspberrypi #pitop

pi-top pi-topTEAM @GetPiTop · Mar 25

Join us tomorrow at 5 pm GMT for our next pi-top Sessions!

We've got some new content to share, and new members of the community who have some exciting material joining the call! Sign up now: [hubs.ly/H0JQX610](#)

#RaspberryPi #IoT

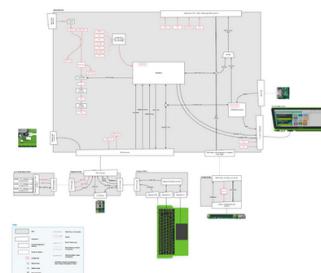


alexstotodev

3 12d

Teardown of the Pi-top v3

Block Diagram of the Pi-top v3

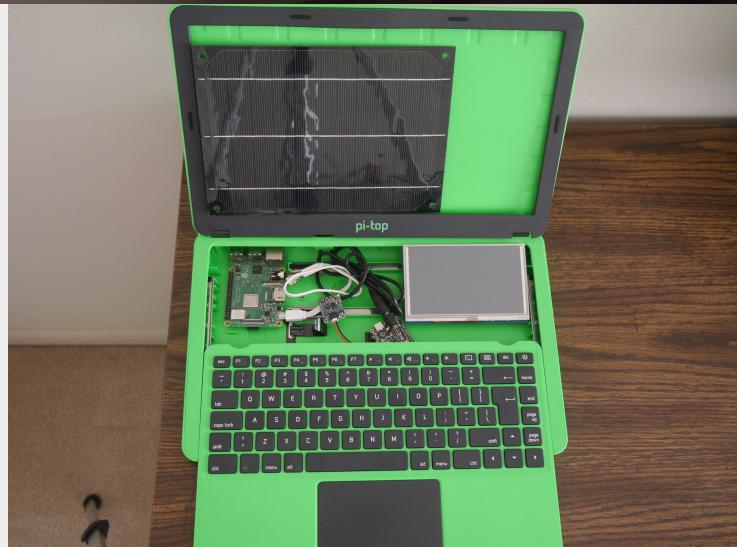


Overview: Teardown

I performed a small teardown of the Pi-top to learn more about it and see what's possible; what follows is an overview of the process and concludes with thoughts and considerations for the next steps.



Low Power



scrunch

13 19d

Status: Approved

Name: Low-power OS

Objective: The goal of this project is to run an OS on an ultra low-power CPU/MCU that can output terminal or a window manager to an e-paper display.

Audience: low-voltage, proof of concept

Timeline: 3/14/2021-4/13/2021

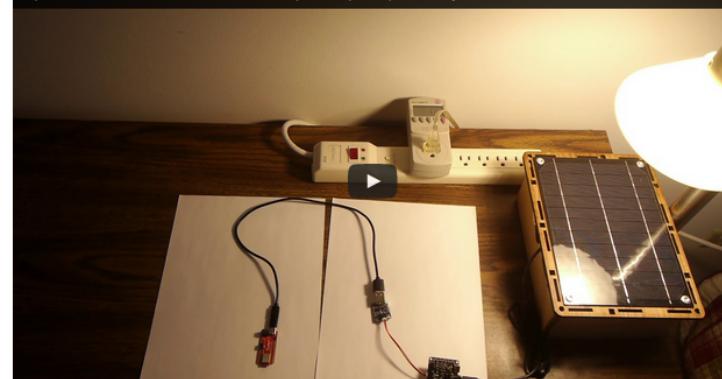
Members: @scrunch , @alexsotodev open to new members, including after project started.

Contact: giovanni.lostumbo@gmail.com

URL: Discussion ("low-power-solar" group) : <https://discord.com/invite/nnxKnxh>
<https://github.com/EI2030/Low-power-E-Paper-OS> 14

Hardware: Redboard Artemis,

Sparkfun Redboard Artemis Nano with Ambiq Micro Apollo3 powered by 5W Solar Panel & 10.5W LED Bulb



pi-top

pi-top.com KnowledgeBase

Solar PiTop for E-Paper Display Development

pi-top [3]



InIrd

2 8d

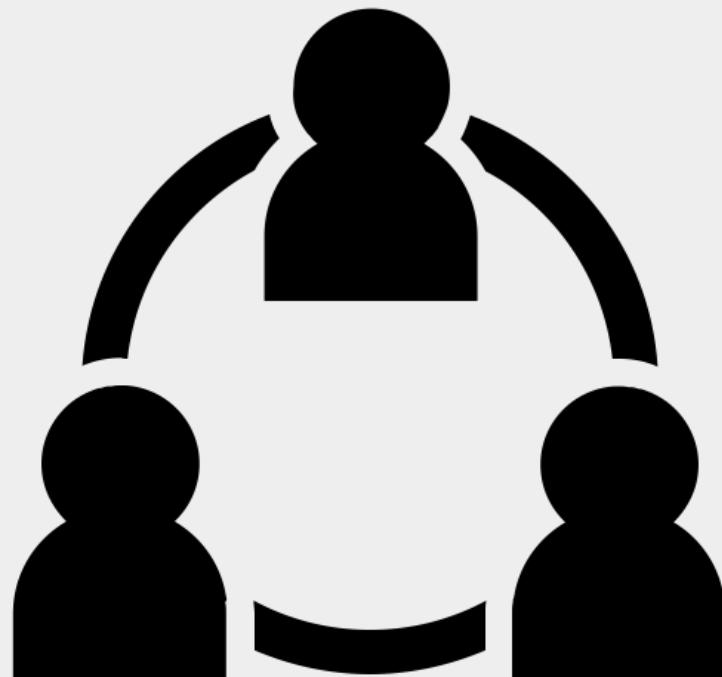
Hi,

this is Giovanni from EI2030.org 11

I have posted a concept mod for the Pi-Top [v3]: I was thinking more of a cyberdeck idea since the solar powered display would need a larger panel since it would use more power. Under the keyboard fits a 5" screen, although I plan to order a different one without HDMI since the one in the photo arrived doa.

NEW

Working Groups



Laptop case design



Name : Research: Laptop case design

Objective : An ongoing group that researches the design of a laptop case to use with a non-emissive display. Group members will define, ideate, prototype, and test ideas.

Audience : General, modders, DIY,

Timeline : Ongoing

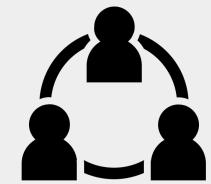
Members : [@alexso](#)todev, looking for members.

Contact : contact@alexso.dev or [Discord](#)

Looking for :

- Digital Fabrication
- DIY/Creatives/Modders
- Researcher
- Onshape, Fusion 360, OpenSCAD

i.MX7/8 and Drivers



Name : Research: i.MX7/8 and Drivers

Objective : An ongoing group that researches the NXP microcontrollers i.MX7/8 with the intention to use with as a laptop with an e-ink display. Group members will research the I-MX7Dual, I-MX8ulp, EPDC, waveforms, reverse-engineering.

Audience : General, modders, DIY, engineers

Timeline : Ongoing

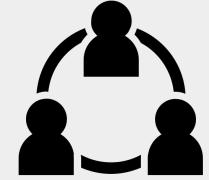
Members : [@alexso](#)todev, looking for members.

Contact : contact@alexso.dev or [Discord](#)

Looking for :

- DIY/Modders
- Researchers
- Knowledge of C, programming, embedded dev

Porting Linux to Ambiq Apollo 4

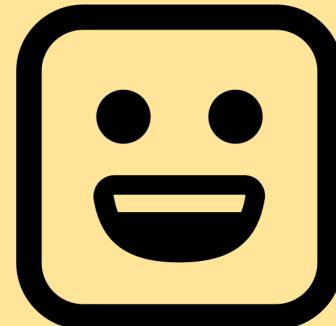


- New Research Group (April 14-5/13)
- Goals
 - Porting Linux to Ambiq Apollo platform
 - Determining system requirements for apps
 - Bootloader development (Coreboot-like/Petitboot)
 - Multiboot “app as an OS” or kexec method

Next Steps ➔

- Continue spreading the word and bringing more folks on board.
- Further defining and bringing clarity to the project.
- Ramp-up state: formalizing tools, forum, templates
- Writing an article that summarizes the information shared here
- Building community, building relationships, building openly

alexsoto.dev/slides



Thank you!

