

Repurposing Gadgets

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Agenda



Introduction



Gadgets and Ideas



Tools and Utilities







Tinkering

Introduction





Hello, I am Daniel :-)



Work and education

-  IT security and computer science
-  software engineer
-  infrastructure and web
-  apps, UIs, ecommerce

Open Source contributions

-  hardware and firmware
-  operating systems
-  software distributions
-  reverse engineering

Gadgets and Ideas

Wireless Storages

... are just networked devices with storage



old ideas

- 👤 MCU running a small application, sometimes RTOS
- 👤 SoC, Arm or MIPS, running Linux
- 👤 built-in SD card reader

new ideas

- 👤 access point for devices in your NoT (Network of Things)
- 👤 MQTT broker for controlling things, e.g., via SUSI AI

Network Video Recorders (NVRs)



old ideas

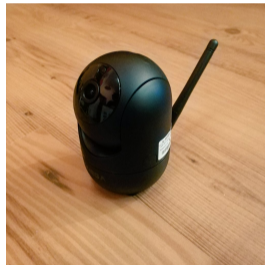
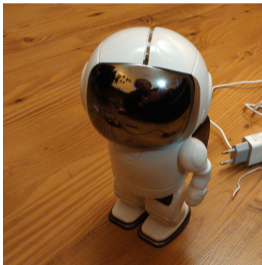
- 👤 essentially storage with more connectors
 - ▶ USB, HDMI, ethernet
 - ▶ built-in network switch
 - ▶ analog video input
- 👤 SoC, mostly Arm, running Linux

new ideas

- 👤 little general purpose computer with web browser
- 👤 home theatre / movie player

IP cameras

Essentially, these are just camera sensors attached to some SoC that is running Linux, with Wi-Fi and/or ethernet modules and often SD card readers.



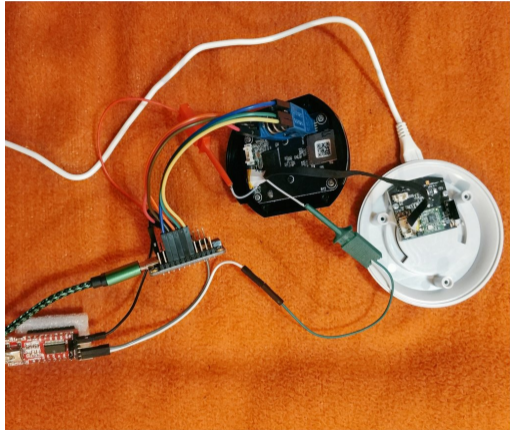
They typically feature two motors to rotate and tilt, sometimes a speaker and a microphone for two-way audio communication.

OpenIPC project - <https://openipc.org/>

Tools and Utilities

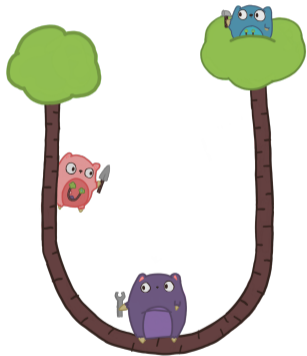
Hardware





- 👤 network cables and switch
- 👤 wireless access point
- 👤 SPI flash programmer
- 👤 USB serial converter
- 👤 dupont wires and probes
- 👤 soldering equipment
- 👤 screwdrivers



u-root

A universal root filesystem



-  many small tools
-  all open, meant for studying and understanding
-  easily portable
-  written in Go



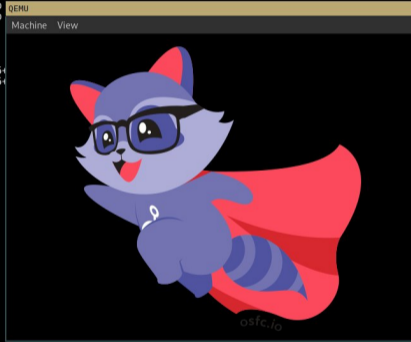
<https://u-root.org/>

u-root Graphics

```
1 2 3 4 7 [Live - Mitschnitt] EdenHeimer @ Parookavi 2076 1 day 5.6.15 orangewrt 101K 01:29 2020-06-11
tmux /home/dan/go/src/github.com/u-root/u-root
2.609348 cfg80211: Loading compiled-in X.509 certificates for regulatory database
2.609348 cfg80211: Loading compiled-in X.509 certificates for regulatory database
2.614659 cfg80211: Loaded X.509 cert 'sforshee: 00b28ddf47aef9cea7'
2.614659 cfg80211: Loaded X.509 cert 'sforshee: 00b28ddf47aef9cea7'
2.618696 platform regulatory.0: Direct firmware load for regulatory.db
2.618696 platform regulatory.0: Direct firmware load for regulatory.db
2.626748 cfg80211: failed to load regulatory.db
2.626748 cfg80211: failed to load regulatory.db
4.128016 floppy0: no floppy controllers found
4.128016 floppy0: no floppy controllers found
4.132123 scsi 2:0:0:0: CD-ROM QEMU QEMU DVD-ROM 2.5+
4.132123 scsi 2:0:0:0: CD-ROM QEMU QEMU DVD-ROM 2.5+
4.156113 sr 2:0:0:0: [sr0] scsi3-mmc drive: 4x/4x cd/rw xa/form2 tray
4.156113 sr 2:0:0:0: [sr0] scsi3-mmc drive: 4x/4x cd/rw xa/form2 tray
4.161769 cdrom: Uniform CD-ROM driver Revision: 3.20
4.161769 cdrom: Uniform CD-ROM driver Revision: 3.20
4.166065 sr 2:0:0:0: Attached scsi generic sg0 type 5
4.166065 sr 2:0:0:0: Attached scsi generic sg0 type 5
4.171155 Freeing unused kernel image (initmem) memory: 1636K
4.171155 Freeing unused kernel image (initmem) memory: 1636K
4.178898 Write protecting the kernel read-only data: 32768k
4.178898 Write protecting the kernel read-only data: 32768k
4.184760 Freeing unused kernel image (text/rodata gap) memory: 2040K
4.184760 Freeing unused kernel image (text/rodata gap) memory: 2040K
4.188583 Freeing unused kernel image (rodata/data gap) memory: 200K
4.188583 Freeing unused kernel image (rodata/data gap) memory: 200K
4.192784 Run /init as init process
4.192784 Run /init as init process
2020/06/10 23:29:09 Welcome to u-root!

u-root

[ 4.214060] cgroup: Unknown subsys name 'net_cls'
[ 4.214060] cgroup: Unknown subsys name 'net_cls'
[ 4.217236] cgroup: Unknown subsys name 'hugetlb'
[ 4.217236] cgroup: Unknown subsys name 'hugetlb'
Framebuffer resolution: 640 480 640 3
??@webboot
~/> sh dan 0 fish 2 sh * :~) orangepad 101%
```



centre



DHCP server



TFTP server



simple binary, written in Go

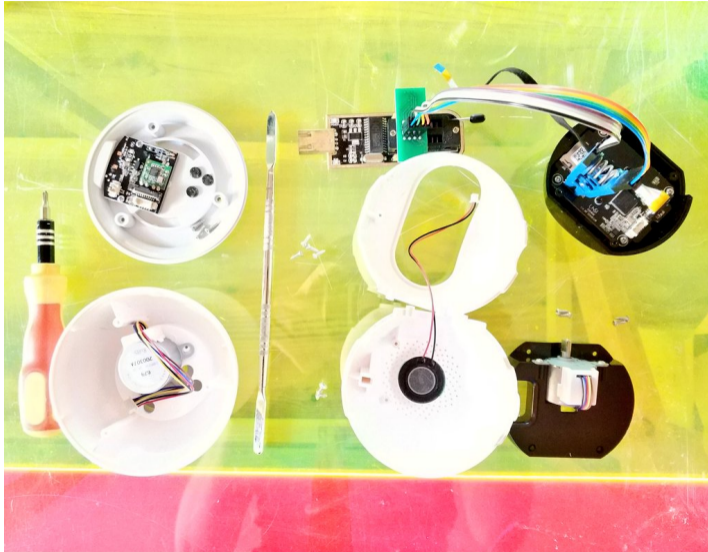


easy to run on your laptop

<https://github.com/Harvey-OS/go/tree/main/cmd/centre>

Tinkering

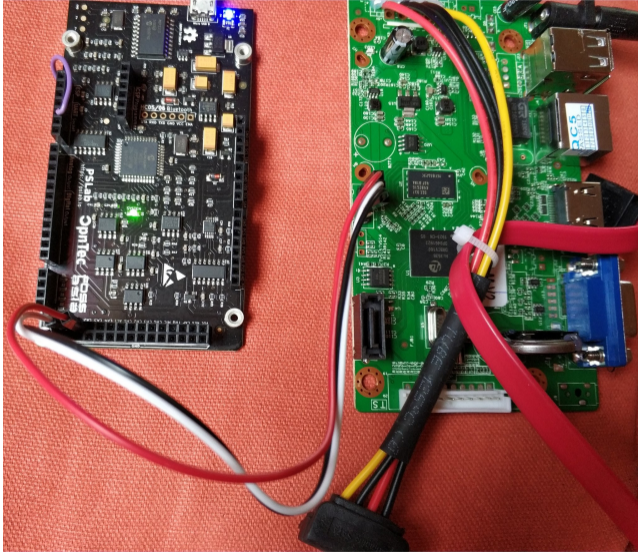
IP Camera Teardown



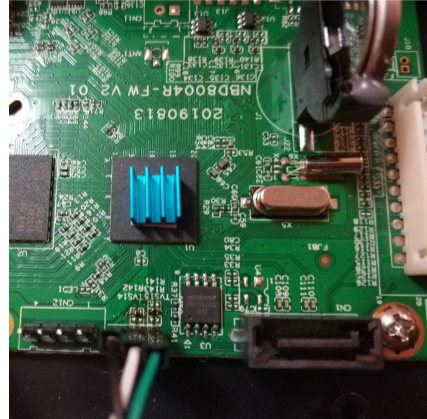
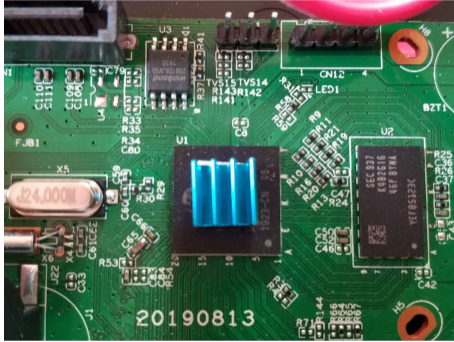
NVRs from inside



PSLab as a Logic Analyzer



Adding Missing Components



u-root on a Wireless Storage

```
root@airdisk:~# chroot mipsle/ /bin/sh
/# ls -l
Exception: exec: "ls": executable file not found in $PATH
[tty], line 1: ls -l
/# paths=[/bbin @$paths]
/# ls -l
drwxr-xr-x 1001 1001 0 Sep 15 20:26 bbin
drwxr-xr-x 1001 1001 0 Sep 15 20:18 bin
drwxr-xr-x 1001 1001 0 Apr 22 18:02 dev
drwxr-xr-x 1001 1001 0 Sep 15 20:18 etc
Lrwxrwxrwx root 0 9 Sep 15 20:18 init -> bbin/init
drwxr-xr-x 1001 1001 0 Apr 22 18:02 lib64
drwx----- root 0 0 Sep 15 19:50 root
drwxr-xr-x 1001 1001 0 Apr 22 18:02 tcz
drwxrwxrwx 1001 1001 0 Apr 22 18:02 tmp
drwxr-xr-x 1001 1001 0 Apr 22 18:02 ubin
drwxr-xr-x 1001 1001 0 Apr 22 18:02 usr
drwxr-xr-x 1001 1001 0 Apr 22 18:02 var
/# cat /etc/resolv.conf
nameserver 8.8.8.8
/# uname -a
Linux airdisk 3.10.14+ #2 Tue Sep 15 20:03:49 CST 2015 mips (none)
/# 
```

root@airdisk

u-root on an NVR



Thanks! Questions?

Extras

Fun

astronaut protocol

SanDisk Media Drive disco