

Freeing the Binary Format of the reMarkable e-ink Tablet

Decoding, documenting and converting the internal file format of the *reMarkable e-ink tablet*

Disclaimer(s)

22-23.09 %

DATENSPUREN.DE

This is a hobby project.

#MACHTNIx

The author(s) and contributor(s) are not associated with reMarkable AS, Norway.

reMarkable is a registered trademark of *reMarkable AS* in some countries. Please refer to <https://remarkable.com> for their product.

#DS18

 ax3l

@axccl

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

Everybody <3 e-ink

The (proprietary) device

#DS18

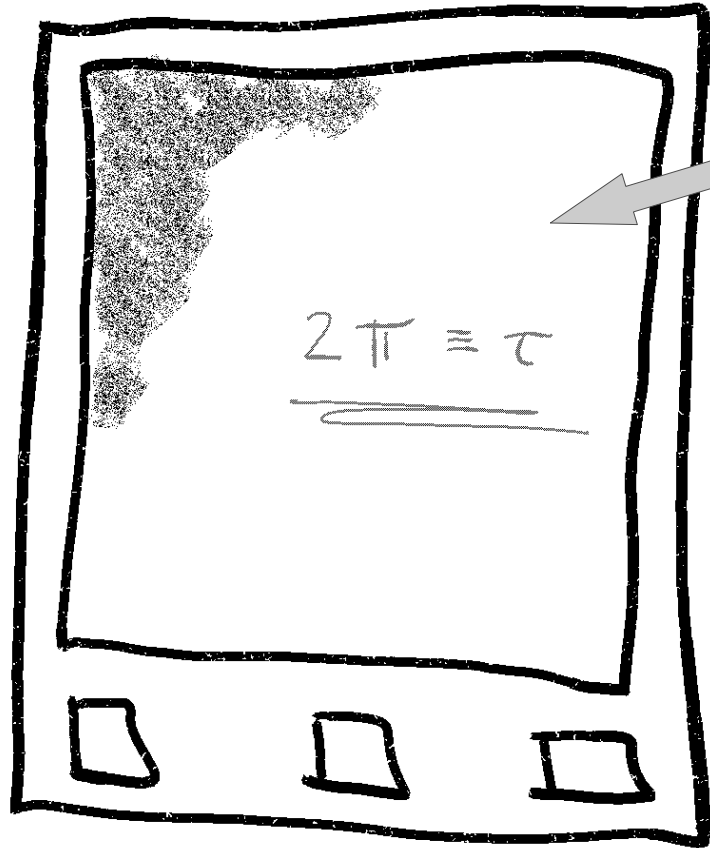
 ax3l

@axccl

e-ink Tablet

22-23.09 %

DATENSPUREN.DE



you can draw on it

"paper-like"

#MACHTNIx

technical specs

ARMv7 (Freescale i.MX6 SoloLite)

low-latency, high-res. Wacom display

Linux 4.1.28 with root access

Apps: Qt 5.9 + SDK

#DS18

 ax3l

@axccl

reMarkable FOSS Activities

and updates

22-23.09 %

DATENSPUREN.DE

#MACHTNIx



reMarkable AS

Better code, better paper, better thinking.

Oslo, Norway

<https://remarkable.engin...>

technology@remarkable...

Repositories 48

People 5

Projects 0

Pinned repositories

linux

Our Linux kernel

C ★ 44 🍷 5

uboot

Our uboot version

C ★ 2 🍷 5

epaper-qp

Just a quickly hacked together qpa based on qminimal

C++ ★ 2

imx_usb_loader

Forked from boundarydevices/imx_usb_loader

Usb loader for imx51/53/6x

C ★ 2 🍷 1

karchive

Forked from KDE/karchive

Qt 5 addon providing access to numerous types of archives

C++ 🍷 1

remarkable-fail

simple systemd service to handle failures

Shell 🍷 3

@axccl

Runs Linux!

Summon the power of GPL

22-23.09 %

DATENSPUREN.DE

#MACHTUNIX

```
axel@ax3l:~ x 130 $ ssh root@192.168.43.163
root@192.168.43.163's password:
r e M a r k a b l e
ZERO GRAVITAS
remarkable: ~/
```

- change boot / standby / power-off screen
- add page templates
- advanced wifi settings ...
- run own Qt apps

#DS18

 ax3l

@axccl

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

User Data

It's our precious

#DS18



ax3l

@axccl

Proprietary Binary Format

22-23.09 %

DATENSPUREN.DE

- internal format for notebooks: .lines
- vector export (PDF) bloated & broken
- import/export (Linux & Android) ~~broken~~ *fixed*,
webapp, "cloud" ...

#MACHTNIx

#DS18

 ax3l

@axccl

Proprietary Binary Format

22-23.09 %

DATENSPUREN.DE

- internal format for notebooks: .lines
- vector export (PDF) bloated & broken
- import/export (Linux & Android) broken *fixed*, webapp, "cloud" ...

#MACHTNIx

- OCR, animations, more brushes, imports in inkscape, live/input to other devices
- informational self-determination

#DS18



@axccl

Decode it!

from simple to complex

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

#DS18

 ax3l

@axccl

Decode it!

from simple to complex

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

```
00000000..72.65.4d.61.72.6b.61.62..6c.65.20.6c.69.6e.65.73..|reMarkable.lines|
00000010..20.77.69.74.68.20.73.65..6c.65.63.74.69.6f.6e.73..|.with.selections|
00000020..20.61.6e.64.20.6c.61.79..65.72.73.01.00.00.00.01..|.and.layers.....|
00000030..00.00.00.00.00.00.00.....|.....|
00000037
```

#DS18

 ax3l

@axccl

Decode it!

from simple to complex

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

```
00000000..72.65.4d.61.72.6b.61.62..6c.65.20.6c.69.6e.65.73..|reMarkable.lines|
00000010..20.77.69.74.68.20.73.65..6c.65.63.74.69.6f.6e.73..|.with.selections|
00000020..20.61.6e.64.20.6c.61.79..65.72.73.01.00.00.00.01..|.and.layers....|
00000030..00.00.00.01.00.00.00.04..00.00.00.00.00.00.00.00..|.....|
00000040..00.00.00.00.00.f0.3f.03..00.00.00.00.00.e8.41.00..|.....?.....A.|
00000050..e0.e3.44.81.09.98.3c.c1..50.9f.bd.c1.50.9f.3e.00..|..D...<.P...P.>.|
00000060..00.e8.41.00.e0.e3.44.81..09.98.3c.c1.50.9f.bd.c1..|..A...D...<.P...|
00000070..50.9f.3e.f4.7c.e8.41.11..de.e3.44.db.d6.a0.3b.c1..|P.>|.A...D...;|
00000080..50.9f.bd.c1.50.9f.3e.....|P...P.>|
00000087
```

#DS18

 ax3l

@axccl

Decode it!

from simple to complex

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

```
00000000·72·65·4d·61·72·6b·61·62·6c·65·20·6c·69·6e·65·73· | reMarkable·lines |
00000010·20·77·69·74·68·20·73·65·6c·65·63·74·69·6f·6e·73· | ·with·selections |
00000020·20·61·6e·64·20·6c·61·79·65·72·73·01·00·00·00·01· | ·and·layers·.... |
| 00000030·00·00·00·02·00·00·00·04·00·00·00·00·00·00·00· | ..... |
00000040·00·00·00·00·00·00·f0·3f·03·00·00·00·00·00·e8·41·00· | .....?.....A. |
00000050·e0·e3·44·81·09·98·3c·c1·50·9f·bd·c1·50·9f·3e·00· | ..D...<.P...P.>. |
00000060·00·e8·41·00·e0·e3·44·81·09·98·3c·c1·50·9f·bd·c1· | ..A...D...<.P... |
00000070·50·9f·3e·f4·7c·e8·41·11·de·e3·44·db·d6·a0·3b·c1· | P.>.|.A...D...;. |
00000080·50·9f·bd·c1·50·9f·3e·04·00·00·00·00·00·00·00·00· | P...P.>..... |
00000090·00·00·00·00·00·00·f0·3f·04·00·00·00·00·00·a0·41·00· | .....?.....A. |
000000a0·20·da·44·41·08·04·3d·d9·3a·33·be·c1·50·1f·3f·00· | ..DA..=.:3..P.? |
000000b0·00·a0·41·00·20·da·44·41·08·04·3d·d9·3a·33·be·c1· | ..A...DA..=.:3.. |
000000c0·50·1f·3f·bf·5d·9e·41·40·27·da·44·c1·09·9c·3b·d9· | P.?].A@'.D...;. |
000000d0·3a·33·be·c1·50·1f·3f·2c·25·9e·41·5d·28·da·44·bb· | :3..P.?,%A](.D. |
000000e0·db·ee·3b·d9·3a·33·be·c1·50·1f·3f·..... | ..;.:3..P.? |
000000eb
```

#DS18

 ax3l

@axccl

C-Structs

POD data layout

```
// linux, gcc, x86-64

struct Car
{
    unsigned int    no_tires;
    double          gasoline;
    float           speed;
};
```

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

standard layout

	sizeof()
(u)int	4
double	8
float	4

@axccl

Systematically Guess

a matrix for de-serialization

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

#DS18



ax3l

@axccl

Systematically Guess

a matrix for de-serialization

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

char int8 int32 int64 float16 float32 ...

#DS18



ax3l

@axccl

Systematically Guess

a matrix for de-serialization

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

char int8 int32 int64 float16 float32 ...

+0

+1

+2

+3

Byte offset for next value

#DS18

 ax3l

@axccl

Sy
a m

#DS

int8_t	int16_t	int32_t	float
4	4	4	5.60e-45
0	0	16777216	2.35e-38
0	0	65536	9.18e-41
0	256	256	3.58e-43
1	1	1	1.40-45
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	-268435456	-1.58e+29
0	0	1072693248	1,87E+03
0	-4096	71299072	2.25e-36
-16	16368	278512	3.90e-40



#MACHTNIx

axccl

Sy
a m

#DS

int8_t	int16_t	int32_t	float
4	4	4	5.60e-45
0	0	16777216	2.35e-38
0	0	65536	9.18e-41
0	256	256	3.58e-43
1	1	1	1.40-45
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	-268435456	-1.58e+29
0	0	1072693248	1,87E+03
0	-4096	71299072	2.25e-36
-16	16368	278512	3.90e-40



DE

#MACHTNIx

axccl

Sy
a m

#DS

int8_t	int16_t	int32_t	float
4	4	4	5.60e-45
0	0	16777216	2.35e-38
0	0	65536	9.18e-41
0	256	256	3.58e-43
1	1	1	1.40-45
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	-268435456	-1.58e+29
0	0	1072693248	1,87E+03
0	-4096	71299072	2.25e-36
-16	16368	278512	3.90e-40



#MACHTNIx

axccl

Sy
a m

#DS

int8_t	int16_t	int32_t	float
4	4	4	5.60e-45
0	0	16777216	2.35e-38
0	0	65536	9.18e-41
0	256	256	3.58e-43
1	1	1	1.40-45
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	0	0,0E+00
0	0	-268435456	-1.58e+29
0	0	1072693248	1,87E+03
0	-4096	71299072	2.25e-36
-16	16368	278512	3.90e-40



#MACHTNIx

axccl

Result

int32_t
int32_t
int32_t
int32_t
int32_t
int32_t
float
int32_t
5x float
5x float
5x float



#MACHTNIx

#DS18

 ax3l

@axccl

Result



```
int32_t  
  int32_t  
    int32_t  
      int32_t  
        int32_t  
          int32_t  
            float  
              int32_t  
                5x float  
                  5x float  
                    5x float
```

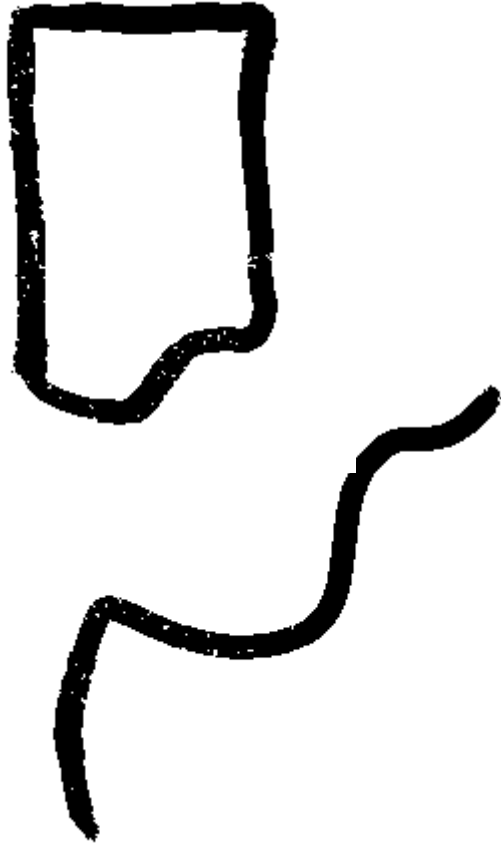
#MACHTNIx

#DS18

 ax3l

@axccl

Result



no. of pages
no. of layers

no. of lines

brush type

color

zero (selected?)

brush base size

no. of points

coord, pressure, 2x rotation

coord, pressure, 2x rotation

coord, pressure, 2x rotation



DATENSPUREN.DE

#MACHTNIx

#DS18

 ax3l

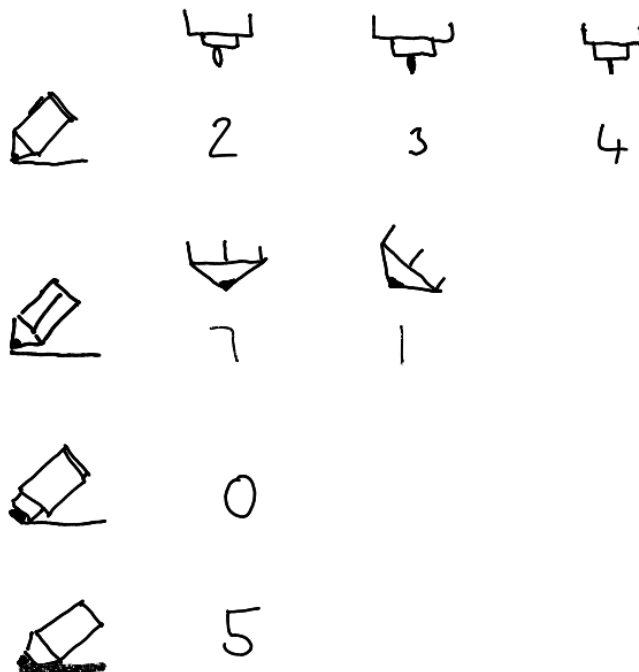
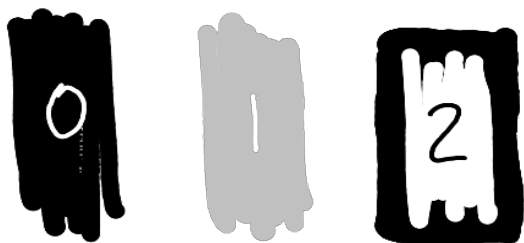
@axccl

Enums / Magic Numbers

22-23.09 %

DATENSPUREN.DE

#MACHTNIx



- 1.875
- 2.0
- 2.125

#DS18

 ax3l

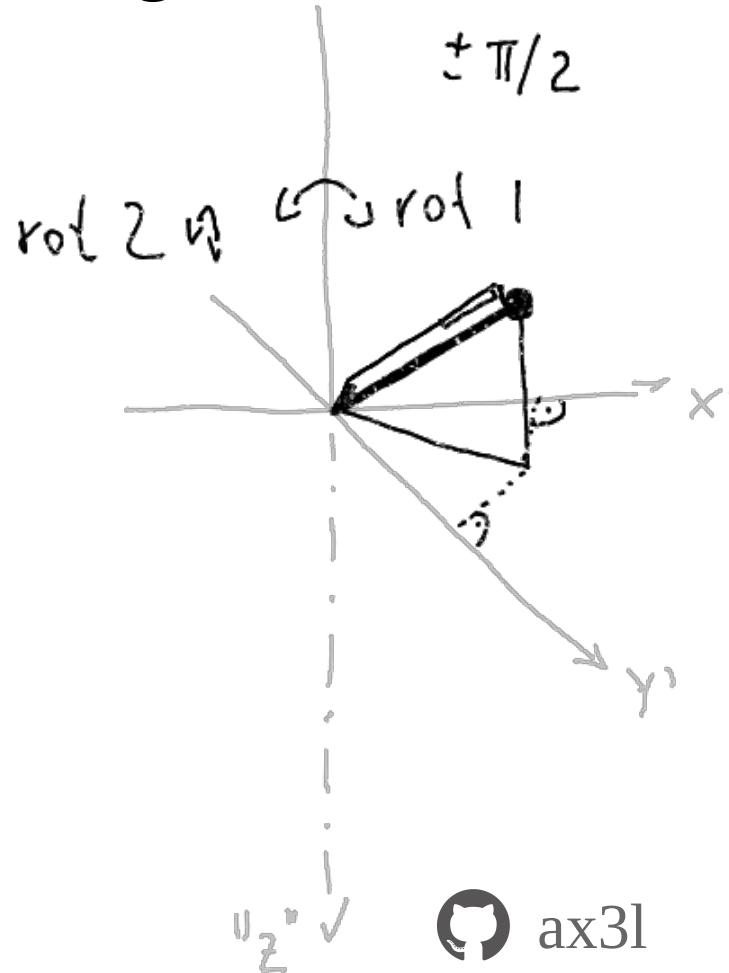
@axccl

Enums / Magic Numbers

22-23.09 %

DATENSPUREN.DE

#MACHTNIx



#DS18

 ax3l

@axccl

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

What the FOSS?

With knowledge ~~comes responsibility~~ the fun starts

#DS18

 ax3l

@axccl

File recognition

Unix .magic files

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

```
$ file myDrawing.lines  
myDrawing.lines: data
```

```
$ file myDrawing.lines  
myDrawing.lines: reMarkable tablet notebook lines, 1404 x 1872, 4 pages
```

#DS18

 ax3l

@axccl

File recognition

Unix .magic files

22-23.09 %

DATENSPUREN.DE

#MAGICTNIX

```
0      string  reMarkable
11     string  lines
17     string  with
22     string  selections
33     string  and
37     string  layers
43     lelong  x      reMarkable tablet notebook lines, 1404 x 1872, %x page(s)
! :mime  image/x-remarkable
```

#DS18

 ax3l

@axccl

Code

Pull requests 9

Projects 0

Insights

new magic for the remarkable table.

[Browse files](#)

master

 **zoulasc** committed on Jul 26

1 parent [e79fe86](#)

commit [1b6cc8ebe1274211814c84afe3645f60c2afb677](#)

Showing 1 changed file with 14 additions and 1 deletion.

Unified Split

15  magic/Magdir/images

View 

... @@ -1,6 +1,6 @@

1
2

```
#-----  
-----
```

3 - # \$File: images,v 1.146 2018/07/03 20:55:37 christos Exp
\$

4 # images: file(1) magic for image formats (see also

1
2

```
#-----  
-----
```

3 + # \$File: images,v 1.147 2018/07/26 08:28:56 christos Exp
\$

4 # images: file(1) magic for image formats (see also

Library: Open API!

Lines are Beautiful [C++]

22-23.09 %

DATENSPUREN.DE

NIX

```
1 #include <rmlab/rmlab.hpp>
2 #include <iostream>
3
4 // ...
5
6 rmlab::Notebook myNotebook("somePath/");
7
8 for( auto & page : myNotebook.pages )
9     for( auto & layer : page.layers )
10         for( auto & line : layer.lines )
11             for( auto & point : line.points )
12                 std::cout << point.x << " " << point.y << std::endl;
```


New Possibilities!

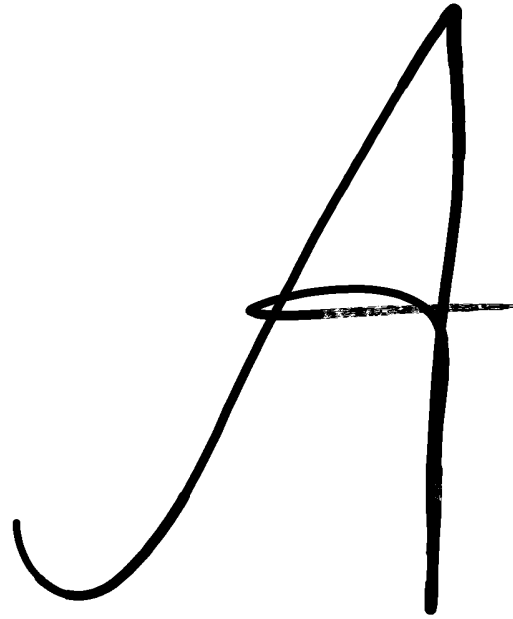
e.g. roll your own renderer

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

ORIGINAL



#DS18



ax3l

@axccl

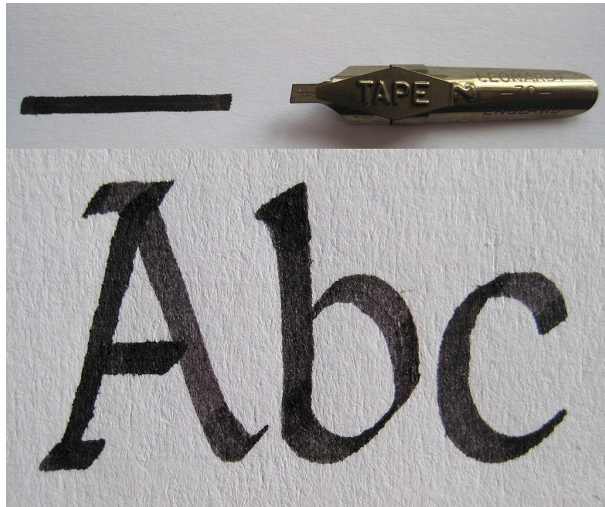
New Possibilities!

e.g. roll your own renderer

22-23.09 %

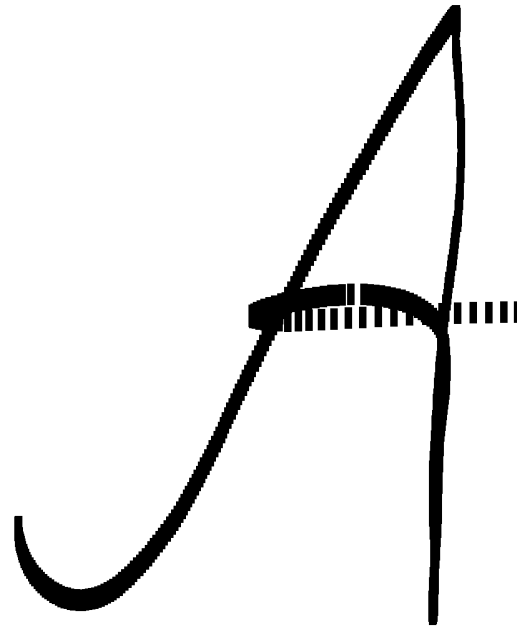
DATENSPUREN.DE

#MACHTNIx



 wikipedia: Floreana

render 1



#DS18

 ax3l

@axccl

New Possibilities!

e.g. roll your own renderer

22-23.09 %

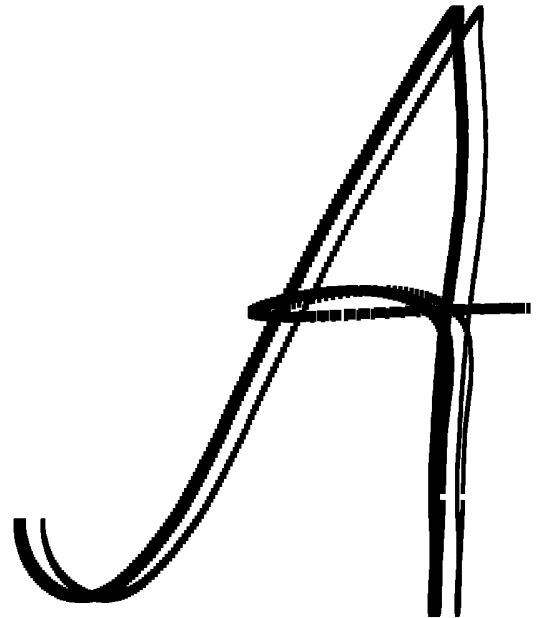
DATENSPUREN.DE

#MACHTNIx



 wikipedia: Floreana

render 2



#DS18

 ax3l

@axccl

New Possibilities!

e.g. roll your own renderer

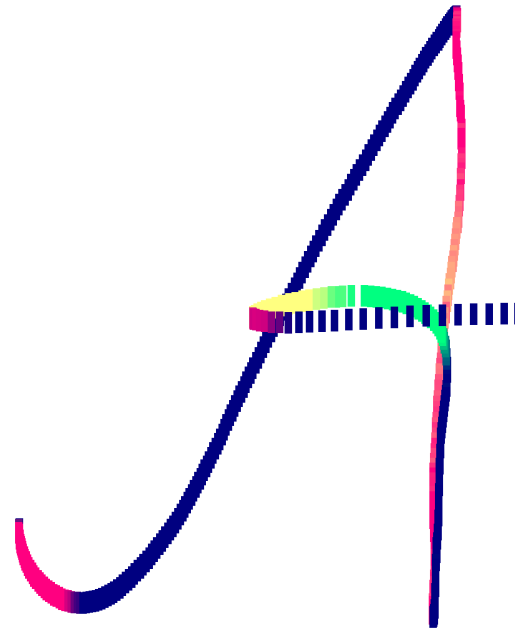
22-23.09 %

DATENSPUREN.DE

#MACHTNIx

color := f(dx, dy)

render 3



#DS18

 ax3l

@axccl

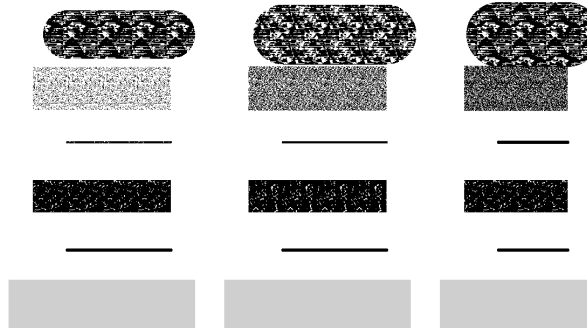
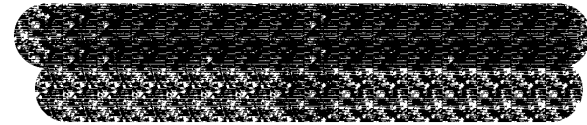
Decoding Original Renderer

work-in-progress

22-23.09 %

DATENSPUREN.DE

#MACHTNIx



#DS18

@axccl

What the FOSS?

documentation, file API, render example

22-23.09 %

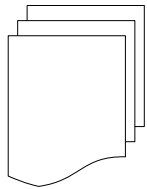
DATENSPUREN.DE

#MACHTNIx



ax3l / lines-are-beautiful

[C++]



<https://plasma.ninja/blog>

[docs]

#DS18



ax3l

@axccl

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

Community

With knowledge ~~comes responsibility~~ the fun starts

#DS18

 ax3l

@axccl

Contributors!

22-23.09 %

DATENSPUREN.DE

ax3l / lines-are-beautiful

Unwatch 7

Star 29

Code

Issues 5

Pull requests 1

Projects 0

Wiki

Insights

Settings

Implement SVG renderer #13

Merged ax3l merged 6 commits into ax3l:develop from matteodelabre:add-svg-renderer on Aug 2

Conversation 12

Commits 6

Checks 0

Files changed 12



matteodelabre commented on Aug 1

Contributor + 😊 ...

This is a new renderer (`lines2svg`) able to create SVG files based on `.lines` files. One file is created per page, each named `test-n.png`, where `n` is the index of the page.

Implemented features:

- basic, non-textured strokes;
- base brush size;
- color;
- highlighter;
- normal eraser and region eraser.

Unsupported features:

Reviewers

ax3l

Assignees

ax3l

Labels

tools

Projects

None yet



Mattéo Delabre

matteodelabre

Étudiant et passionné d'informatique, de mathématiques et d'autres sciences.

Follow

Block or report user

Université de Montpellier

Montpellier, France

<https://matteodelabre.me/>

Hacking

everything open - APIs



canselcik / **libremarkable**

framebuffer [rust]

#MACHTNIx



#DS18

 ax3l

@axccl

Hacking

everything open - APIs

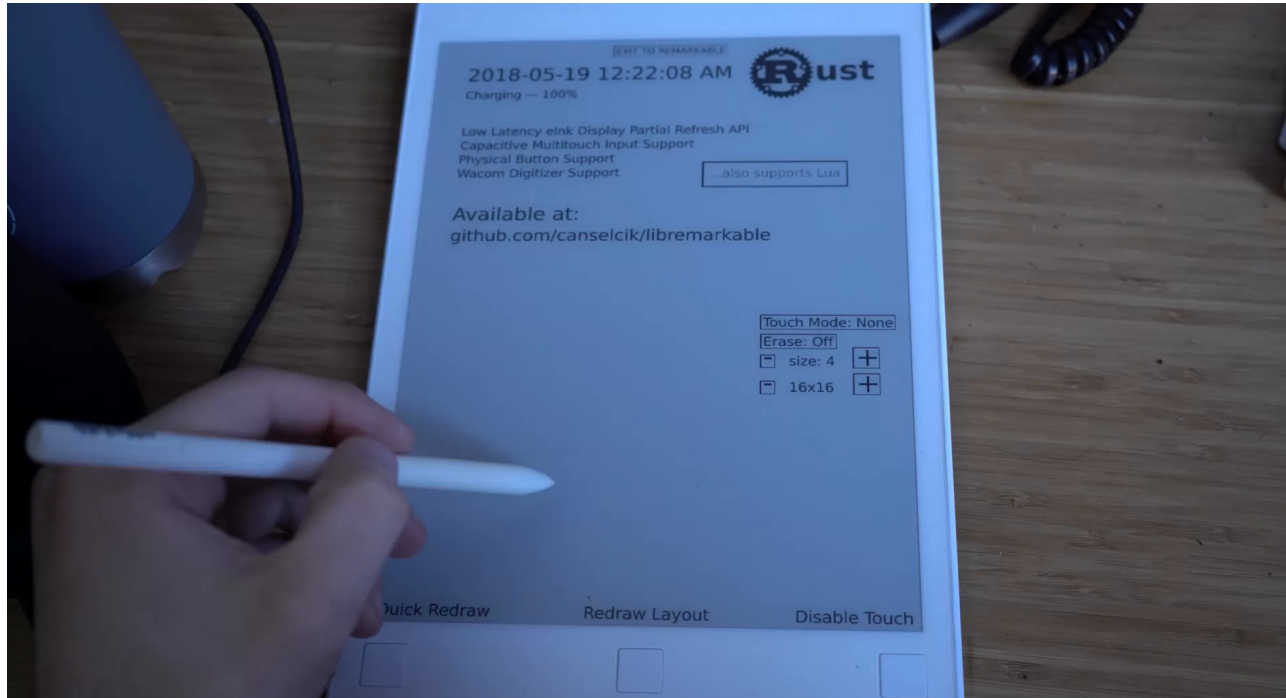
22-23.09 %

DATENSPUREN.DE

#MACHTNIx

canselcik / **libremarkable**

framebuffer [rust]



#DS18

@axccl

Hacking

everything open - APIs

22-23.09 %

DATENSPUREN.DE

#MACHTNIx

canselcik / **libremarkable**

framebuffer [rust]

splitbrain / **ReMarkableAPI**

cloud API [php]

juruen / **rmapi**

cloud API [go]



reHackable / ... [misc. tools]

github.com/topics/remarkable-tablet [hashtag]

#DS18



ax3l

@axccl

Communication

chats and curators

22-23.09 %

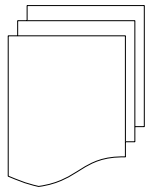
DATENSPUREN.DE

#MACHTNIx



reHackable / **awesome-reMarkable**

remarkablewiki.com



r/RemarkableTablet/

discordapp.com/channels/385916768696139794

#DS18



ax3l

@axccl