A Tclish Espresso Machine:
—Project update (after 7 years)

A programmer talks about espresso.

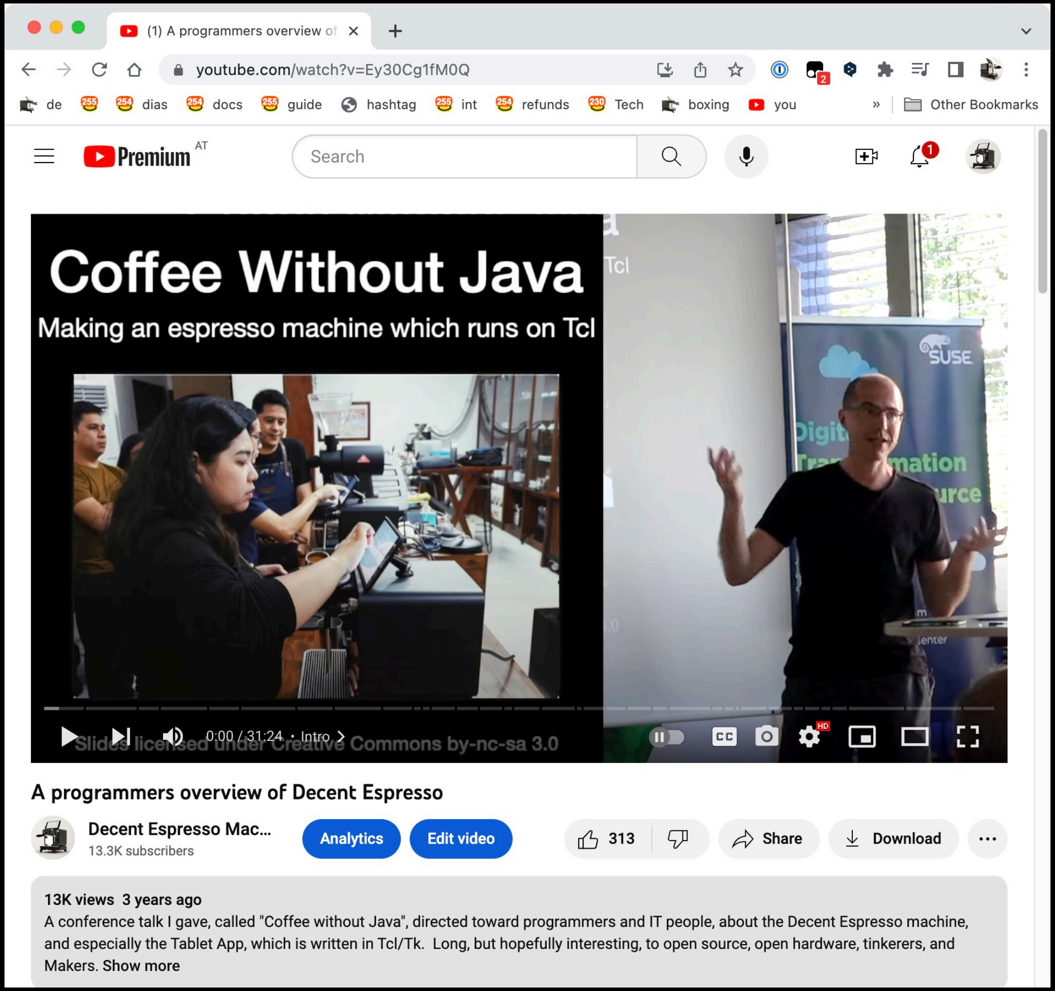
John Buckman in Vienna, Austria (July 2023)

http://decentespresso.com/doc/

In 2019

I presented here, and 13,000 people watched!

https://www.youtube.com/watch?v=Ey30Cg1fM0Q


(1) A programmers overview of
youtube.com/watch?v=Ey30Cg1fM0Q
Premium
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Coffee Without Java
Making an espresso machine which runs on Tcl
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0:00 / 31:24 · Intro
Decent Espresso Mac...
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A programmers overview of Decent Espresso

13K views 3 years ago
A conference talk I gave, called "Coffee without Java", directed toward programmers and IT people, about the Decent Espresso machine, and especially the Tablet App, which is written in Tcl/Tk. Long, but hopefully interesting, to open source, open hardware, tinkerers, and Makers. Show more

What is this?

an espresso machine built from scratch

Why?

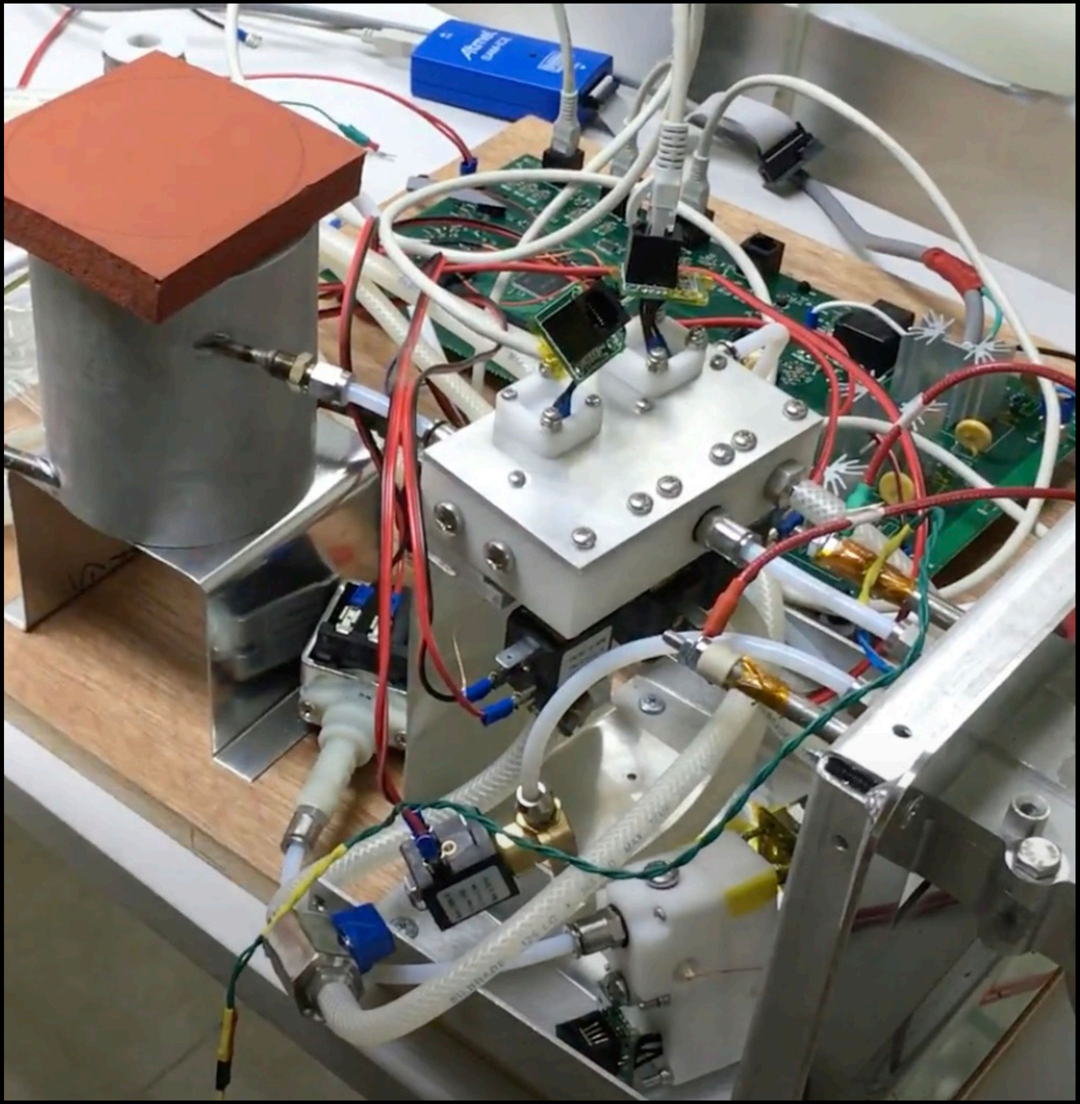
- because espresso was pre-scientific

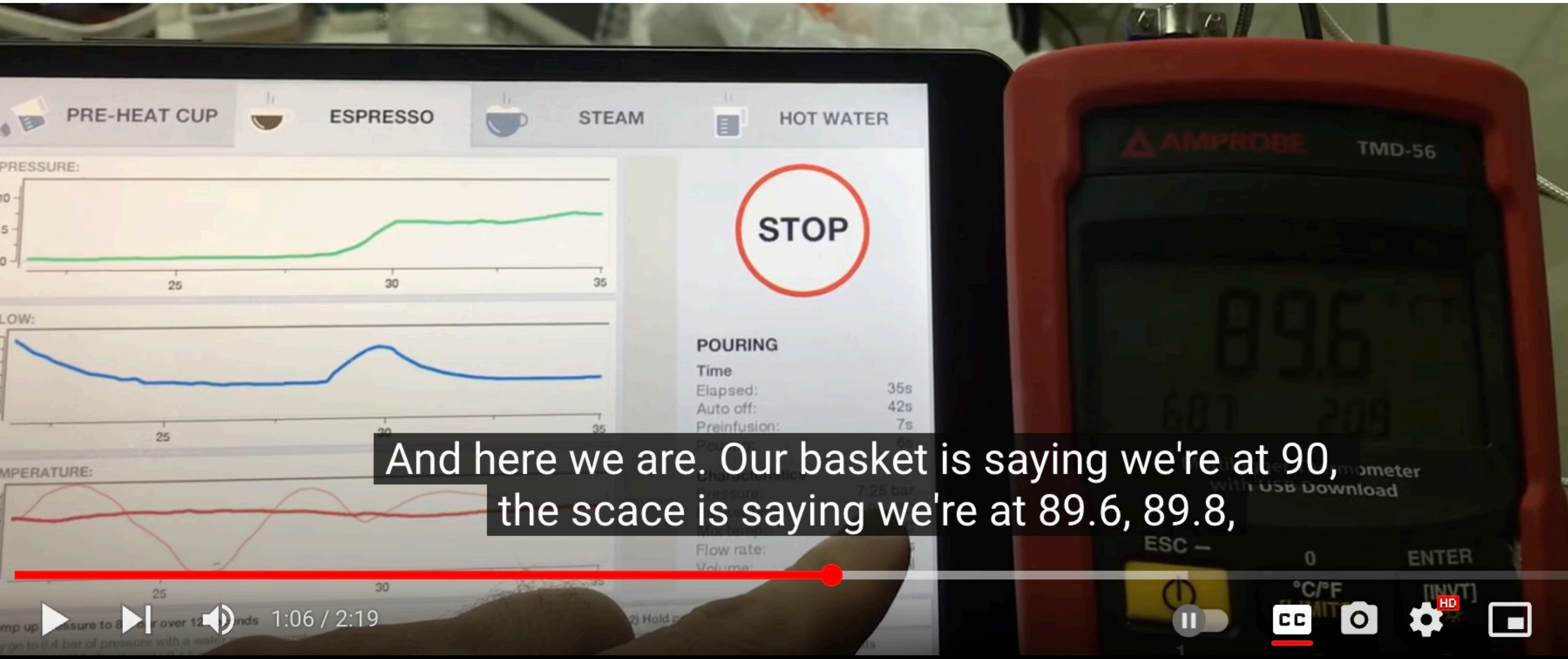
- espresso machines were hard wired for one approach only

So? What to do?

sensors were needed to capture real data

https://www.youtube.com/watch?v=AS6FGEWScmU



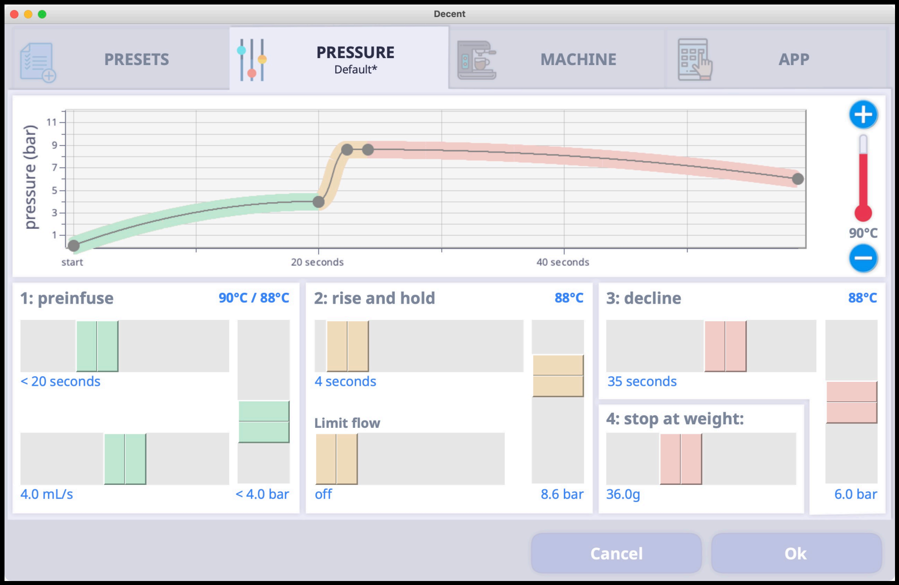


https://www.youtube.com/watch?v=zfJ-dNjHdFE&t=3s

An app was needed to display data neutrally and truthfully

Programming espresso shots

a visual espresso-programming tool to encourage experimentation

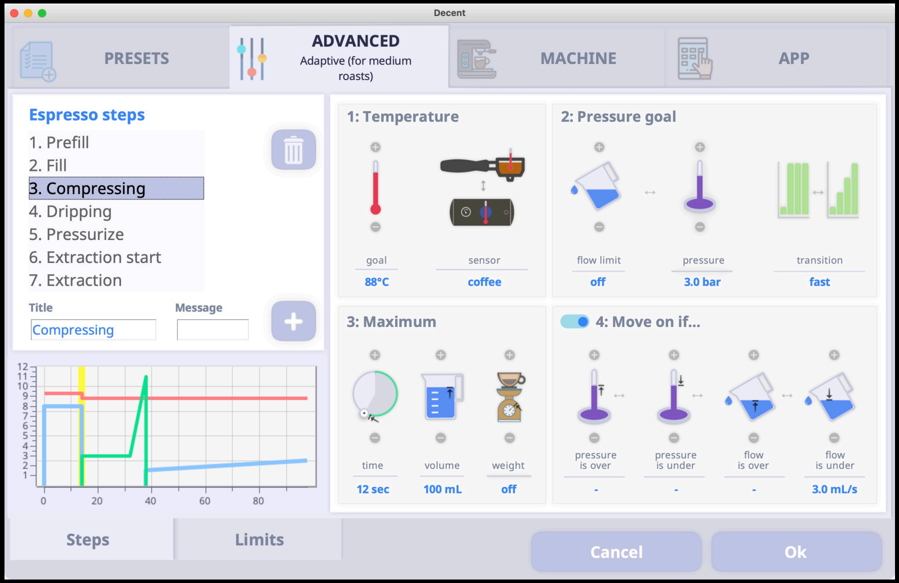


1: preinfuse 90°C / 88°C
< 20 seconds
4.0 mL/s
< 4.0 bar

2: rise and hold 88°C
4 seconds
Limit flow
off
8.6 bar

3: decline 88°C
35 seconds
6.0 bar

4: stop at weight:
36.0g



Espresso steps
1. Prefill
2. Fill
3. Compressing
4. Dripping
5. Pressurize
6. Extraction start
7. Extraction

Title: Compressing
Message:

1: Temperature
goal: 88°C
sensor: coffee

2: Pressure goal
flow limit: off
pressure: 3.0 bar
transition: fast

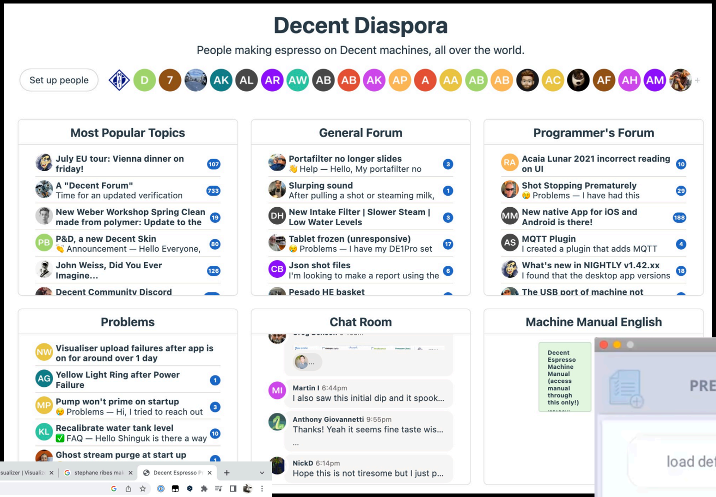
3: Maximum
time: 12 sec
volume: 100 mL
weight: off

4: Move on if...
pressure is over: -
pressure is under: -
flow is over: -
flow is under: 3.0 mL/s

Communicating

sharing of learning, best practices, integration of research results

https://www.youtube.com/watch?v=VEzH1JBA3k8



Decent Diaspora

People making espresso on Decent machines, all over the world.

Set up people

Most Popular Topics
- July EU tour: Vienna dinner on friday!
- A "Decent Forum" — Time for an updated verification
- New Weber Workshop Spring Clean made from polymer: Update to the
- P&D, a new Decent Skin — Announcement — Hello Everyone,
- John Weiss, Did You Ever Imagine…
- Decent Community Discord

General Forum
- Portafilter no longer slides — Help — Hello, My portafilter no
- Slurping sound — After pulling a shot or steaming milk,
- New Intake Filter | Slower Steam | Low Water Levels
- Tablet frozen (unresponsive) — Problems — I have my DE1Pro set
- Json shot files — I'm looking to make a report using the
- Pesado HE basket

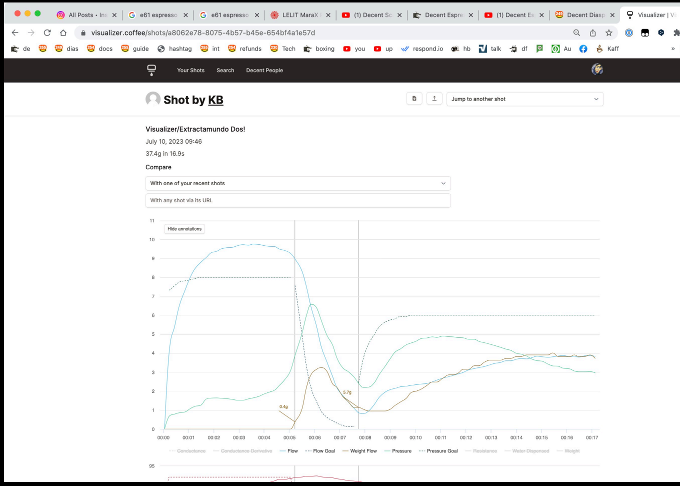
Programmer's Forum
- Acaia Lunar 2021 incorrect reading on UI
- Shot Stopping Prematurely — Problems — I have had this
- New native App for iOS and Android is there!
- MQTT Plugin — I created a plugin that adds MQTT
- What's new in NIGHTLY v1.42.xx — I found that the desktop app versions
- The USB port of machine not

Problems
- Visualiser upload failures after app is on for around over 1 day
- Yellow Light Ring after Power Failure
- Pump won't prime on startup — Problems — Hi, I tried to reach out
- Recalibrate water tank level — FAQ — Hello Shinguk is there a way
- Ghost stream purge at start up

Chat Room
- Martin I 6:44pm: I also saw this initial dip and it spook…
- Anthony Giovannetti 9:55pm: Thanks! Yeah it seems fine taste wis…
- NickD 6:14pm: Hope this is not tiresome but I just p…

Machine Manual English

Decent Espresso Machine Manual (access manual through this only!)



visualizer.coffee/shots/a8062e78-8075-4b57-b45e-654bf4a1e57d

Your Shots Search Decent People

Shot by KB

Jump to another shot

Visualizer/Extractamundo Dos!

July 10, 2023 09:46

37.4g in 16.9s

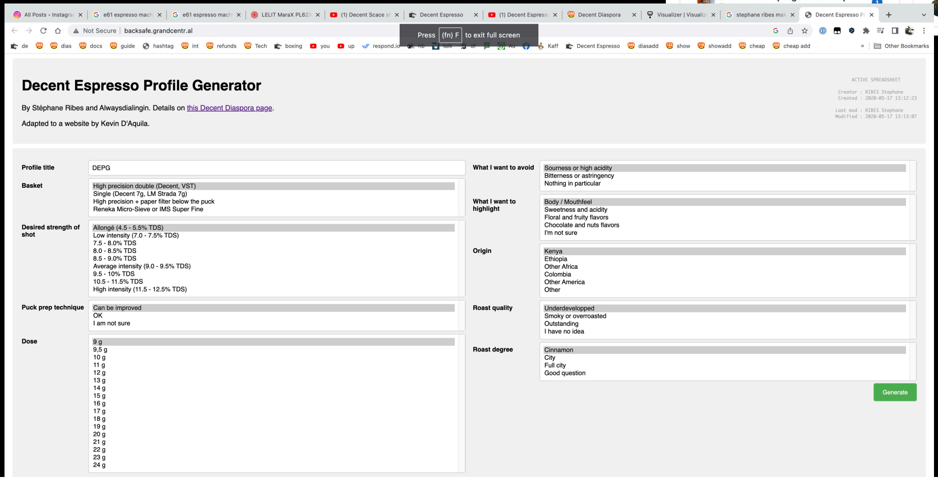
Compare

With one of your recent shots

With any shot via its URL

Hide annotations

https://visualizer.coffee/



backsafe.grandcentr.al

Press (fn) F to exit full screen

Decent Espresso Profile Generator

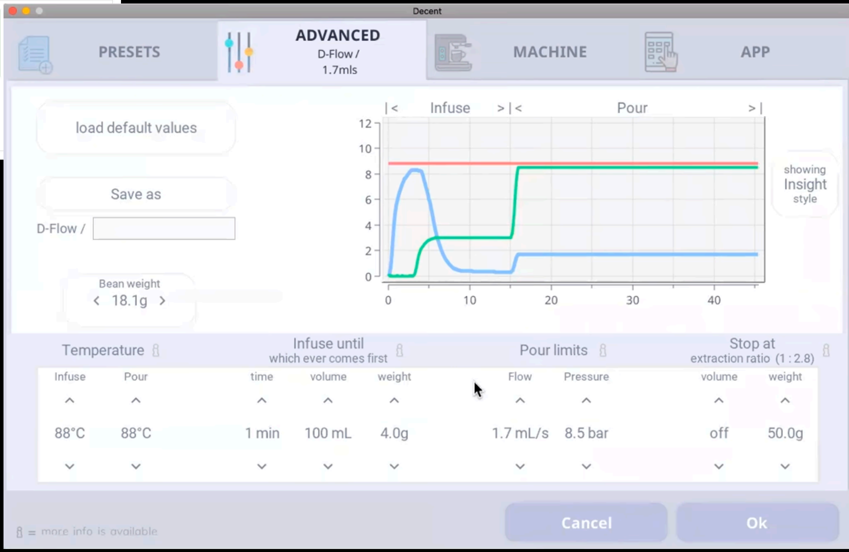
By Stéphane Ribes and Alwaysdialingin. Details on this Decent Diaspora page.

Adapted to a website by Kevin D'Aquila.

ACTIVE SPREADSHEET
Creator : RIBES Stephane
Created : 2020-05-17 13:12:23
Last mod : RIBES Stephane
Modified : 2020-05-17 13:13:07

Profile title	DEPG
Basket	High precision double (Decent, VST); Single (Decent 7g, LM Strada 7g); High precision + paper filter below the puck; Reneka Micro-Sieve or IMS Super Fine
Desired strength of shot	Allongé (4.5 - 5.5% TDS); Low intensity (7.0 - 7.5% TDS); 7.5 - 8.0% TDS; 8.0 - 8.5% TDS; 8.5 - 9.0% TDS; Average intensity (9.0 - 9.5% TDS); 9.5 - 10% TDS; 10.5 - 11.5% TDS; High intensity (11.5 - 12.5% TDS)
Puck prep technique	Can be improved; OK; I am not sure
Dose	9 g; 9,5 g; 10 g; 11 g; 12 g; 13 g; 14 g; 15 g; 16 g; 17 g; 18 g; 19 g; 20 g; 21 g; 22 g; 23 g; 24 g
What I want to avoid	Sourness or high acidity; Bitterness or astringency; Nothing in particular
What I want to highlight	Body / Mouthfeel; Sweetness and acidity; Floral and fruity flavors; Chocolate and nuts flavors; I'm not sure
Origin	Kenya; Ethiopia; Other Africa; Colombia; Other America; Other
Roast quality	Underdevelopped; Smoky or overroasted; Outstanding; I have no idea
Roast degree	Cinnamon; City; Full city; Good question

Generate



Decent

PRESETS | ADVANCED D-Flow / 1.7mls | MACHINE | APP

load default values

Save as

D-Flow /

Bean weight 18.1g

Temperature		Infuse until which ever comes first			Pour limits		Stop at extraction ratio (1 : 2.8)	
Infuse	Pour	time	volume	weight	Flow	Pressure	volume	weight
88°C	88°C	1 min	100 mL	4.0g	1.7 mL/s	8.5 bar	off	50.0g

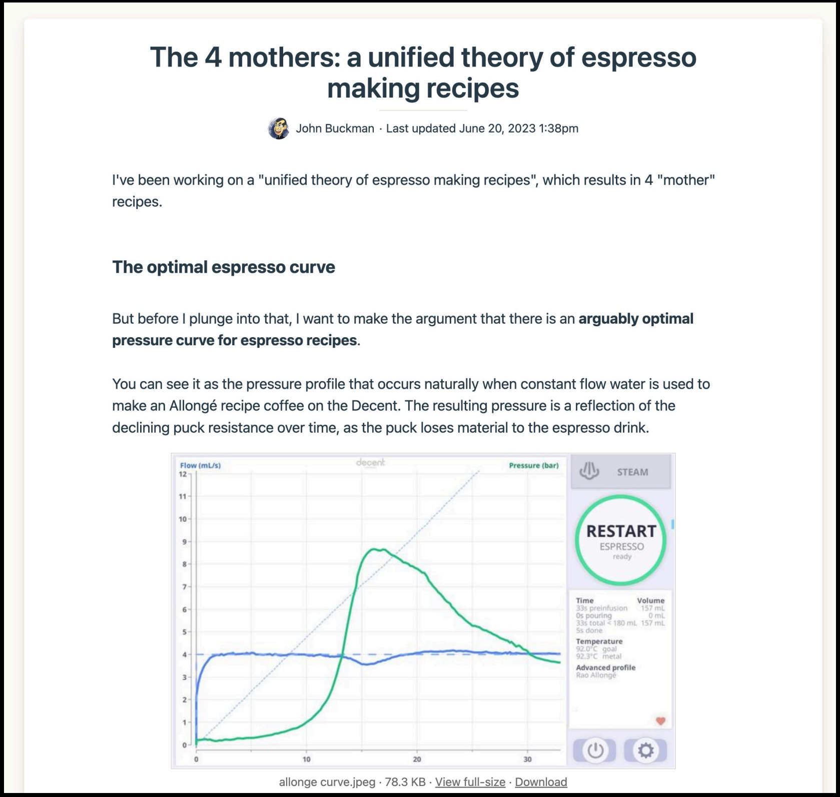
= more info is available

Cancel Ok

https://www.youtube.com/watch?v=3Ib63xBNrzw

Simplifying & Sharing

Distribution of what was learnt to non-experts



The 4 mothers: a unified theory of espresso making recipes

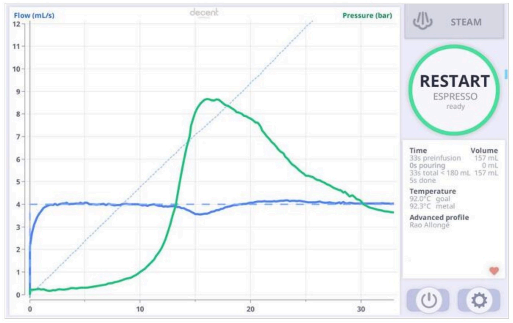
John Buckman · Last updated June 20, 2023 1:38pm

I've been working on a "unified theory of espresso making recipes", which results in 4 "mother" recipes.

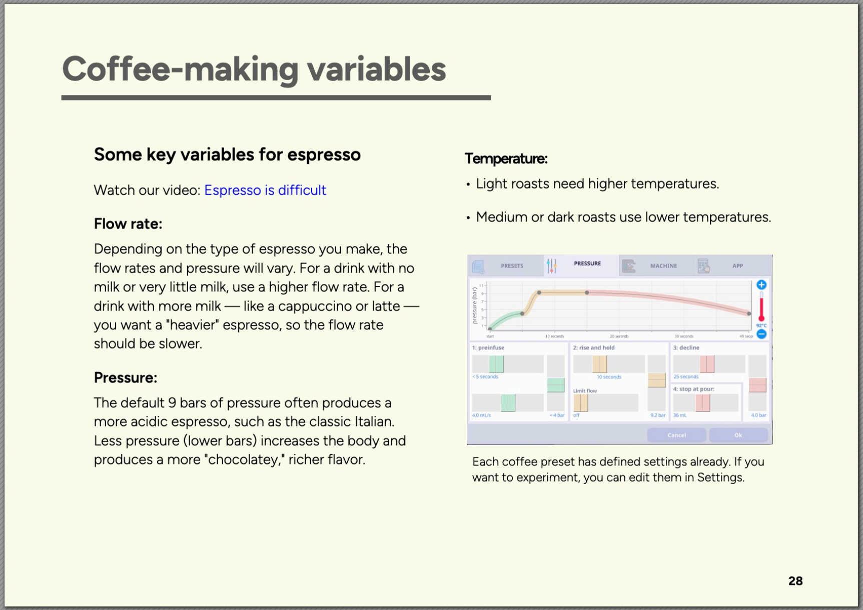
The optimal espresso curve

But before I plunge into that, I want to make the argument that there is an **arguably optimal pressure curve for espresso recipes**.

You can see it as the pressure profile that occurs naturally when constant flow water is used to make an Allongé recipe coffee on the Decent. The resulting pressure is a reflection of the declining puck resistance over time, as the puck loses material to the espresso drink.



allonge curve.jpeg · 78.3 KB · View full-size · Download



Coffee-making variables

Some key variables for espresso

Watch our video: Espresso is difficult

Flow rate:

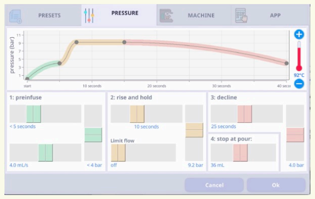
Depending on the type of espresso you make, the flow rates and pressure will vary. For a drink with no milk or very little milk, use a higher flow rate. For a drink with more milk — like a cappuccino or latte — you want a "heavier" espresso, so the flow rate should be slower.

Pressure:

The default 9 bars of pressure often produces a more acidic espresso, such as the classic Italian. Less pressure (lower bars) increases the body and produces a more "chocolatey," richer flavor.

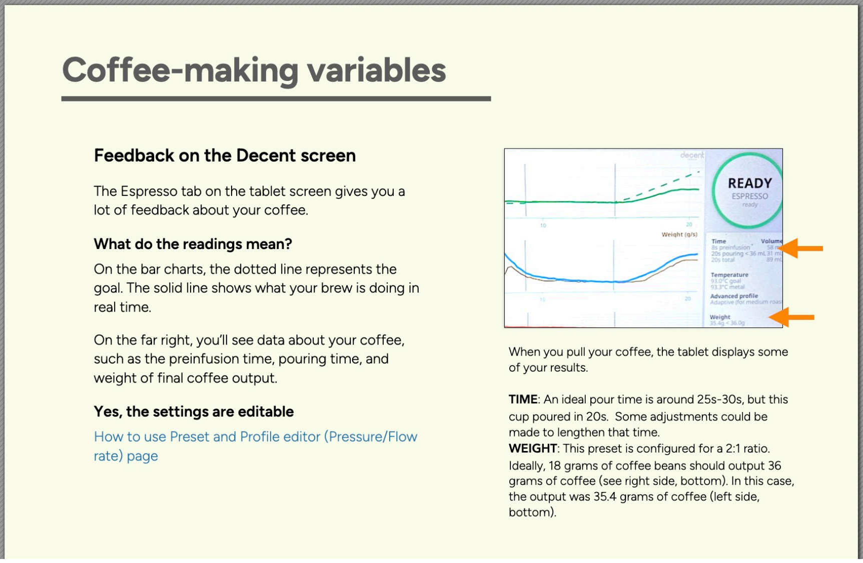
Temperature:

- Light roasts need higher temperatures.
- Medium or dark roasts use lower temperatures.



Each coffee preset has defined settings already. If you want to experiment, you can edit them in Settings.

28



Coffee-making variables

Feedback on the Decent screen

The Espresso tab on the tablet screen gives you a lot of feedback about your coffee.

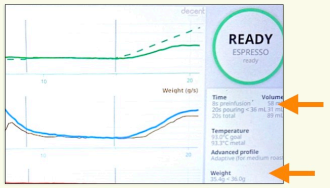
What do the readings mean?

On the bar charts, the dotted line represents the goal. The solid line shows what your brew is doing in real time.

On the far right, you'll see data about your coffee, such as the preinfusion time, pouring time, and weight of final coffee output.

Yes, the settings are editable

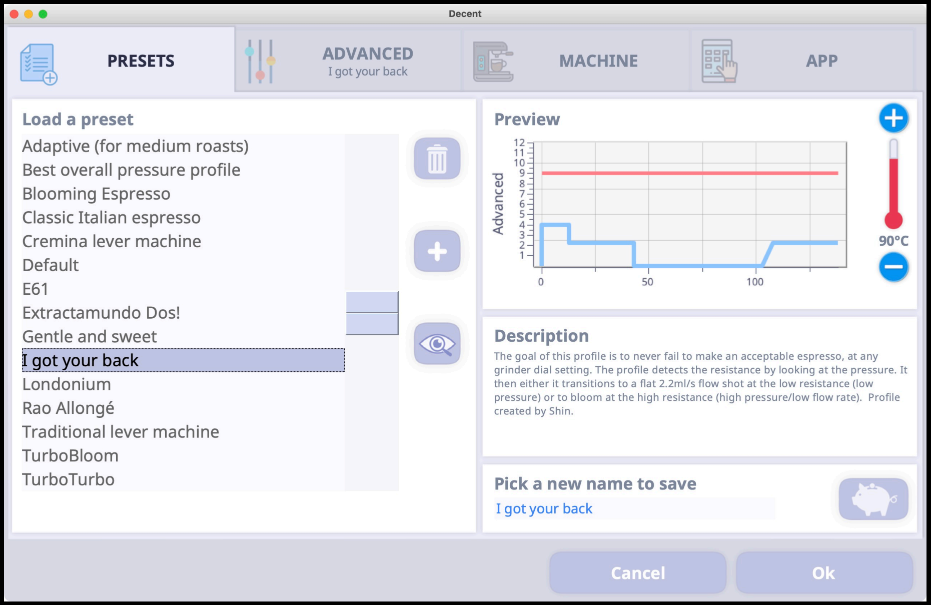
How to use Preset and Profile editor (Pressure/Flow rate) page



When you pull your coffee, the tablet displays some of your results.

TIME: An ideal pour time is around 25s-30s, but this cup poured in 20s. Some adjustments could be made to lengthen that time.
WEIGHT: This preset is configured for a 2:1 ratio. Ideally, 18 grams of coffee beans should output 36 grams of coffee (see right side, bottom). In this case, the output was 35.4 grams of coffee (left side, bottom).

Tolerance for imperfection



Load a preset

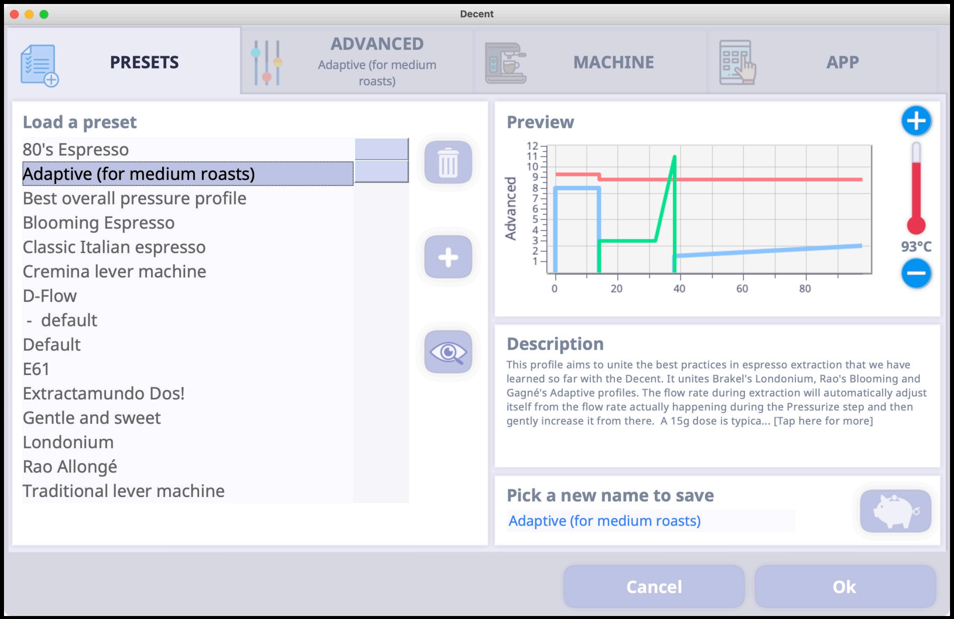
Adaptive (for medium roasts)
Best overall pressure profile
Blooming Espresso
Classic Italian espresso
Cremina lever machine
Default
E61
Extractamundo Dos!
Gentle and sweet
I got your back
Londonium
Rao Allongé
Traditional lever machine
TurboBloom
TurboTurbo

Description

The goal of this profile is to never fail to make an acceptable espresso, at any grinder dial setting. The profile detects the resistance by looking at the pressure. It then either it transitions to a flat 2.2ml/s flow shot at the low resistance (low pressure) or to bloom at the high resistance (high pressure/low flow rate). Profile created by Shin.

Pick a new name to save

I got your back



Load a preset

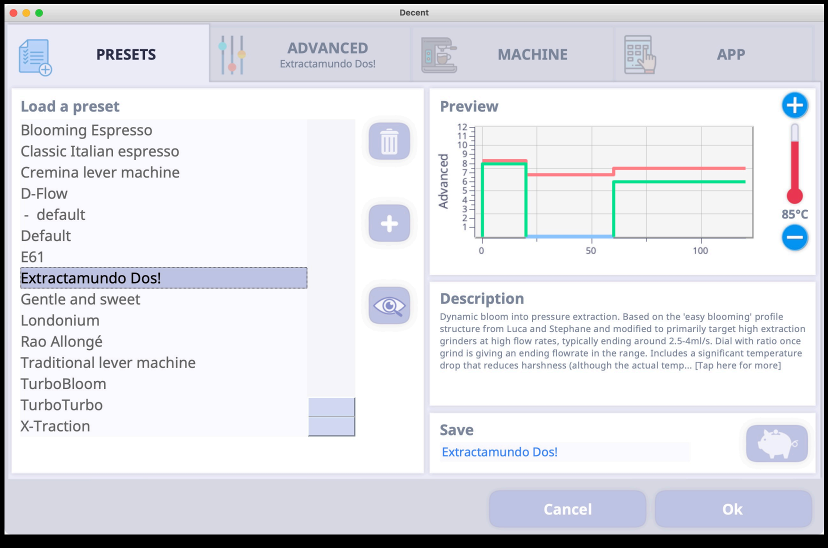
80's Espresso
Adaptive (for medium roasts)
Best overall pressure profile
Blooming Espresso
Classic Italian espresso
Cremina lever machine
D-Flow
 - default
Default
E61
Extractamundo Dos!
Gentle and sweet
Londonium
Rao Allongé
Traditional lever machine

Description

This profile aims to unite the best practices in espresso extraction that we have learned so far with the Decent. It unites Brakel's Londonium, Rao's Blooming and Gagné's Adaptive profiles. The flow rate during extraction will automatically adjust itself from the flow rate actually happening during the Pressurize step and then gently increase it from there. A 15g dose is typica... [Tap here for more]

Pick a new name to save

Adaptive (for medium roasts)



Load a preset

Blooming Espresso
Classic Italian espresso
Cremina lever machine
D-Flow
 - default
Default
E61
Extractamundo Dos!
Gentle and sweet
Londonium
Rao Allongé
Traditional lever machine
TurboBloom
TurboTurbo
X-Traction

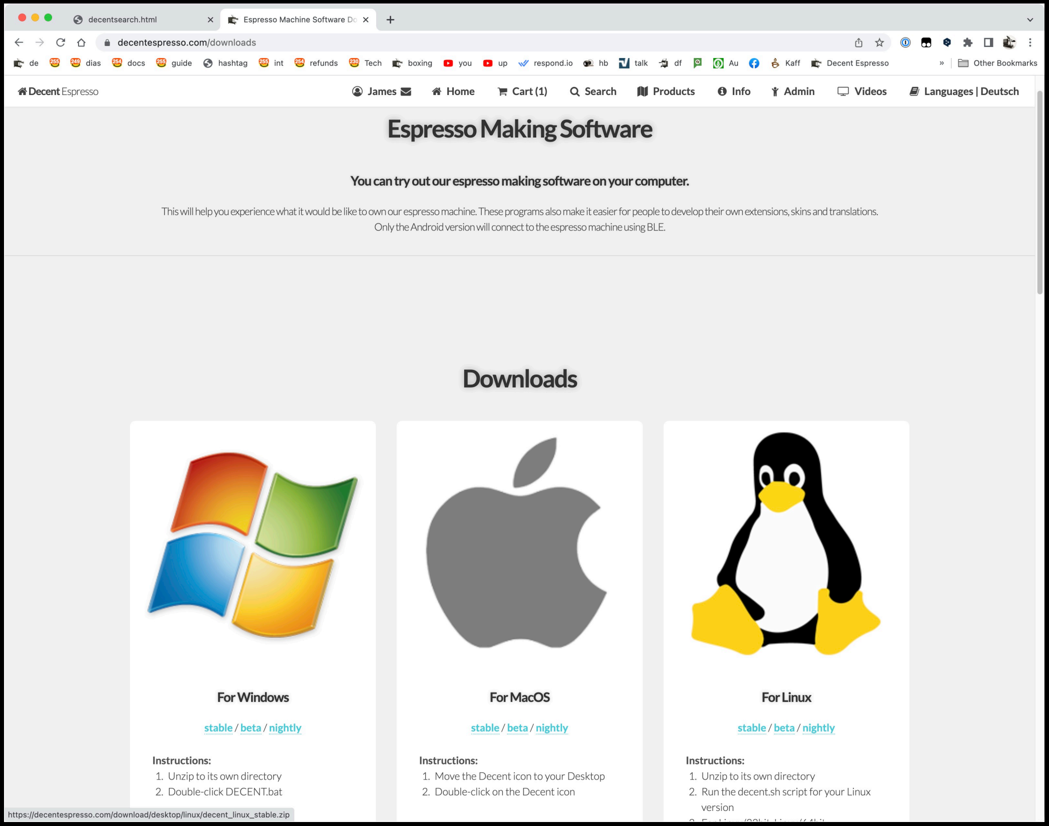
Description

Dynamic bloom into pressure extraction. Based on the 'easy blooming' profile structure from Luca and Stephane and modified to primarily target high extraction grinders at high flow rates, typically ending around 2.5-4ml/s. Dial with ratio once grind is giving an ending flowrate in the range. Includes a significant temperature drop that reduces harshness (although the actual temp... [Tap here for more]

Save

Extractamundo Dos!

a UI was needed to display that data neutrally and truthfully



Espresso Making Software

You can try out our espresso making software on your computer.

This will help you experience what it would be like to own our espresso machine. These programs also make it easier for people to develop their own extensions, skins and translations. Only the Android version will connect to the espresso machine using BLE.

Downloads

For Windows

stable / beta / nightly

Instructions:

1. Unzip to its own directory
2. Double-click DECENT.bat

For MacOS

stable / beta / nightly

Instructions:

1. Move the Decent icon to your Desktop
2. Double-click on the Decent icon

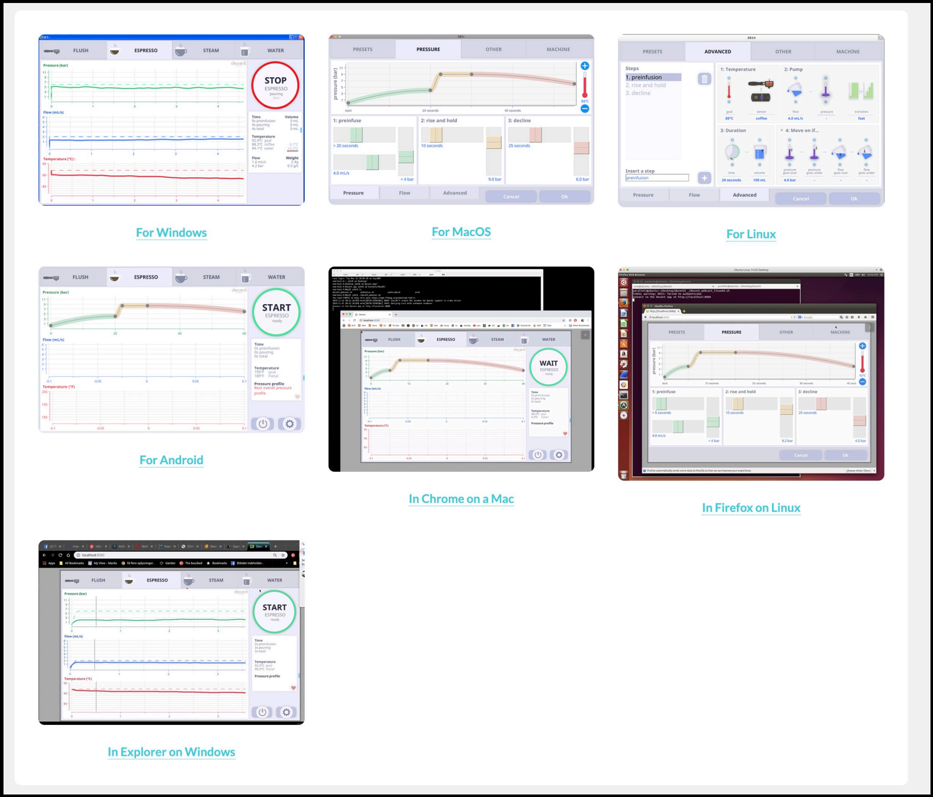
For Linux

stable / beta / nightly

Instructions:

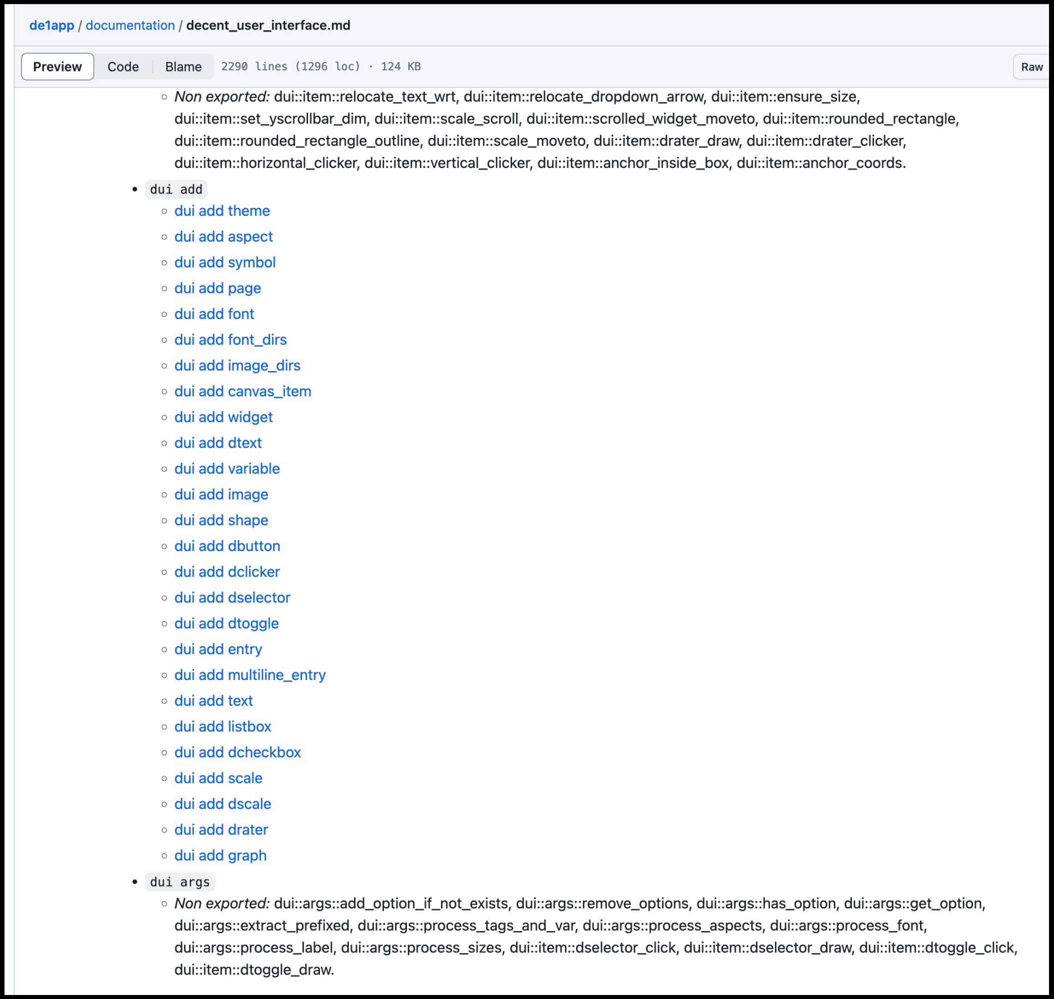
1. Unzip to its own directory
2. Run the decent.sh script for your Linux version

https://decentespresso.com/download/desktop/linux/decent_linux_stable.zip



DUI widgets library

by Enrique Bengoechea



de1app / documentation / decent_user_interface.md

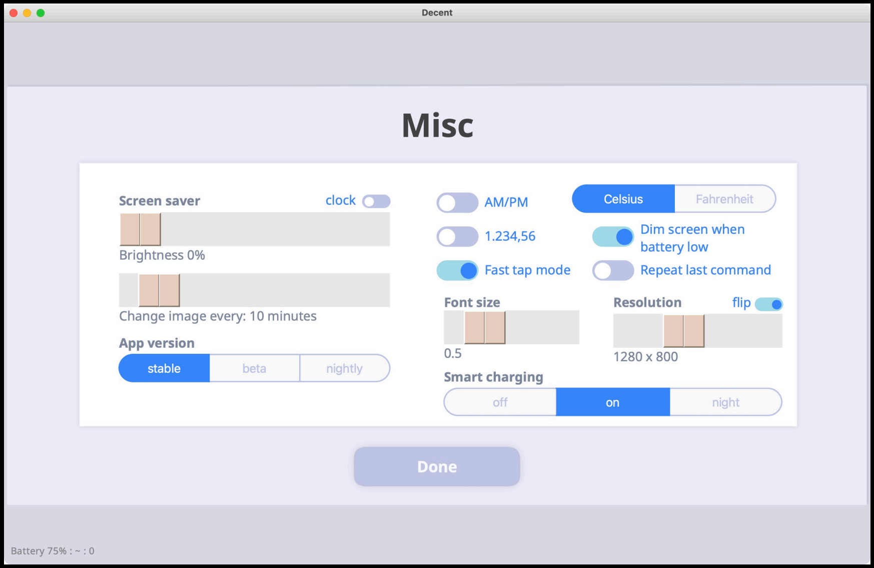
Preview Code Blame 2290 lines (1296 loc) · 124 KB Raw

- *Non exported:* dui::item::relocate_text_wrt, dui::item::relocate_dropdown_arrow, dui::item::ensure_size, dui::item::set_yscrollbar_dim, dui::item::scale_scroll, dui::item::scrolled_widget_moveto, dui::item::rounded_rectangle, dui::item::rounded_rectangle_outline, dui::item::scale_moveto, dui::item::drater_draw, dui::item::drater_clicker, dui::item::horizontal_clicker, dui::item::vertical_clicker, dui::item::anchor_inside_box, dui::item::anchor_coords.

- `dui add`
  - dui add theme
  - dui add aspect
  - dui add symbol
  - dui add page
  - dui add font
  - dui add font_dirs
  - dui add image_dirs
  - dui add canvas_item
  - dui add widget
  - dui add dtext
  - dui add variable
  - dui add image
  - dui add shape
  - dui add dbutton
  - dui add dclicker
  - dui add dselector
  - dui add dtoggle
  - dui add entry
  - dui add multiline_entry
  - dui add text
  - dui add listbox
  - dui add dcheckbox
  - dui add scale
  - dui add dscale
  - dui add drater
  - dui add graph
- `dui args`
  - *Non exported:* dui::args::add_option_if_not_exists, dui::args::remove_options, dui::args::has_option, dui::args::get_option, dui::args::extract_prefixed, dui::args::process_tags_and_var, dui::args::process_aspects, dui::args::process_font, dui::args::process_label, dui::args::process_sizes, dui::item::dselector_click, dui::item::dselector_draw, dui::item::dtoggle_click, dui::item::dtoggle_draw.

https://github.com/decentespresso/de1app/blob/main/documentation/decent_user_interface.md

Native-looking widgets



Decent

Misc

Screen saver — clock: off

Brightness 0%

Change image every: 10 minutes

App version: [✓ stable] beta nightly

AM/PM: off

1.234,56: off

Fast tap mode: on

[✓ Celsius] Fahrenheit

Dim screen when battery low: on

Repeat last command: off

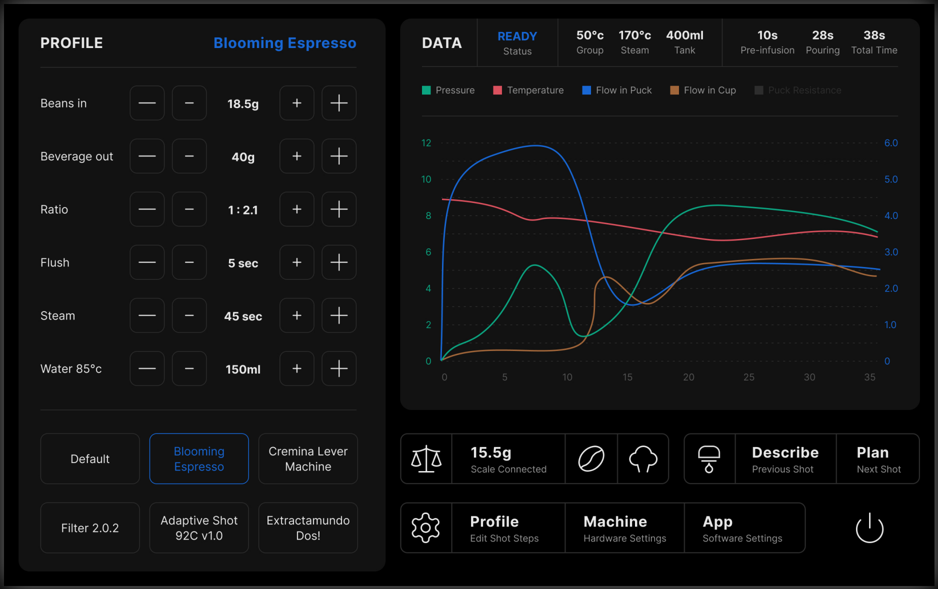
Font size: 0.5

Resolution: 1280 x 800 — flip: on

Smart charging: off [✓ on] night

Done

Battery 75% : ~ : 0



PROFILE — Blooming Espresso

Beans in	18.5g
Beverage out	40g
Ratio	1 : 2.1
Flush	5 sec
Steam	45 sec
Water 85°c	150ml

Default, [✓ Blooming Espresso], Cremina Lever Machine, Filter 2.0.2, Adaptive Shot 92C v1.0, Extractamundo Dos!

DATA — READY Status; 50°c Group; 170°c Steam; 400ml Tank; 10s Pre-infusion; 28s Pouring; 38s Total Time

15.5g Scale Connected

Describe Previous Shot

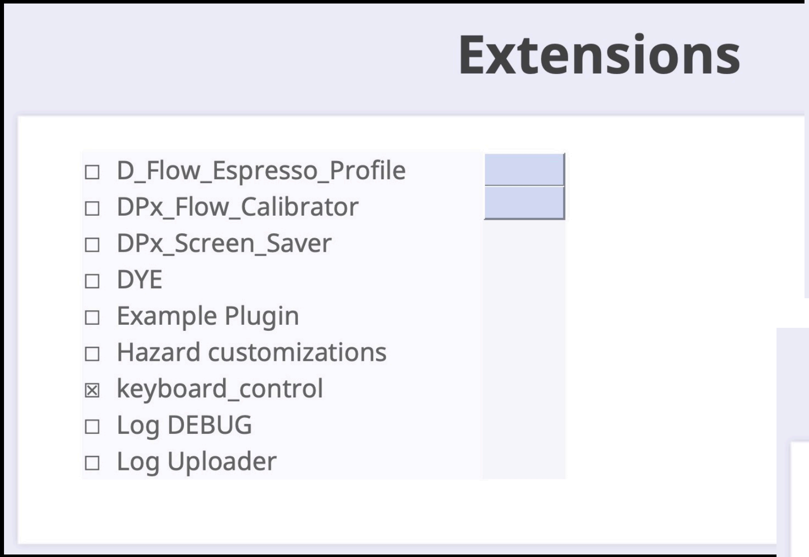
Plan Next Shot

Profile Edit Shot Steps

Machine Hardware Settings

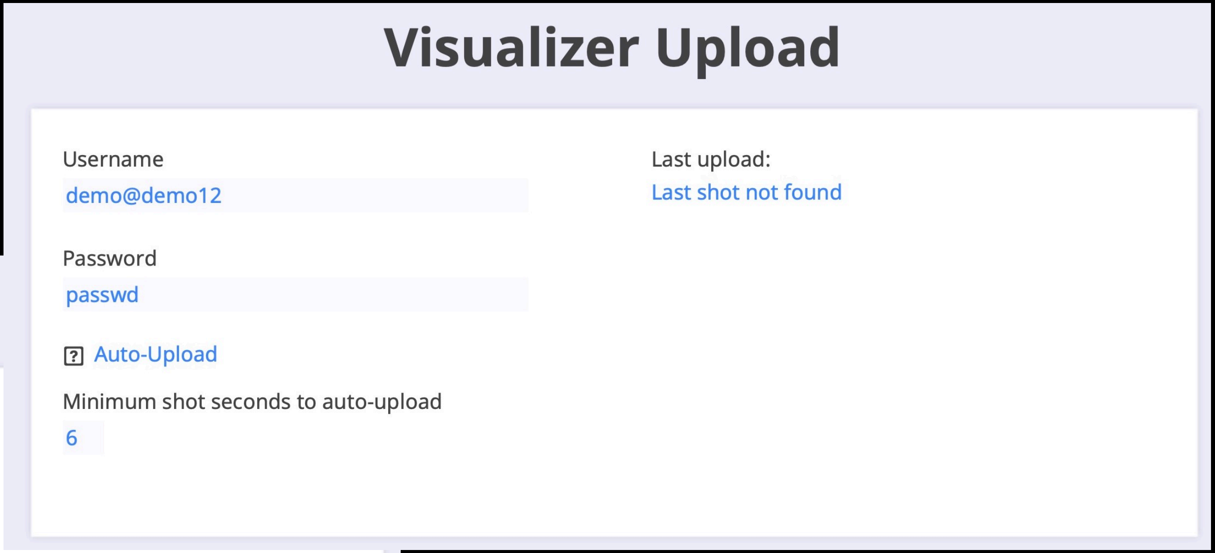
App Software Settings

App Extensions



Extensions

- ☐ D_Flow_Espresso_Profile
- ☐ DPx_Flow_Calibrator
- ☐ DPx_Screen_Saver
- ☐ DYE
- ☐ Example Plugin
- ☐ Hazard customizations
- ☒ keyboard_control
- ☐ Log DEBUG
- ☐ Log Uploader



Visualizer Upload

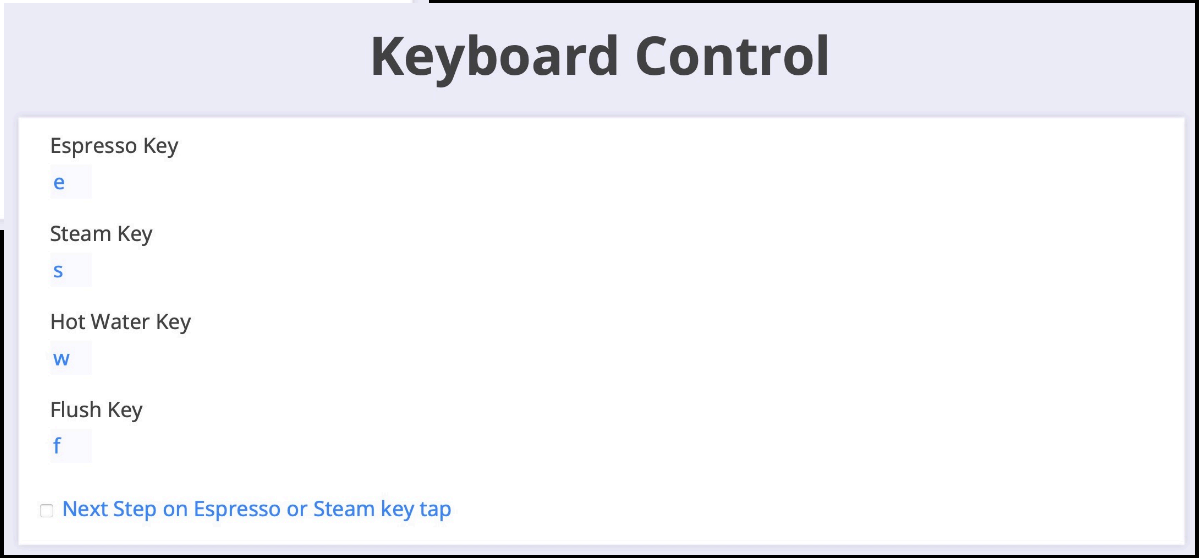
Username
demo@demo12

Password
passwd

☐ Auto-Upload

Minimum shot seconds to auto-upload
6

Last upload:
Last shot not found



Keyboard Control

Espresso Key
e

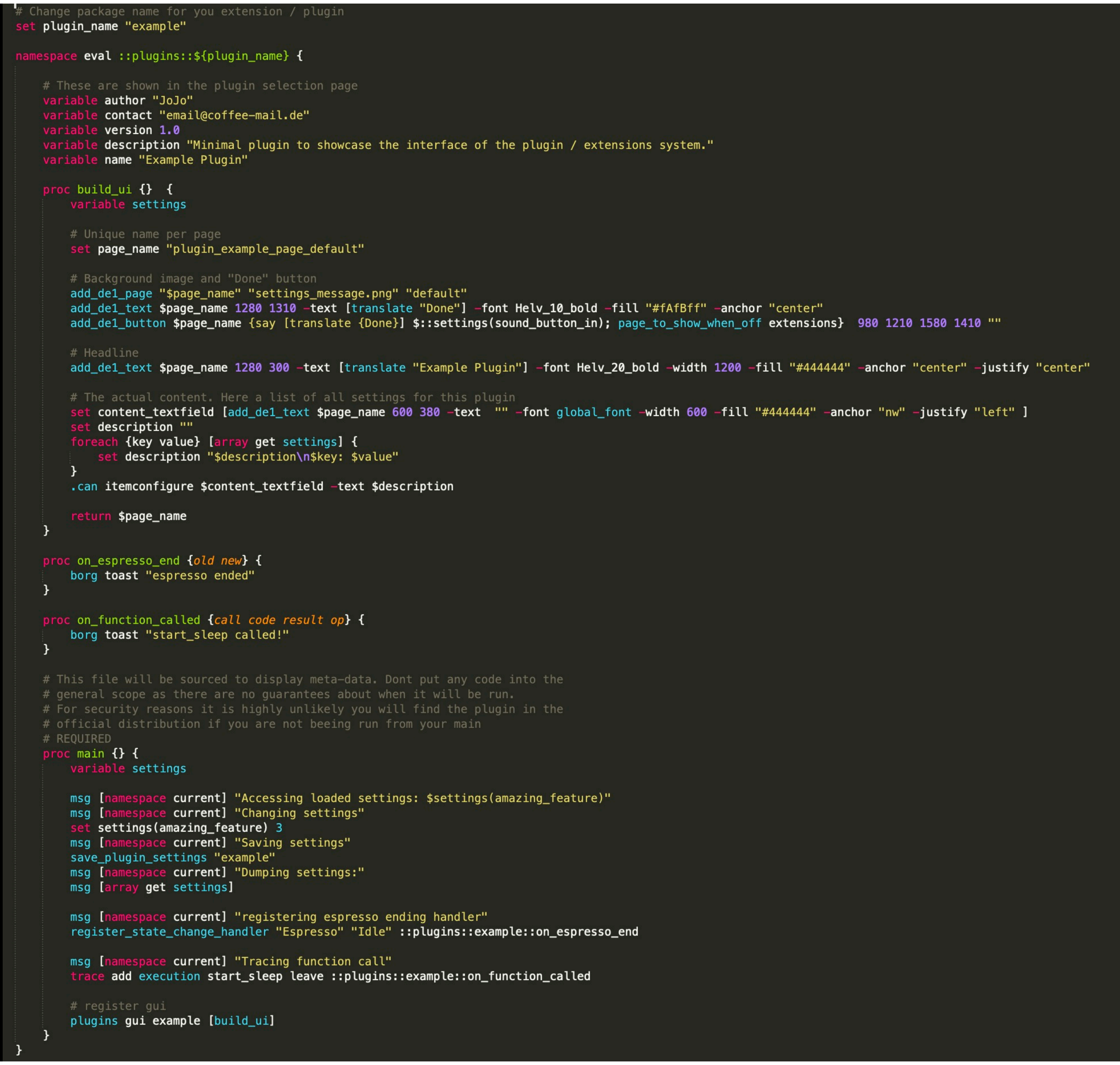
Steam Key
s

Hot Water Key
w

Flush Key
f

☐ Next Step on Espresso or Steam key tap

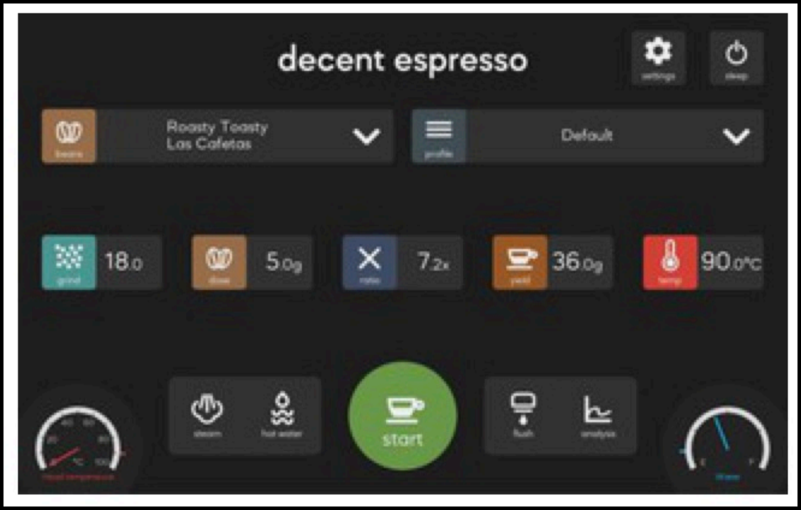
App Extension Example

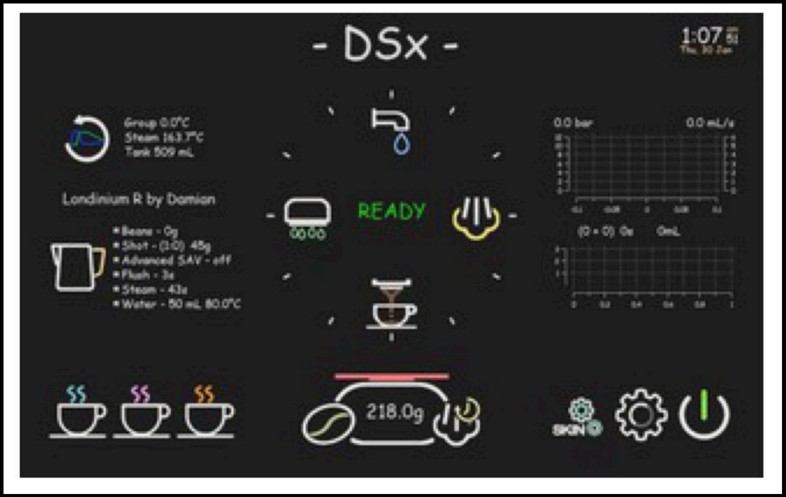


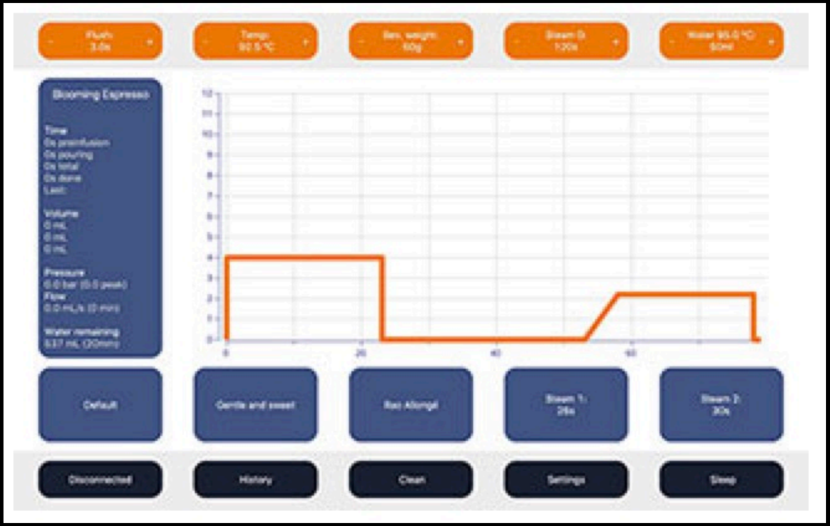
```
# Change package name for you extension / plugin
set plugin_name "example"

namespace eval ::plugins::${plugin_name} {

    # These are shown in the plugin selection page
    variable author "JoJo"
    variable contact "email@coffee-mail.de"
    variable version 1.0
    variable description "Minimal plugin to showcase the interface of the plugin / extensions system."
    variable name "Example Plugin"

    proc build_ui {}  {
        variable settings

        # Unique name per page
        set page_name "plugin_example_page_default"

        # Background image and "Done" button
        add_de1_page "$page_name" "settings_message.png" "default"
        add_de1_text $page_name 1280 1310 -text [translate "Done"] -font Helv_10_bold -fill "#fAfBff" -anchor "center"
        add_de1_button $page_name {say [translate {Done}] $::settings(sound_button_in); page_to_show_when_off extensions}  980 1210 1580 1410 ""

        # Headline
        add_de1_text $page_name 1280 300 -text [translate "Example Plugin"] -font Helv_20_bold -width 1200 -fill "#444444" -anchor "center" -justify "center"

        # The actual content. Here a list of all settings for this plugin
        set content_textfield [add_de1_text $page_name 600 380 -text  "" -font global_font -width 600 -fill "#444444" -anchor "nw" -justify "left" ]
        set description ""
        foreach {key value} [array get settings] {
            set description "$description\n$key: $value"
        }
        .can itemconfigure $content_textfield -text $description

        return $page_name
    }

    proc on_espresso_end {old new} {
        borg toast "espresso ended"
    }

    proc on_function_called {call code result op} {
        borg toast "start_sleep called!"
    }

    # This file will be sourced to display meta-data. Dont put any code into the
    # general scope as there are no guarantees about when it will be run.
    # For security reasons it is highly unlikely you will find the plugin in the
    # official distribution if you are not beeing run from your main
    # REQUIRED
    proc main {} {
        variable settings

        msg [namespace current] "Accessing loaded settings: $settings(amazing_feature)"
        msg [namespace current] "Changing settings"
        set settings(amazing_feature) 3
        msg [namespace current] "Saving settings"
        save_plugin_settings "example"
        msg [namespace current] "Dumping settings:"
        msg [array get settings]

        msg [namespace current] "registering espresso ending handler"
        register_state_change_handler "Espresso" "Idle" ::plugins::example::on_espresso_end

        msg [namespace current] "Tracing function call"
        trace add execution start_sleep leave ::plugins::example::on_function_called

        # register gui
        plugins gui example [build_ui]
    }
}
```

Easily make new UIs

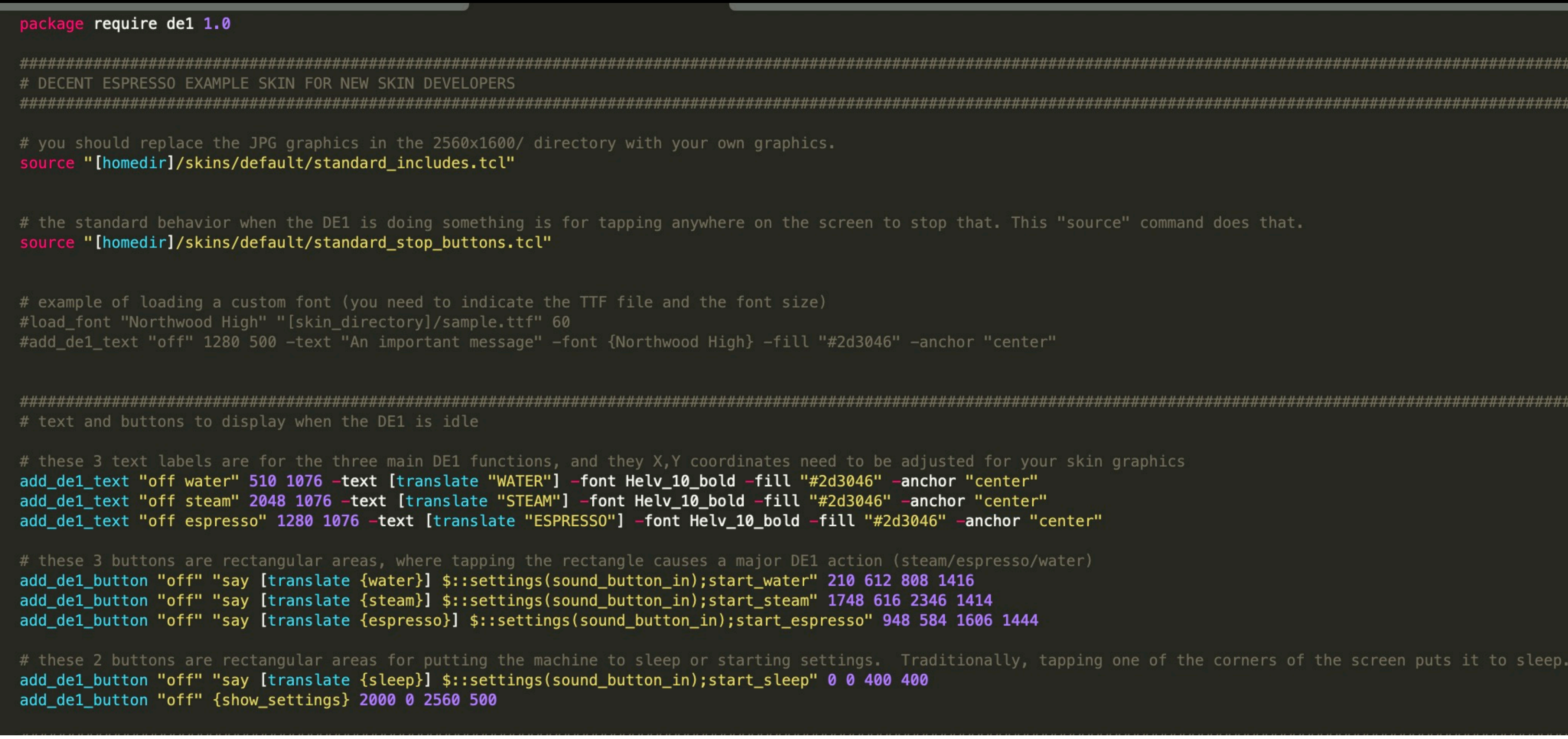
skin development via a language-within-a-language approach







Sample Skin



```
package require de1 1.0

########################################################################################################################################################################
# DECENT ESPRESSO EXAMPLE SKIN FOR NEW SKIN DEVELOPERS
########################################################################################################################################################################

# you should replace the JPG graphics in the 2560x1600/ directory with your own graphics.
source "[homedir]/skins/default/standard_includes.tcl"


# the standard behavior when the DE1 is doing something is for tapping anywhere on the screen to stop that. This "source" command does that.
source "[homedir]/skins/default/standard_stop_buttons.tcl"


# example of loading a custom font (you need to indicate the TTF file and the font size)
#load_font "Northwood High" "[skin_directory]/sample.ttf" 60
#add_de1_text "off" 1280 500 -text "An important message" -font {Northwood High} -fill "#2d3046" -anchor "center"


########################################################################################################################################################################
# text and buttons to display when the DE1 is idle

# these 3 text labels are for the three main DE1 functions, and they X,Y coordinates need to be adjusted for your skin graphics
add_de1_text "off water" 510 1076 -text [translate "WATER"] -font Helv_10_bold -fill "#2d3046" -anchor "center"
add_de1_text "off steam" 2048 1076 -text [translate "STEAM"] -font Helv_10_bold -fill "#2d3046" -anchor "center"
add_de1_text "off espresso" 1280 1076 -text [translate "ESPRESSO"] -font Helv_10_bold -fill "#2d3046" -anchor "center"

# these 3 buttons are rectangular areas, where tapping the rectangle causes a major DE1 action (steam/espresso/water)
add_de1_button "off" "say [translate {water}] $::settings(sound_button_in);start_water" 210 612 808 1416
add_de1_button "off" "say [translate {steam}] $::settings(sound_button_in);start_steam" 1748 616 2346 1414
add_de1_button "off" "say [translate {espresso}] $::settings(sound_button_in);start_espresso" 948 584 1606 1444

# these 2 buttons are rectangular areas for putting the machine to sleep or starting settings.  Traditionally, tapping one of the corners of the screen puts it to sleep.
add_de1_button "off" "say [translate {sleep}] $::settings(sound_button_in);start_sleep" 0 0 400 400
add_de1_button "off" {show_settings} 2000 0 2560 500
```

Skin writing extensions

Screen Variables are Tk text widgets that refresh

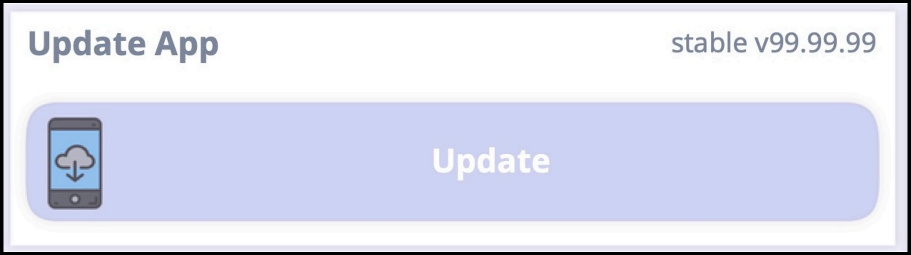
```
add_de1_variable "steam_1" 537 1250 -text "" -font Helv_10_bold -fill
$tappable_text_color -anchor "center"  -textvariable {[seconds_text
$::settings(steam_timeout)]}
```

Mechanism for any Tk widget

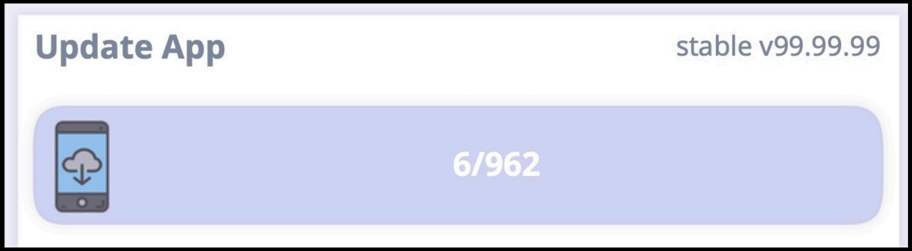
```
# 3 equal sized charts
add_de1_widget "off espresso espresso_1 espresso_2 espresso_3" graph 20 267 {
   bind $widget [platform_button_press] {
      say [translate {zoom}] $::settings(sound_button_in);
```

An Over-the-air update mechanism

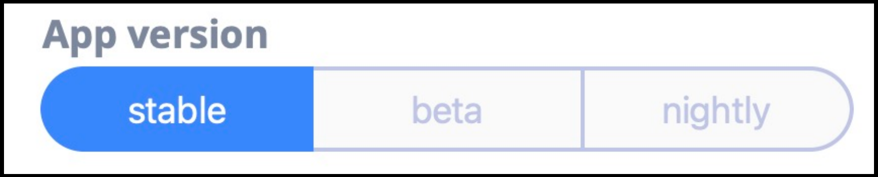
and global challenges with making that actually work


Update App stable v99.99.99

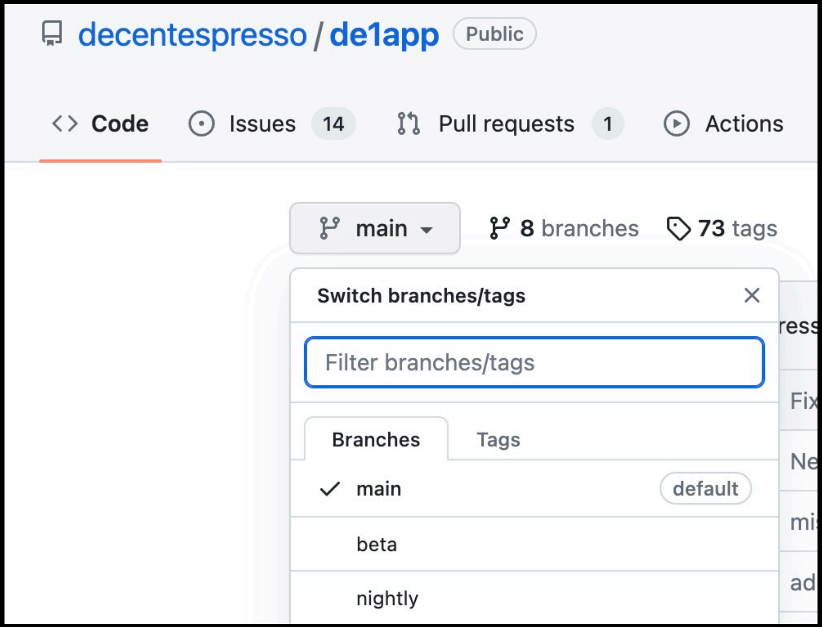
Update


Update App stable v99.99.99

6/962


App version

[✓ stable] beta nightly


decentespresso / de1app Public

✓ main default
beta
nightly

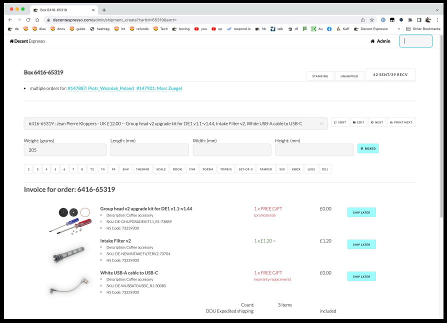
Challenges

- shipping the same app on Android, Windows, OSX and Linux
- converting the Tcl app into a WebApp using mp4 streaming
- what kind of people embraced Tcl and why
- what kind of people hated Tcl, why, and what happened then
- the move from open-source-but-one-programmer to a full open source multi-programmer participation via Github and relinquishing control
- challenges of supporting many different resolutions, tablets and Android versions
- Right-to-left languages

Future

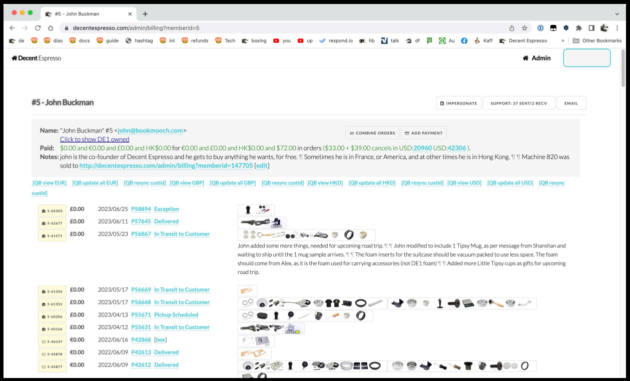
- Surprising findings how Tcl outperforms competing other programs (in other languages) trying to do similar things
- What hasn't turned out well, and what we’re trying to do about it. Bluetooth is our main problem.
- The future of Tcl for us, as Python, Javascript, as others launch competing apps
- Cloud integration
- Two apps at once: point-of-sale and order queue management. Mobile-ordering app. iOS via webapp/mp4.

Other Decent Uses of Tcl & Naviserver

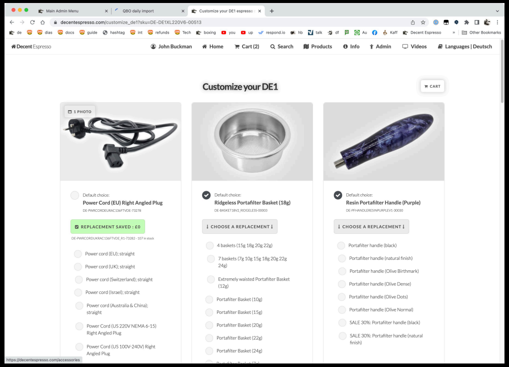

Box 6416-65319

Invoice for order: 6416-65319

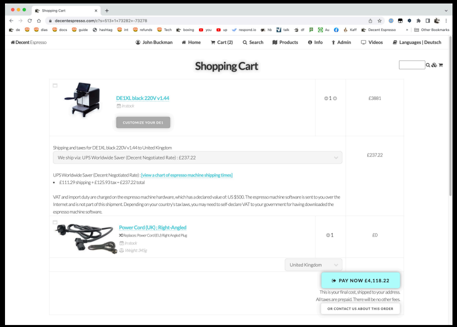
Boxing & Shipping via APIs


#5 - John Buckman

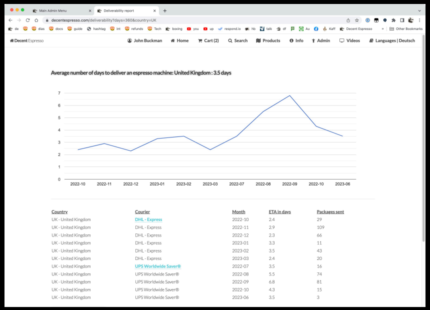
Customer admin


Customize your DE1

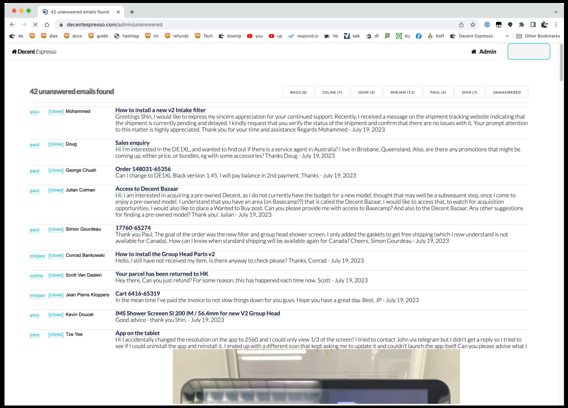
Espresso machine customization


Shopping Cart

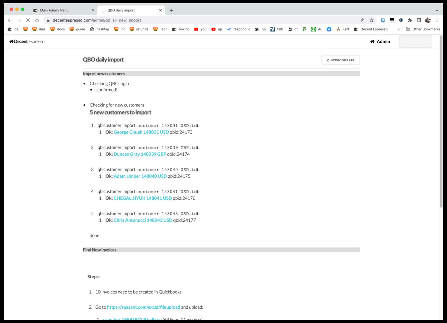
Real-time inventory shopping cart


Average number of days to deliver an espresso machine: United Kingdom : 3.5 days

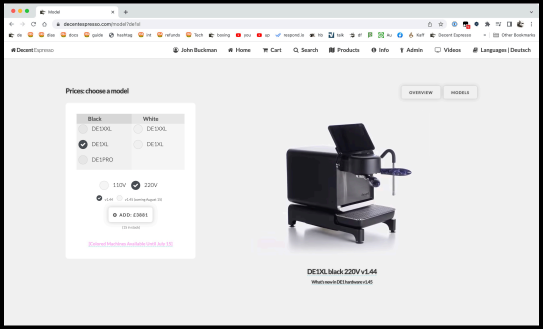
Real UPS/Fedex monitoring via APIs


42 unanswered emails found

Customer support

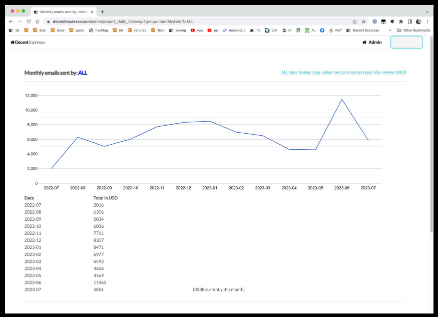

QBO daily import

Quickbooks API Integration


Prices: choose a model

DE1XL black 220V v1.44

Espresso machine shopping


Monthly emails sent by: ALL

Internal staff metrics