

PigNap Development Timeline

| #Commit | Date | Commit | Firmware | Hardware | Stakeholders |
|---------|------------|---|--|---|---|
| 1 | 04.06.2019 | 7907759 Initial Commit | Kconfig for SDK options | prototype #1 (breakout board) | |
| 2 | 04.06.2019 | 6df2d14 Vagrant USB Virtual Serial | Vagrant for reproducible builds on all machines (later a small variation point) | | |
| 3 | 04.06.2019 | f672f27 Vagrant USB Bridge | | | |
| 4 | 04.06.2019 | d9ddfbe VS Code | | | |
| 5 | 05.06.2019 | cabcb11 Debounced Pins | experimented with custom Kconfig options | | |
| 6 | 11.06.2019 | 18fb9ff Small changes | settled for plain cpp options, only using Kconfig for SDK as sdkconfig too brittle (and configuration management was perceived as irrelevant at this point), introduced config.h for magic numbers and simplified adaptation later on | | |
| 7 | 12.06.2019 | 02bf8b5 Outputs, better debouncing | heavy use of config.h to extract magic numbers and make their usage readable. "this must be changed for the final product" => aware of evolution potential | | |
| 8 | 02.07.2019 | 75db623 Added output pin names | added config.c with pin names | | |
| 9 | 02.07.2019 | 70d44bc Added button pin names | same for buttons | | |
| 10 | 02.07.2019 | 99f1c39 Swapped input-only pins | pins changed in config.h/c | | |
| | | | | we discovered that certain pins are input only on the esp32. so this was a design flaw in the initial PCB, which was not produced yet so no variation was needed | |
| 11 | 02.07.2019 | 309a623 Added documentation | added requirements documents and initial PCB design | PCB design by external partner, each change requires time and money | requirements obtained from domain analysis together with customers and DLG |
| 12 | 02.07.2019 | b242985 LCD support + I2C | main development of prototype #1 begins here, heavy use of config.h/c for potential variation points such as LCD (as it was clear that later prototypes would require small changes). No distinction between magic numbers (stack size) and variability (durations). This proved extremely useful later, as there is one central place where the "feature model" is encoded. | LCD dropped in later prototypes and replaced by OLED display | |
| 13 | 03.07.2019 | 102fc82 Basic treatment process | implements business logic for anesthesia | | hugely influenced by law, DLG, and customer needs |
| 14 | 03.07.2019 | 67afea3 LCD log task to avoid delays in the treatment process | | | |
| 15 | 03.07.2019 | 9badaec Renamed treatment process event | | | |
| 16 | 03.07.2019 | c158bac Treatment phase 2 PWM | usage of simplified macros: #define DURATION 3 //TODO: 75, manual switch of these values if needed | | |
| 17 | 03.07.2019 | 6373d06 Basic counter task | | | |
| 18 | 03.07.2019 | 33beb92 Filter & Isoflurane Reset | | problem discovered: goldcap capacitor does not work in certain edge cases. Dropped in favor of a pure software solution | prescribed by law / work safety |
| 19 | 05.07.2019 | 449a870 RTC | use Vagrantfile/cron to auto-update the __TIME__ and __DATE__ configuration options, later dismissed for simplicity | RTC is very brittle and hard to get right in software, but the hardware chip was fixed and not changed until the end. Choosing I2C as bus also helped, because there was no pin chaos | law prescribes daily logging of anesthesia, which requires RTC. Most discovered bugs relate to the complex RTC system and could have been avoided if not for this requirement |
| 20 | 05.07.2019 | 6840a45 RTC low battery warning | | | |
| 21 | 07.07.2019 | bcc65c2 Use RTC OSF flag | | | |
| 22 | 07.07.2019 | 63dab57 More efficient controller message queue | | | |
| 23 | 07.07.2019 | 63ab67a Voltage monitor stub | | | |
| 24 | 08.07.2019 | 90c796a Simple Wifi setup | basic business logic regarding anesthesia done, HTTP server development starts here | | necessitated by law to access log information |

25 08.07.2019 1a14cd4 Wifi task pinned at core 0
 26 08.07.2019 69173a5 Basic HTTP server
 27 08.07.2019 16af7e0 Embedded HTML files
 28 08.07.2019 e437312 Basic status route
 29 08.07.2019 f3a717e Basic status view
 30 09.07.2019 b8d84c0 Basic settings view
 31 09.07.2019 561857e Serve static assets
 32 09.07.2019 bbb4a40 Improved settings
 33 09.07.2019 26d0856 Station Wifi settings
 34 10.07.2019 8867f38 Wifi scan (unused, because AP mode does not allow scanning)
 35 10.07.2019 a855347 DHCP hostname
 36 10.07.2019 ae7ac7b Read Wifi settings from NVS
 37 11.07.2019 514b6e5 Non-volatile memory

38 11.07.2019 bf15994 Reading history
 39 11.07.2019 4d136fd Refactoring
 40 12.07.2019 4c25536 Admin interface
 41 12.07.2019 7861641 Virtual padding of history until today
 42 12.07.2019 553dab3 Total counter => today counter
 43 12.07.2019 4a9d562 History
 44 12.07.2019 4e31b7d Factory reset
 45 12.07.2019 52279c7 Virtual today cell
 46 12.07.2019 337972d History export
 47 12.07.2019 2938377 Voltage monitor
 48 12.07.2019 3ddb5eb5 Notes updated

49 14.07.2019 ddb8691 Production flag

50 14.07.2019 cb24851 PIGNAP => Pignap
 51 14.07.2019 64e09ea Removed compile date and time (too complicated)
 52 15.07.2019 c0de583 Solved year 2038 problem by introducing a 64-bit wtime_t type
 53 15.07.2019 26d65e8 Refactored routing
 54 17.07.2019 e036bce GPIO test

55 18.07.2019 7406d20 Internal pullup resistors
 56 20.07.2019 76cce22 Removed voltage monitor
 57 20.07.2019 aa2b785 Board version switch

58 27.07.2019 5caeb06 HTTP filter & isoflurane reset

59 27.07.2019 27739f7 Include MAC address in SSID
 60 27.07.2019 a3059bb Refactorings
 61 31.07.2019 9c343aa CP210x kernel module update

later removed because not used by customers

log history development, history is stored as a ring buffer in some persistent memory, complex feature that requires transactional semantics, interacts richly with RTC

this concludes the main development, most following commits deal with changing requirements / production issues

IS_PRODUCTION flag added to config.h

adapted pins to prototype #2

added BOARD_VERSION, which replaces IS_PRODUCTION

reintroduced IS_PRODUCTION

removed wifi AP scan

settings due to customer needs

prototype #1 uses NVS memory (not durable enough in practice, however). Thus, abstracted away into mem.c to be substituted later

later dropped in favor of software solution

prototype #2 in production, main development still on prototype #1, both had to be supported, #1 used shorter durations for anesthesia

#2 has different pins: colors for LEDs were swapped due to an error in PCB design, this would have been expensive to fix on hardware level, so introducing a variation point was deemed the better solution

#2 lacked pullup resistors for buttons, another variation point caused more problems (regarding strapping pins) than it solved, so dropped
 #2 had an issue with booting due to a certain pin, pin mapping had to be changed again, leading to a prototype #3, all three were in use (#1 and 2 in development, 2 and 3 in deployment/testing)

in testing, short durations are useful, so two variables determine the configuration (BOARD_VERSION and IS_PRODUCTION)

62 31.07.2019 92799d8 Fixed bug where treatment was started in spite of emergency event
63 31.07.2019 52303c2 Revised battery reset
64 31.07.2019 f46e9d3 Improved admin section
65 01.08.2019 724b9cb Improved battery change

66 01.08.2019 0c8b29b Battery change tests
67 01.08.2019 3a3bde7 Board version 3
68 01.08.2019 e3349bb UI improvements
69 01.08.2019 99203d2 Restructured repository
70 01.08.2019 2cddb82 Added Android wrapper app skeleton

71 01.08.2019 d8b87a3 Added esptool.py flashing
72 01.08.2019 254056a Added miniterm.py monitoring
73 02.08.2019 c0369cb Adjustments at HCP

74 02.08.2019 1bd90b0 Adjustments
75 02.08.2019 5187f81 Adjustments

76 02.08.2019 2a3495e Adjustments
77 02.08.2019 90b9a4f Adjustments
78 03.08.2019 4bbf10b Basic app added
79 03.08.2019 07c9f33 Restructured app
80 03.08.2019 e5ae6fc App improved
81 03.08.2019 37c2ab5 Added keystore
82 03.08.2019 b124ebf Improved website
83 08.08.2019 543a4e5 Improved history
84 05.09.2019 5a80f82 Reduced treatment duration
85 05.09.2019 a135165 Removed isoflurane counter

86 05.09.2019 24aea9 Small changes
87 05.09.2019 9a7f3cc Adjusted lighting in treatment phases

88 23.09.2019 debd146 Basic FRAM

89 25.09.2019 e62666c FRAM memory integration
90 26.09.2019 a3e735c Improved error handling
91 26.09.2019 9e5bdfb Improved admin UI
92 12.10.2019 e882abb Basic OLED display
93 13.10.2019 c57243c Improved OLED display
94 15.10.2019 47db8d9 Removed unused counter

95 15.10.2019 07e0bf9 Added total counter

96 27.10.2019 5ccf86f Added air detection
97 27.10.2019 49e914b Fixed subtle blocking bug
98 27.10.2019 a74df35 Added third treatment phase

99 27.10.2019 06a5661 Minor refactoring
100 31.10.2019 0c6df10 Fixed phase description in HTML
101 03.12.2019 a57481f Revert "Added air detection"

| | | |
|--|---|--|
| PIN/TAN system for changing batteries | if battery runs out, it must be changed - but this allows manipulations of the history, which contradicts the law | law dictates that logging must be manipulation-safe |
| | updated pin mapping/pullup resistors for #3 | |
| this starts a detour where we developed an Android app and proper flashing scripts | | |
| two Vagrantfiles: one for the development and deployment environment each, chosen manually | this was necessary to ensure reproducible builds on different machines | |
| config.h updated to use BOARD_VERSION == 2 ... | another pin mapping/inversion change created #4 (1, 2 in use for development, 3 and 4 in field) | |
| | | |
| reduced duration of anesthesia | narcotic is now measured outside of the software, so the isoflurane counter is dropped | DLG lowered requirements customers want a direct feedback via fill nozzle |
| added DONE state for lighting | | customers were puzzled by the lighting phases |
| added support for external FRAM storage as an alternative to NVS | FRAM supports thousands of write cycles to store history data, NVS is still used in some devices (e.g., #1) | law requires 1 year storage |
| | | |
| OLED display as alternative to LCD | still, devices with LCD are in use | customers want a proper display |
| removed counter | in the beginning, an external counter was supposed to exist - this was supplanted by the OLED display | |
| total counter added | | customers/veterinaries demanded a counter for all treatments |
| | detect whether compressed air is enabled | |
| added PHASE_3 state for treatment | a third treatment phase helps with streamlining the process | found in in-field testing |
| | | |
| removed air detection | problems with air detection, solved outside of software | |

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| 102 | 03.12.2019 | 53339cc Added prefilter counter | | added a prefilter to #4, repurposed old isoflurane counter (so no #5 was needed) | for improved work safety, a prefilter was demanded by customers |
| 103 | 04.12.2019 | 4d9ebe9 Rebranded for Schulze Bremer | changed all logos | | BEG responsible for distribution/marketing, device is officially introduced to interested parties |
| 104 | 23.12.2019 | bb7a080 Added articles | | | |
| 105 | 23.12.2019 | 6ce4356 Added heat-up | added a timer after starting the device | no hardware changes necessary | demanded by DLG and customers |
| 106 | 30.12.2019 | 0e2c59a Added heat-up condition | | | |
| 107 | 15.01.2020 | c228b00 Default PIN for first battery change | changes controller thresholds for filter etc. | | new values for filter etc. determined |
| 108 | 28.02.2020 | 50eb3c1 Updated website | | | |
| 109 | 01.03.2020 | 4678139 Added docs | | | |
| 110 | 01.03.2020 | ee696fe Improved Vagrantfile | | | |
| 111 | 01.03.2020 | d7e2001 FM24CL64B support | added software support for both small and large FRAMs | new FRAM is required with more storage, but the old one must still be supported for in-field/DLG testing, so a new variation point was necessary | law change necessitates 3 year history now, requires 2200 bytes |
| 112 | 01.03.2020 | 9b5f4dc 3-year data retention | changed config.h to allow for 3 year history | | |
| 113 | 01.03.2020 | b04e5d1 Fixed buffer overflows | the following commits implement final improvements and bug fixes | | |
| 114 | 01.03.2020 | e47d5cc Changed telephone number | | | |
| 115 | 01.03.2020 | de48b19 Added descending order for history iterator | | | |
| 116 | 01.03.2020 | 6d7b153 Adjusted filter warning threshold | | | |
| 117 | 01.03.2020 | 4449c05 Can reset filter at any time | | | demanded by customers |
| 118 | 01.03.2020 | 9e5249d Increased size of event queues | | | |
| 119 | 02.03.2020 | b38cc87 Pre-release for certification | | | used by DLG/CE for certification |
| 120 | 02.03.2020 | 2518ee3 Added docs | | | |
| 121 | 13.03.2020 | eb0336a Keep filter messages on display | | | demanded by customers |
| 122 | 13.03.2020 | 7c19ff6 Hold button for filter reset | | | demanded by customers |
| 123 | 13.03.2020 | 88f2451 Fixed GPIO test | | | |
| 124 | 13.03.2020 | a3859c6 Fixed GPIO pins | pin mapping was accidentally swapped in config.h | | |
| 125 | 23.03.2020 | 1e77678 Skip heating up on device initialization and battery update | | | |
| 126 | 23.03.2020 | d8bf56b (tag: v3) Build configurations | added simple script to build and zip all relevant configurations, just by including the right header file (this introduced a new bug, sadly) | this was needed to ship the final firmware in all relevant configurations/combinations (for all prototypes, production/testing environments, and FRAMs) | |
| 127 | 29.04.2020 | e633a03 Docs added | | | |
| 128 | 29.04.2020 | d3e6fed Removed filter reset in app | | | |
| 129 | 29.04.2020 | 1259b14 2019 -> 2020 | | | |
| 130 | 29.04.2020 | 4bc0d7c Log filter reset date | required change of history format, but only a software change | | DLG demanded this for manipulation-safety |
| 131 | 29.04.2020 | 781e813 Log prefilter reset date | | | DLG demanded this for manipulation-safety |
| 132 | 29.04.2020 | 0de470d Fixed rtc_date_t parameters | | | |
| 133 | 29.04.2020 | 6e5d5f4 Fixed FRAM address configuration bug | | | |
| 134 | 29.04.2020 | 3e2b072 Fixed weird font-family choice in Skeleton CSS | | | |
| 135 | 29.04.2020 | a829bed Added docs on FRAM bug | bug documented in docs/fram-bug.txt | | |
| 136 | 08.05.2020 | f7a74a1 Updated config | | | |
| 137 | 08.05.2020 | 1926249 Updated branding | | | |
| 138 | 23.06.2020 | 066bd3c Updated values | | | |
| 139 | 25.12.2020 | 14569f0 Docs added | final version delivered to customers | | |
| 140 | 25.05.2021 | de944e6 (HEAD -> master, origin/master) Docs added | | | |