

Melodious Medleys

The BPVH Skunk Works of a Veterinary Artificer

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The systems built at two veterinary hospitals, and the ideas still in progress · Public edition

Melodious Medleys: The BPVH Skunk Works of a Veterinary Artificer

Everything Dr. Shayne Ballou built at Bloomfield Pointe Veterinary Hospital and Animal Clinic East, and what each piece does

Public edition, 2026

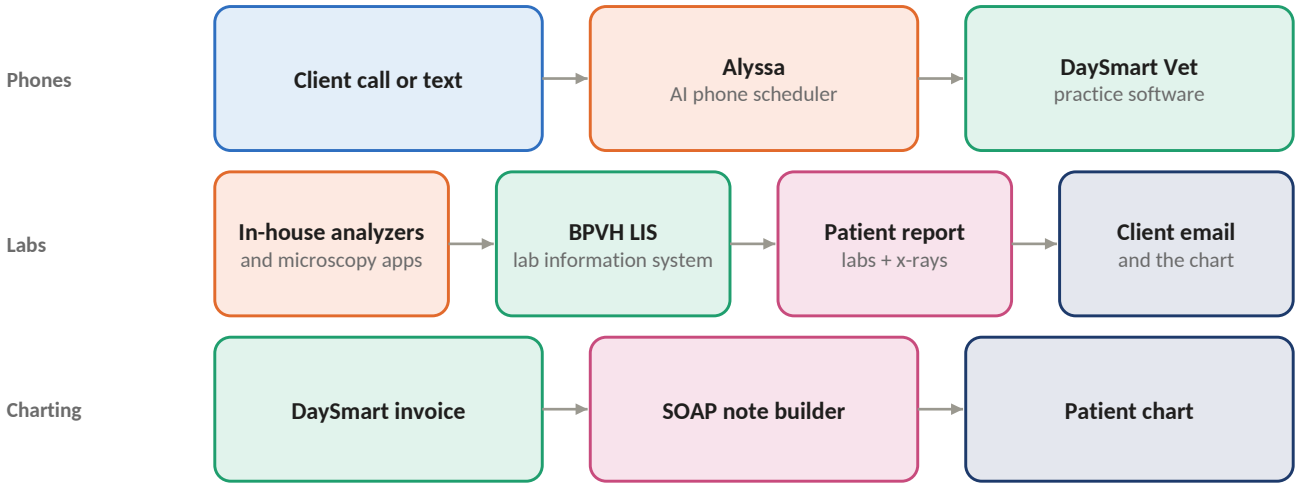
About This Book

Dr. Shayne M. Ballou built much of the technology at Bloomfield Pointe Veterinary Hospital (BPVH) in Pontiac and Animal Clinic East (ACE) in Detroit himself, so the clinics run on systems no vendor supports. This book is an overview of those systems. Each chapter covers the problem, what was built and how it works.

Part One covers systems that are built and in use. Part Two covers prototypes, unfinished builds and ideas.

The Big Picture

How the pieces fit together



Part One: Completed Systems

Chapter 1: Alyssa, the AI Phone Scheduler

The Problem

The clinics used a commercial AI phone service. It went down about once a week, which meant missed calls and lost bookings. Staff spent their day on the phone booking routine appointments instead of looking after patients.

What Was Built

Alyssa is an AI voice agent that answers the phone, talks to clients and books appointments straight into DaySmart Vet. She has an older female voice with a Southern accent, and her greeting says Dr. Ballou built her to help with scheduling. Her standing policy is that all appointments are booked through her, the app or the website, and staff only schedule surgeries and emergencies.

The Backstory: Why Alyssa Exists

The two clinics get an estimated 50 to 100 scheduling calls a day between them. The paid AI phone service booked into DaySmart but went down about once a week, and every outage meant missed calls. Dr. Ballou decided to build a replacement he controlled.

The road there wasn't straight, and the false starts explain why the system looks the way it does:

1. **API request.** He asked DaySmart Vet for API access.
2. **Text-a-link idea.** While waiting, he scaled back to a simple system that greets after-hours callers and texts them the online booking link.
3. **Twilio detour.** Twilio's business-profile approval dragged on, so he briefly dropped Twilio, then came back to it once it was approved.
4. **Back to a real agent.** He returned to a true conversational booking agent and chose Retell as the voice platform, rather than building speech handling himself, to get running faster.
5. **Browser hands.** Rather than wait on full API access, he had the agent work DaySmart through a browser on a clinic PC. Booking automation was built first because it was the riskiest part.
6. **Simplify for stability.** Creating new client and pet profiles turned out to be fragile. Since October 12, 2026, Alyssa just books the slot and puts the caller's details in the appointment notes.
7. **Grew into a front desk.** Records, vaccine history, lab emails, text conversations, ACE after-hours coverage and callback lists were added one at a time from October into November 2026.

Everything Alyssa Can Do

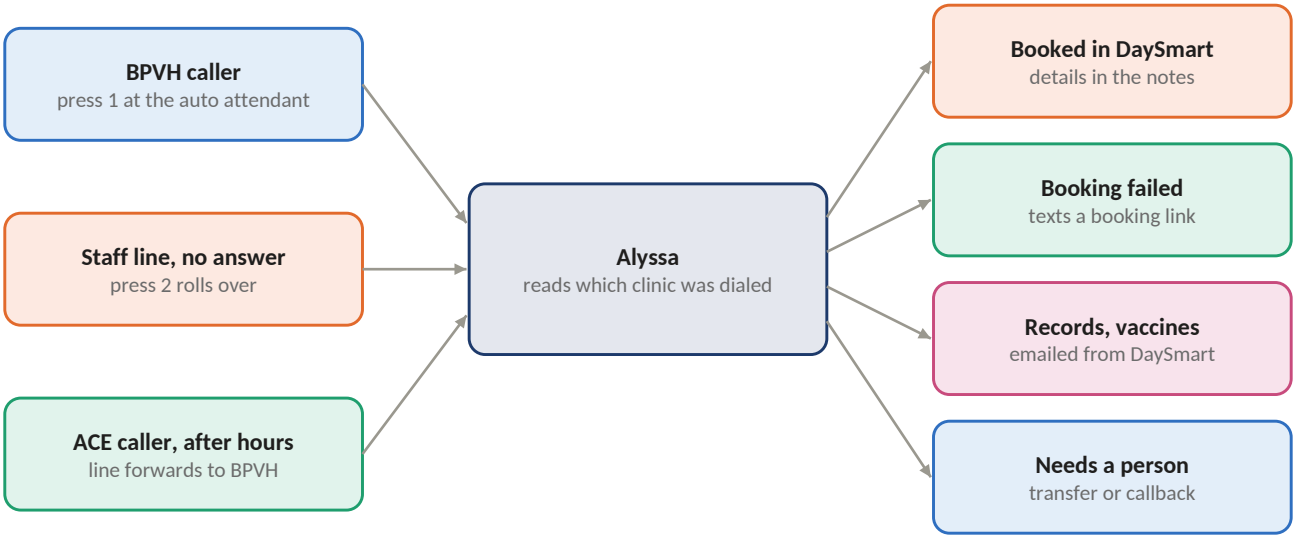
Ability	How it works
Book appointments by phone	Books at BPVH or ACE, which share one DaySmart account, following the clinic's booking rules
Book by text	Clients text the clinic's DaySmart number, and Alyssa reads, replies and books inside DaySmart
Recover a failed booking	If a phone booking fails, she texts the client a link to finish booking online
Send medical records	By call or text; she emails them from DaySmart
Send vaccine and rabies records	By call or text
Email lab results	Lab reports are filed to DaySmart charts and emailed to clients (live since October 12, 2026), with a text saying results were sent
Attach labs and x-rays to charts	Fuzzy-matches the pet's name against that day's schedule, ignoring misspellings. If two pets share a name, she picks the appointment closest to when the file was made.
Answer basic questions	Hours, walk-in times, how to get records, the Pet Care by DaySmart Vet app, and that staff handle surgery and emergencies
Know which clinic was called	Reads the forwarding information on forwarded ACE calls and greets callers as Animal Clinic East
Hand off to people	Transfers to the BPVH staff team during business hours and shows the client's caller ID; emergencies go to a person
Keep a callback list	Non-urgent after-hours callers get a text and are added to a callback list for the next morning
Write SOAP notes	Drafts notes from invoices and posts them to the chart (Chapter 5)
Watch herself	An hourly watchdog alerts Dr. Ballou if something goes wrong

Why These Choices

1. Retell over building speech from scratch, to get a working agent quickly, with the option to move to Twilio Media Streams later.
2. Browser automation over the API, because the DaySmart API couldn't do everything needed, such as attachments, and access was slow to arrive.
3. **Keep the main number.** BPVH's main number was never ported or changed, so clients and listings stay the same.
4. **Policy built into the greeting.** Saying up front that appointments go through Alyssa, the app or the website frees staff for surgery and emergencies.

How a Call Flows

Every call ends with Alyssa or a person, never a dead end



BPVH callers pick a key at the auto attendant: press 1 for Alyssa, press 2 for staff, and an emergency key that always reaches a person. After-hours ACE calls go straight to Alyssa, and every Alyssa call ends in a booking, a text, emailed records or a person.

The Parts

1. **Phones.** Both clinics run on Verizon One Talk. The BPVH auto attendant sends press 1 to Alyssa and press 2 to staff. ACE's line forwards to BPVH after hours so Alyssa answers both. She works out which clinic was dialed and greets the caller to match.
2. **Voice platform.** Retell does the speech side, and Twilio numbers, one per clinic, are the front door.
3. **The hands.** Alyssa's server runs on a clinic PC and works DaySmart through a browser window dedicated to her.
4. **Booking rules.** Alyssa follows each clinic's scheduling rules and leaves surgery to staff. She books the slot and puts the caller's and pet's details in the notes rather than searching for the client record, because that is more stable.
5. **ACE.** Alyssa can book at either clinic, tell callers how to get records, and point them to the Pet Care by DaySmart Vet app.
6. **Text features.** Clients can text the clinic, and Alyssa can email medical records and vaccine or rabies records.
7. **After hours.** Emergencies go to a person. Non-urgent callers get a text and go on a callback list, and calling back that list is staff's first job each open morning.

Keeping Watch

An hourly watchdog checks that her server is up, that she can still reach DaySmart, and whether any call failed or callbacks are waiting, and alerts Dr. Ballou by iMessage.

Chapter 2: The BPVH Laboratory Information System (LIS)

The Problem

Each in-house analyzer printed or displayed its own results. Staff had to retype numbers into charts, and labs, x-rays and client communication were all separate. Commercial LIS systems are expensive and don't support low-cost open-reagent analyzers.

What Was Built

A custom Python LIS. A Flask web server takes results from every analyzer, flags values against canine and feline reference ranges, shows them on a live dashboard, merges each patient's labs and x-rays into one PDF, files it in Google Drive and emails it to the client while logging a copy to DaySmart.

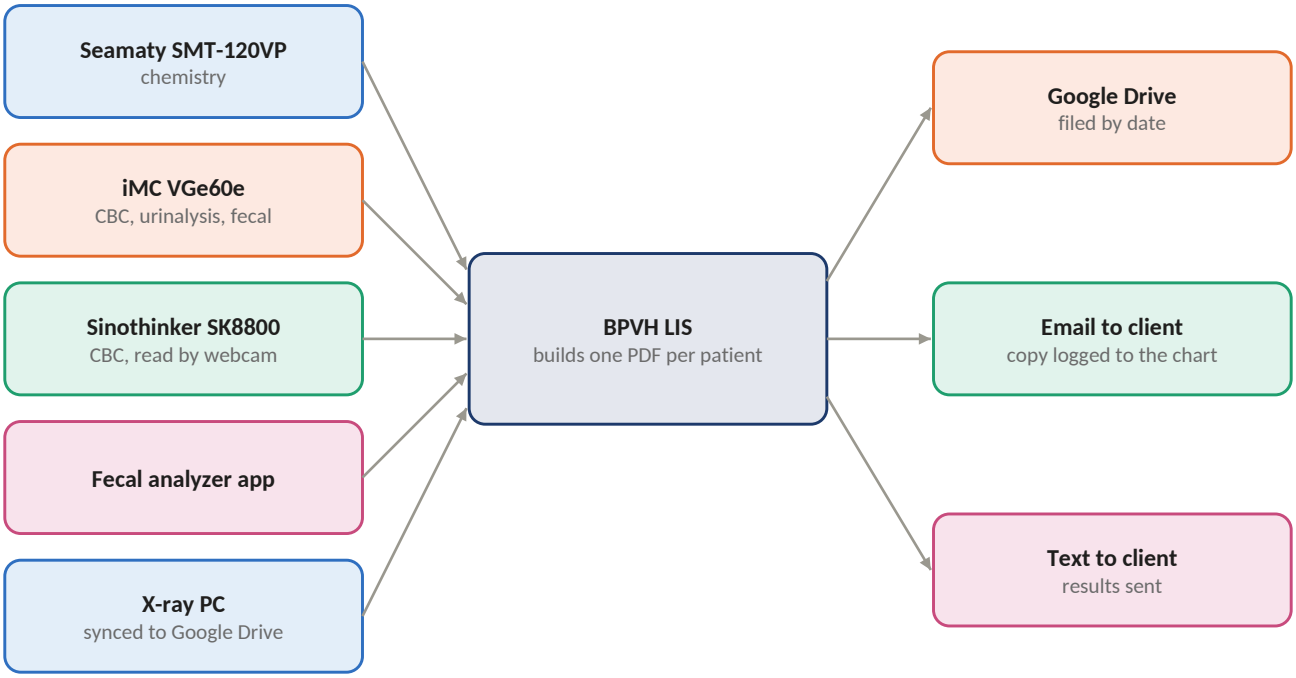
The Backstory

The first version was a single HTML file with parsers for HL7, ASTM, CSV, XML and key=value formats, plus a Python serial bridge for five analyzers. It proved the idea but couldn't run around the clock, so it was rebuilt as the Flask server it is now. The aim was to buy lower-cost open-reagent analyzers and still get results into charts automatically. Commercial LIS systems are built for big-name analyzers.

What Went Wrong Along the Way

1. **The SK8800 never talked.** Every baud rate from 1200 to 115200 came back empty. The analyzer is locked in kiosk mode, and its manual has no export section. A webcam reading its screen is the workaround, and a Mindray BC-2800 was bought as the long-term CBC.
2. **The Seamaty went quiet in October 2026.** A Windows Firewall rule was blocking it, and fixing the rule brought it back.
3. **DaySmart has no attachment API.** That forced the email-plus-chart-log method for getting labs onto charts.

Every analyzer feeds one system, and one report goes to the client and the chart



The Analyzers

Analyzer	Tests	How it connects	Notes
Seamaty SMT-120VP	Chemistry	HL7 over the clinic Wi-Fi	
iMC VGe60e	CBC, urinalysis, fecal	Sends results to the LIS over the network	Each panel goes to its own tab
Sinothinker SK8800	CBC	Serial protocol never decoded; a webcam reads the screen	Settings are locked
Mindray BC-2800	Hematology	Bought as an open-reagent replacement or backup	Integration to follow

Reports and Charting Rules

1. Reports go into per-day folders on the practice Google Drive.
2. Results for the same patient are combined only if they were run on the same day, which confirms it's the same animal. Duplicates are kept and never deleted.
3. Scanner files with no patient name are read to identify the patient. They're uploaded only when the match is certain and held otherwise.
4. A report is matched to a chart by the date the diagnostics were run plus the pet's name, checked against that day's patients.
5. The DaySmart API can't accept attachments. Instead the LIS emails the PDF to the client and copies DaySmart's chart-logging address, so the chart is logged at the client level in the same send.

Chapter 3: The AI Microscopy Analyzers (Ballou Scientific Instruments)

The Problem

Reading fecal floats, urine sediment and cytology by eye takes skilled staff time, and results depend on who's at the scope. Commercial AI analyzers are expensive and lock you into one vendor. The goal was cheap microscopes plus AI that reads the images and sends results straight into the LIS.

The Backstory

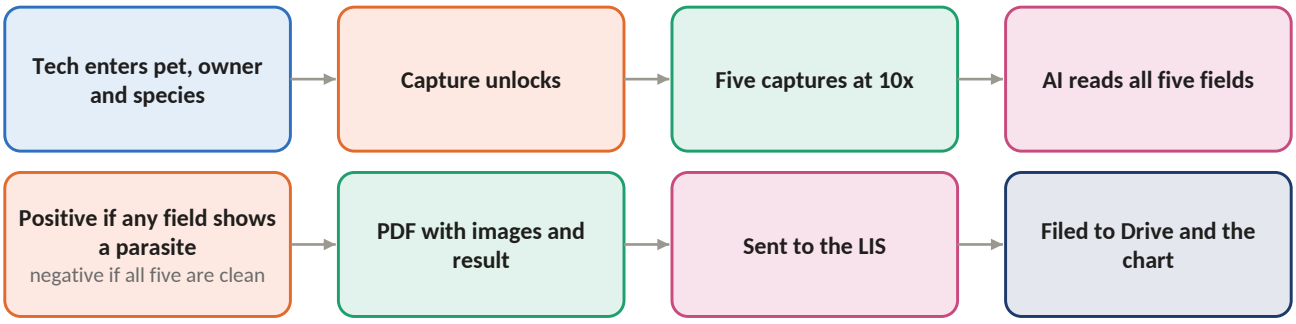
VetHistoPath came first, after the earlier cytopathAI and BPV PathAI Reader experiments, and set the pattern: microscope image in, structured AI report out. The fecal and urine apps copy that pattern for the tests BPVH runs every day. Hardware went through several rounds. The openUC2 Wi-Fi scope was tried first, then USB cameras the app couldn't detect, before settling on the Andonstar. The reason for moving to local YOLOv8 is cost and reliability: no API fee per test and no internet needed.

The Family of Apps

App	What it reads	Status
VetHistoPath	Histopathology slides, multi-species, stain-aware	Built and rebuilt. Came after the earlier cytopathAI and BPV PathAI Reader.
BSI Fecal Analyzer	Parasite ova, canine and feline	Installed and working end to end
Urine Sediment Analyzer	Sediment microscopy, canine and feline (no dipstick reading)	Built. A YOLOv8 cell counter is being added.
FaceLake FL401	Urine dipstick chemistry over Bluetooth	Hardware; results go to the same patient in the LIS
Blood differential and ear/skin cytology	Planned classifiers	Ideas, fed by the OpenFlexure scope (see Part Two)

How a Fecal Test Runs

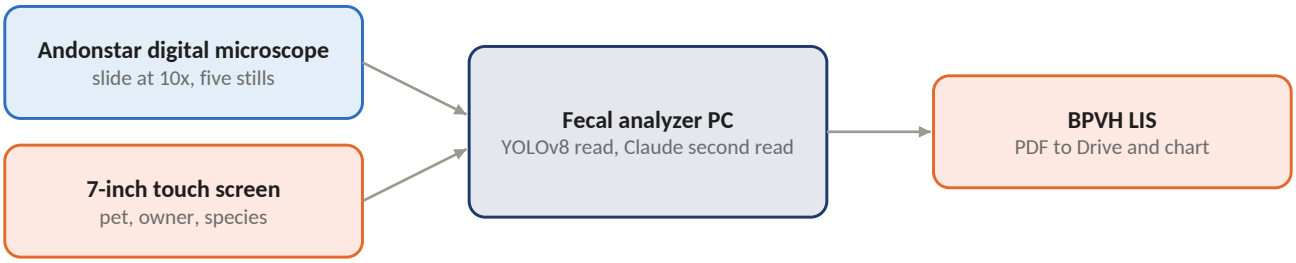
Five fields read, one result filed



How They're Built

1. **Software.** Each is a Windows desktop app: a pywebview window over a Python backend, packaged with PyInstaller and shipped as a normal double-click Setup installer.
2. **The AI.** It started with the Claude API reading every image. The direction now is a local YOLOv8 model as the main classifier for both fecal and urine, trained on the desktop PC's own GPU. Claude stays as an optional second read for unclear cases, so routine tests don't need internet or cost per test. The urine model starts from the GIKI "Urine sediment Yolov8" Roboflow dataset (CC BY 4.0), and every capture is saved as future training data.
3. **Hardware.** Each app has its own PC, separate from the LIS. The fecal scope is now an Andonstar AD246S/249S digital microscope. The earlier openUC2 Wi-Fi scope and USB cameras were swapped out. There's a 7-inch touch screen for touch-only use, and an enclosure is planned so it looks like a real lab analyzer.
4. **Known limit.** Capture is at 10x for speed. Very small organisms such as Giardia and Cryptosporidium may be missed, so a negative doesn't rule those out.

Slide under the scope, tap the screen, result lands in the LIS



The scope, touch screen and PC are one station, which will eventually share a lab-analyzer-style case. The only thing that leaves the station is the finished PDF, sent to the LIS.

VetHistoPath Details

VetHistoPath is a React app branded for Ballou Scientific Instruments. It shrinks each image to 1024 px and sends it to Claude, which returns a structured pathology report. There are standalone HTML and Raspberry Pi versions, plus a Pi kiosk with a Flask backend that handles the Claude calls.

Chapter 4: The CBCT Scanner and Its Reconstruction Software

The Problem

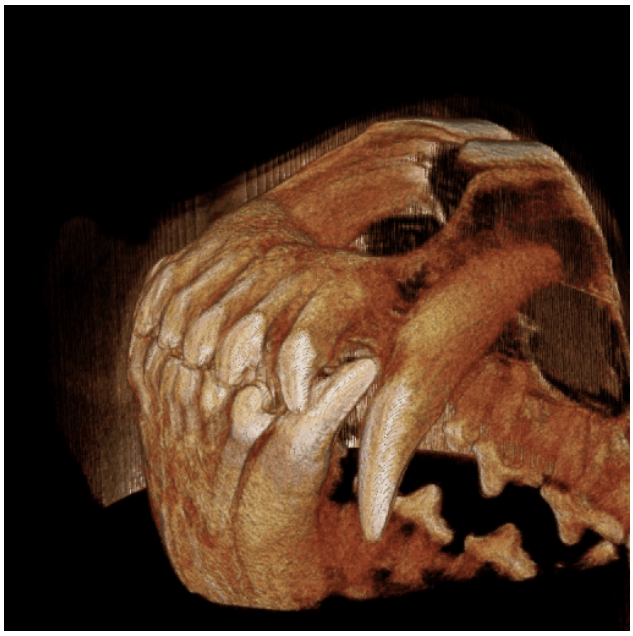
A new veterinary CT costs far more than a two-clinic practice can justify. A used human dental cone beam CT is cheap, but its software only shows the scans the way a dentist would, and it was never meant for animals. That left two problems: getting animals into the machine, and seeing the 3D data properly.

The Backstory

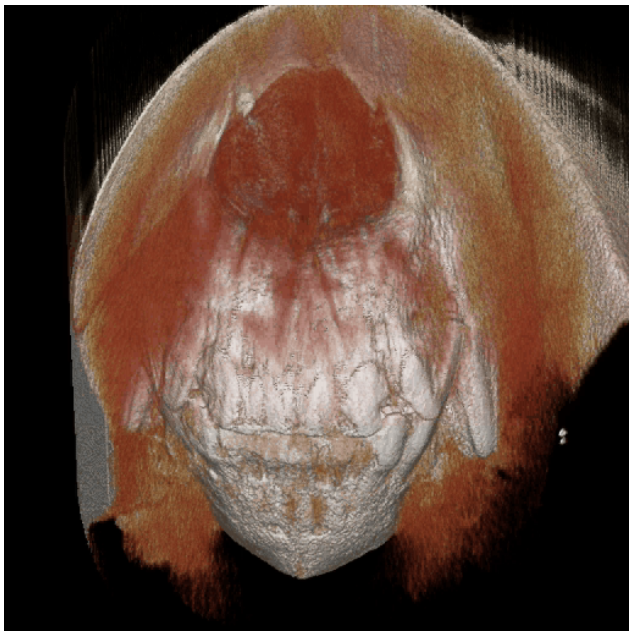
Dr. Ballou looked at new and refurbished veterinary units from NewTom (through Patterson), PrizMed, Probo Medical and Block Imaging before taking the repurposed-dental route. The viewer went through four versions: a basic slice viewer, a branded version, a parser fix after real scans failed to load, and the full 3D suite.

CBCT Scan Examples

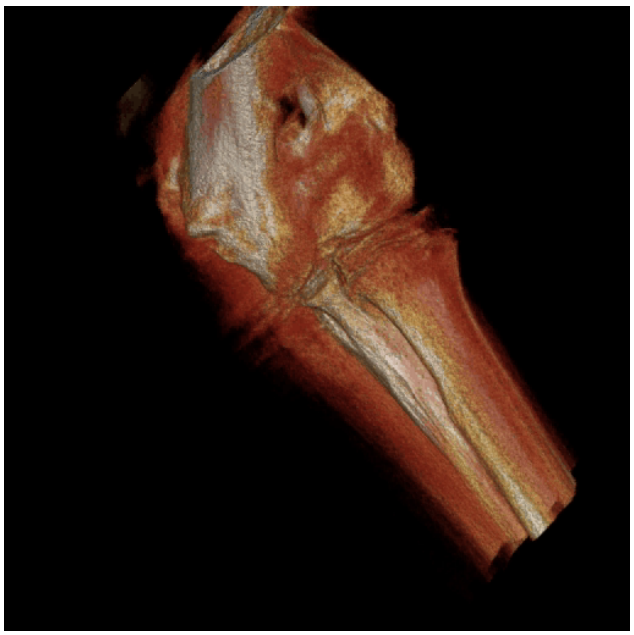
3D volume renders from the i-CAT 17-19 at Bloomfield Pointe Veterinary Hospital



Feline skull, lateral view · 3D volume render



Feline skull, frontal view · soft tissue overlay



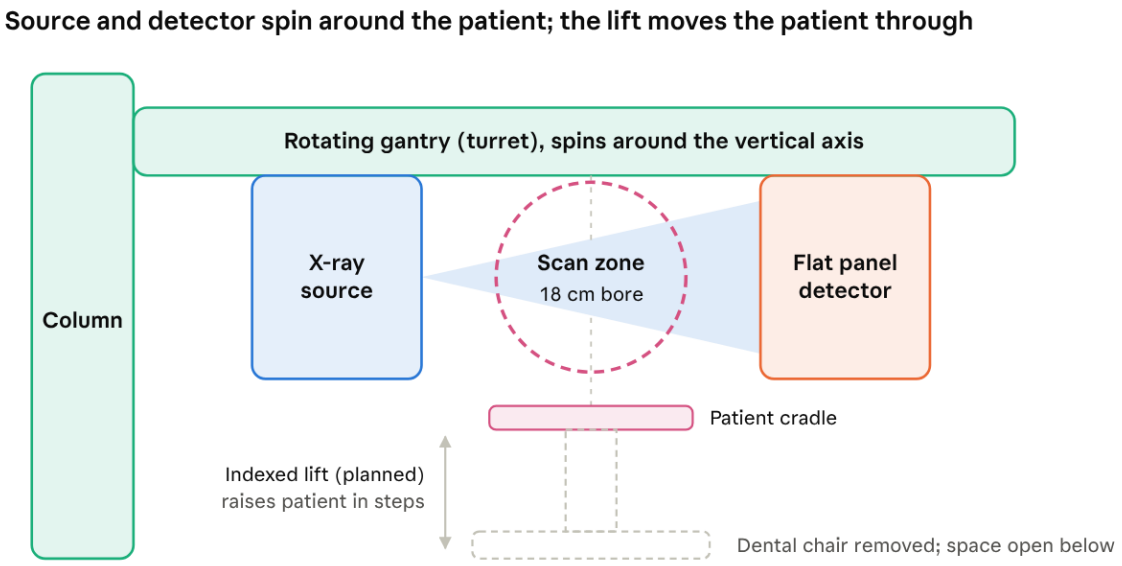
Canine limb joint · bone and soft tissue visible

All scans taken at BPVH on the repurposed i-CAT 17-19 and rendered with the custom BPVH CBCT Viewer.

The Hardware

BPVH's scanner is a repurposed Imaging Sciences International i-CAT 17-19, a human dental CBCT. The patient chair has been removed to open up space under the gantry. Trying to rotate the whole gantry 90° for horizontal patients failed, because the rotor stalls partway around, most likely from gravitational torque imbalance. The plan instead is a vertical indexed lift that raises or lowers the patient through the fixed rotation center in steps, so one scan can be stacked on the next for whole-body imaging.

Spec	Value
Turret bore	18 cm diameter, the hard limit on patient girth
Field of view per scan	About 16–17 cm wide by 13–19 cm tall
DICOM output	Implicit VR Little Endian, 536 × 536 pixels, 300–600 slices per series
Best fit	Cats, small dogs, and heads and limbs of larger dogs

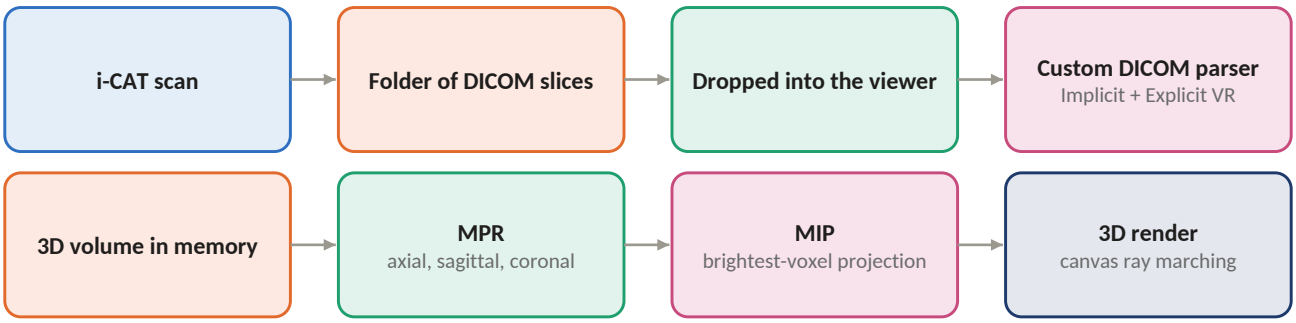


i-CAT 17-19, side view, not to scale. The source and detector hang from the turret and circle the patient. Each scan covers one slab of the body, and the planned lift raises the patient one slab at a time so the scans can be stacked.

The Reconstruction Software: BPVH CBCT Viewer

The viewer is a browser-based React app with BPVH branding and the whale logo. It loads the i-CAT's raw slice stack and rebuilds it into views the scanner's own software doesn't give you.

From scanner to 3D in the browser



1. **Parser.** The first version couldn't read the real scans because the i-CAT writes Implicit VR Little Endian. The parser was rewritten to detect the transfer syntax and read both formats. It also skips empty air slices at the edges.
2. **MPR view.** A 2 × 2 grid shows axial, sagittal and coronal planes at once with linked sliders. This is the main diagnostic view.
3. **MIP view.** A maximum intensity projection along any axis, good for bone and vessels.
4. **3D volume render.** WebGL failed silently in testing, so the renderer uses plain canvas 2D ray marching with trilinear interpolation and front-to-back compositing. You drag to rotate it.
5. **Soft tissue tools.** Window and level presets (Soft Tissue, Liver/Spleen, Lung, Bone, Brain, Vascular, Abdomen, Cardiac, Dental/CBCT) plus soft tissue boost and bone suppression sliders pull out detail that dental CBCT normally buries.

Using it: export the series from the i-CAT, open the viewer and drop every DICOM file from the folder in at once. Loading takes 10–30 seconds depending on the computer.

Still open: the lift and positioning system for whole-body scans isn't built yet. Bore and patient size limits still need to be confirmed.

Chapter 5: The SOAP Note Builder

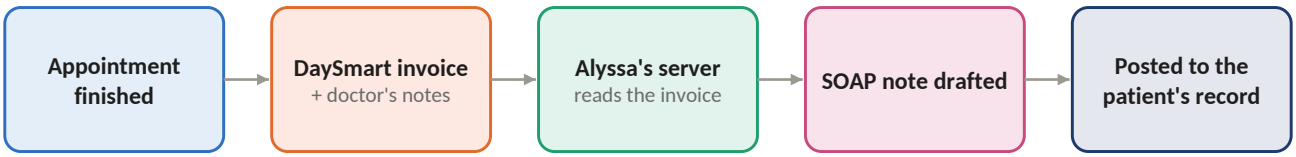
The Problem

Writing up charts after every appointment eats hours. The first idea was an ambient scribe that listens in the exam room. It meant mics, start/stop buttons and a PC in every room, plus the risk of recording conversation that has nothing to do with the exam.

What Was Built

As of November 2026, the SOAP note builder works from the DaySmart invoice instead of audio. The invoice already shows what was done (exam, vaccines, injections, labs), so a SOAP note is drafted from it. The doctor types the exceptions into DaySmart, such as injection route and any abnormal findings, and the note is built from both.

From invoice to chart



How It Works

1. It runs as a module inside Alyssa, because Alyssa already has DaySmart API access.
2. Each note is posted to the patient's Communications record through the DaySmart API.
3. An earlier version delivered notes by email to the chart's logging address. The API replaced it.

The ambient scribe (a mini PC and touchscreen TV per room, an ESP32 lit button to start and stop recording, patient picked from the checked-in list) is still an idea. It's covered in Part Two.

Chapter 6: Anesthesia Monitor Integration

The Problem

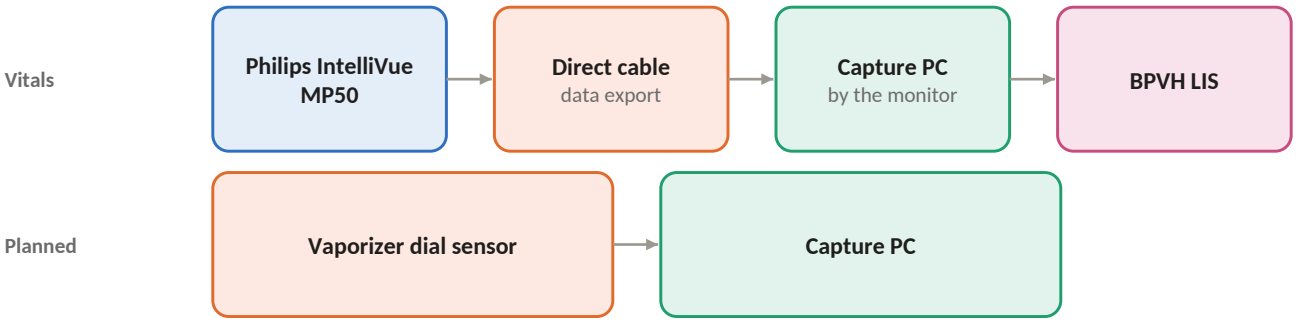
The old monitor, a CMS8000 VET (a rebranded Contec CMS8000), was the subject of a January 2025 CISA/FDA advisory about a backdoor and a remote code execution flaw. The vendor's fix simply removed networking. It can't be put on the clinic network safely, and other low-cost monitors come from the same unaudited supply chain.

What Was Built

A used Philips IntelliVue MP50 human hospital monitor with a Nellcor SpO2 module. It sends vitals over a direct Ethernet cable to a small Windows capture PC next to it. The monitor never touches the practice network.

Before choosing the MP50, Dr. Ballou looked at the Bionet BM3Vet Elite and at DIY builds from OEM modules and a SparkFun AD8232 ECG board. A used hospital monitor gave audited, well-documented hardware for about a tenth of the price.

The monitor stays off the clinic network



Status

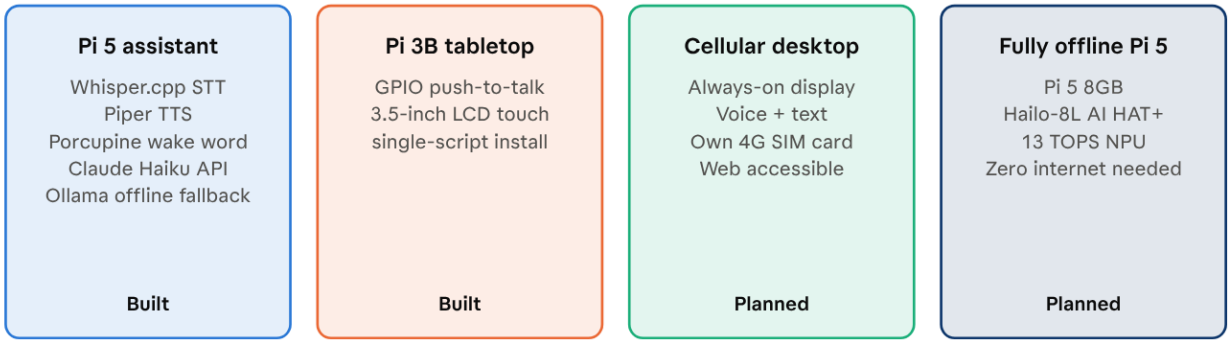
1. The MP50 has no RS232 board, so it uses LAN data export instead.
2. As of October 2026 the monitor and the capture PC are talking over their direct link.
3. Planned: an angle sensor on the MDS Matrx VIP isoflurane vaporizer dial (0–5), zeroed to the dial's off position, so the anesthetic setting is logged next to the vitals and sent to the LIS.

Part Two: Prototypes, Unfinished Builds and Ideas

These projects were started, designed or thought through but aren't in daily use. Each entry gives the problem, the plan and how far it got.

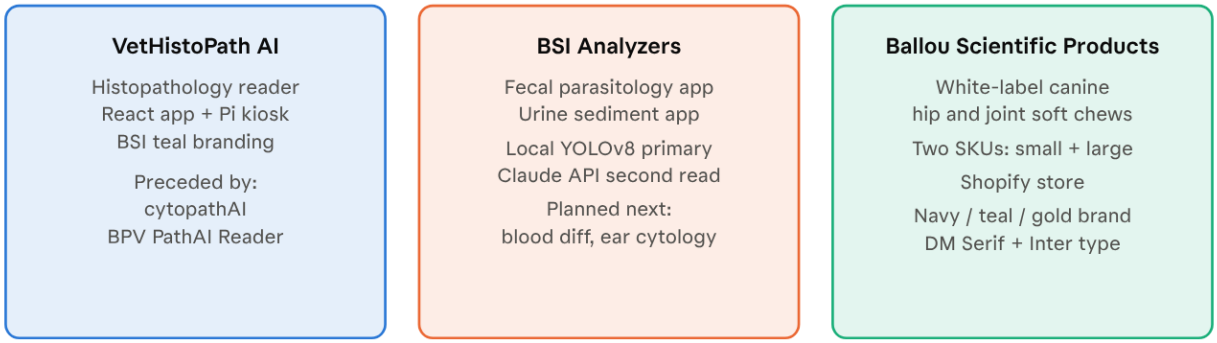
Project	Problem it solves	Plan	Where it stands
In-house payroll program	Paying an outside payroll service	Withholds federal, Michigan and Pontiac taxes and files with the agencies automatically	Scoped
Ambient exam-room scribe	Charting time	Mini PC + touchscreen TV per room, ESP32 lit button to start/stop, pick the patient from the checked-in list	Replaced for now by the invoice-based SOAP builder
Whole-body CBCT lift	i-CAT built for seated humans	Vertical indexed lift through the 18 cm bore, scans stacked	Design stage
Blood differential and ear/skin cytology AI	Manual slide reads	Classifiers fed by the OpenFlexure automated slide-scanning microscope on its own PC	Microscope assembled Oct 2026
Hemofiltration circuit	Kidney and toxin cases with no dialysis nearby	Extracorporeal blood filtration built in-house, simpler than full hemodialysis	Idea
Wearable CFPD device	Continuous flow peritoneal dialysis for a large dog	Medcomp Curl-Cath, Kamoer FX-STP2 peristaltic pump, Talentcell batteries for 20–24 hours	Designed
Surgical video library	Capturing "the way I do things" for training	Headcam + mic, Whisper transcription, searchable transcript index, React player with timestamp-linked playback	Architecture chosen
SK8800 CBC decoding	Locked analyzer with an unknown serial protocol	Try Xon/Xoff flow control, find which internal COM port feeds the DB9, or capture the DB25 printer port	A webcam reads the screen in the meantime
AquaSweep glass cleaner	Algae on 15 mm reef tank glass	Magnetic robot with a permanent magnet plus electromagnet boost and reverse polarity for pad swaps	Personal build, single panel first
Raspberry Pi voice assistants	Hands-free AI help	Pi 5 build (Whisper.cpp, Piper, Porcupine wake word, Claude Haiku, Ollama offline fallback); Pi 3B tabletop push-to-talk unit; planned cellular desktop unit and a fully offline Pi 5 + Hailo-8L build	Pi 5 and Pi 3B built; others planned
OcuClaw on Even Realities G2 glasses	Heads-up access to the AI agent	OpenClaw agent client on the glasses	Set up
Ballou Scientific Products	Side income	White-label canine supplements on Shopify	Started

Four builds, from fully online to fully offline



Four Raspberry Pi assistant builds. They range from cloud-connected to fully air-gapped. The offline build uses a Hailo neural processing unit so it doesn't need an internet connection at all.

Ballou Scientific: software, instruments and supplements



Ballou Scientific spans three lines: diagnostic software (VetHistoPath and its descendants), hardware analyzers (the fecal and urine apps, with blood differential and ear cytology planned), and consumer supplements sold through Shopify.

Appendix: What Each System Replaced

System	Replaced	Compared with buying
Alyssa	A commercial AI phone service and front-desk booking time	Pays only Retell and Twilio usage; no phone-service subscription
BPVH LIS	Retyping results and a commercial LIS	Built in-house; works with lower-cost open-reagent analyzers
Microscopy analyzers	Manual slide reads and commercial AI analyzers	Local YOLOv8 means no API fee per routine test; Claude only for second reads
CBCT	Buying a new veterinary CT	Repurposed used human dental unit
SOAP note builder	Hand-written charting	Runs inside Alyssa; no scribe subscription
Anesthesia monitor	The insecure CMS8000 VET	A used hospital monitor for about a tenth of the price of a new veterinary unit

Appendix: Lessons Learned

1. **Simple and stable beats clever.** Alyssa got more reliable once she stopped creating client profiles and just wrote notes.
2. **Check the firewall first.** A silent analyzer is usually a network rule, not a broken machine.
3. **Locked hardware costs more than it saves.** The SK8800 took weeks and still needs a webcam. Buy analyzers that export over Ethernet or Wi-Fi.
4. **Network security matters for medical devices.** Keep monitors off the clinic network unless they're audited.
5. **Logins drop.** Most outages traced back to a browser session that had logged out.
6. **Build around DaySmart's limits.** When the API can't do something, the browser or the chart-logging email can.