February 11, 2026

LANDSCAPE REPORT

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1. Title

Camera-Free Medication Adherence Verification System Using Multi-Sensor Dispensing and Ingestion Confirmation

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2. Summary of the Invention

The invention is a **privacy-first smart pill organizer** that goes beyond reminders by **verifying dose events** without cameras. It uses **multi-sensor fusion** (e.g., **weight/load cell**, **acoustic/vibration signatures**, **capacitance-based pill presence**, **motion/orientation**, and **open/close sensing**) plus **event-classification logic** to distinguish between states like: **opened → dispensed → removed → ingestion-likely**, while also flagging **tamper/anomaly patterns** (dumping, double dosing, forced access, "pocketing," inconsistent sensor combinations). Outputs include **confidence-scored adherence logs**, alerts, and optional caregiver/clinical sharing—designed to avoid camera intrusion and reduce false positives from "door opened" systems.

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3. Patent References

Here's a non-exhaustive prior-art list relevant to the **camera-free medication adherence verification via multi-sensor dispensing/ingestion inference** concept. This is only a high-level search, not a formal FTO or validity study. **Results are sorted from most relevant.**

Key Patent References

3.1 US9901515B2 – "Smart cap for medication container" – (Roberts)

Summary: Smart cap that measures **weight (load cell / strain gauge)** of medication units and transmits data; may include an **accelerometer** for position. ([Google Patents](https://patents.google.com/patent/US9901515B2/en))
Similarities: Weight-based dose inference; optional motion/orientation; adherence logging and alerts.
Differences: Primarily **cap-on-bottle** weight tracking (not a compartmented organizer with multi-sensor event timelines). Doesn't emphasize **acoustic + capacitance fusion** or a compartment-level **state machine** for ingestion-likely classification.
URL: https://patents.google.com/patent/US9901515B2/en

3.2 US9717654B2 – "Electronic pill box prefill system including a blister pack with a capacitive sensor" – (Dickie)

Summary: Electronic pill box using blister packs with **capacitive sensing** (sensing loops) to detect pill presence/removal. ([Google Patents](https://patents.google.com/patent/US9717654B2/en))
Similarities: Capacitance-based presence/removal detection; structured medication packaging; adherence monitoring.
Differences: Focuses on **blister-pack + capacitive loops** architecture; not centered on **weight + acoustic + IMU correlation** or ingestion-likely confidence scoring/tamper logic for dumping patterns.
URL: https://patents.google.com/patent/US9717654B2/en

3.3 US9311452B2 – "Electronic pill box and medication reminder and compliance system incorporating same" – (Dickie)

Summary: Electronic pill box with reminders/compliance features and system integration (including related family filings). ([Google Patents](https://patents.google.com/patent/US9311452B2/en))
Similarities: Medication compliance platform concept; logs/reminders; modular pillbox approaches.
Differences: Less focused on **sensor-fusion ingestion inference**; typically more in the realm of **reminder/compliance tracking** than "dispensed vs removed vs ingestion-likely" classification.
URL: https://patents.google.com/patent/US9311452B2/en

3.4 US20150048102A1 – "Electronic pill box and medication reminder and compliance system incorporating same" – (Dickie)

Summary: Publication version in the same family as US9311452B2. ([Google Patents](https://patents.google.com/patent/US9311452B2/en))
Similarities: Compliance + reminder system framing.
Differences: Publication-level disclosure; not strongly directed to **multi-sensor** ingestion-likely

inference (esp. acoustic/capacitance/weight correlation).
URL: https://patents.google.com/patent/US20150048102A1/en

3.5 US20160120758A1 – "Electronic pill box and medication reminder and compliance system incorporating same" – (Dickie)

Summary: Publication that explicitly describes pillbox embodiments with **capacitive sensing** approaches for pill detection. (Google Patents)
Similarities: Capacitive detection of pill presence/removal; compliance tracking.
Differences: Does not appear to push hard into **acoustic signature + weight delta + orientation** correlation to build an **ingestion-likely confidence score** with anomaly codes.
URL: https://patents.google.com/patent/US20160120758A1/en

3.6 US9603776B2 – "Smart pill box and medical compliance monitoring" – (Bunker)

Summary: Medication monitoring tied to a broader system (including proximity device / detecting patterns / notices / tamper alarms). (Google Patents)
Similarities: Pattern detection, alerts, and **tamper/movement** monitoring.
Differences: Emphasis is more on **proximity/pattern-of-activity** rather than compartment-level **multi-sensor dispensing and ingestion proxy** classification.
URL: https://patents.google.com/patent/US9603776B2/en

3.7 US9235690B2 – "Medication dispenser with integrated monitoring system" – (Bear)

Summary: Medication dispenser with monitoring; described as verifying loading/removal/remaining meds; includes abuse/diversion monitoring. (Google Patents)
Similarities: Compliance monitoring + diversion/abuse surveillance objectives (conceptually aligned with tamper/anomaly goals).
Differences: Heavier on "dispenser system" architecture; not specifically about **camera-free multi-sensor fusion** using **weight+acoustic+capacitance** as time-correlated signatures.
URL: https://patents.google.com/patent/US9235690B2/en

3.8 US7295890B2 – "Prescription drug compliance monitoring system" – (Richard)

Summary: Compliance monitoring system around medication-taking regimen. (PubChem)
Similarities: Compliance tracking frameworks, reminders/logging.
Differences: Older-generation compliance monitoring; not tailored to modern **sensor fusion** or ingestion-likely confidence scoring.
URL: https://pubchem.ncbi.nlm.nih.gov/patent/US-7295890-B2

3.9 US7844361B2 – "Prescription drug compliance monitoring system" – (Jean-Pierre)

Summary: Cap/base station compliance system (MediMonitor-type descriptions appear in the patent text). (Google Patents)
Similarities: Compliance monitoring, reminders, data transmission.
Differences: More "cap + base station" compliance; not designed around compartment-level sensing and correlated signatures (acoustic/weight/capacitance) to detect dumping or pocketing.
URL: https://patents.google.com/patent/US7844361B2/en

3.10 US6380858B1 – "Systems and methods for monitoring patient compliance …" – (Yarin)

Summary: Early compliance platform; includes "Smart Tray" concepts and sensors (including piezo elements described in embodiments). (Google Patents)
Similarities: Sensorized compliance monitoring, data sharing, system architecture.
Differences: Not focused on a **pill-organizer state machine** that distinguishes "opened vs dispensed vs removed vs ingestion-likely" with multi-sensor correlation and modern privacy-first feature design.
URL: https://patents.google.com/patent/US6380858B1/en

3.11 US8727180B2 – "Smart cap system" – (Zonana)

Summary: Medication compliance management cap that controls dispensing and records dispensing history. (Google Patents)
Similarities: Cap-based compliance management; dispensing history.
Differences: Not aimed at multi-sensor fusion (acoustic/capacitance/weight) to infer ingestion-likely and detect dumping behavior across compartments.
URL: https://patents.google.com/patent/US8727180B2/en

3.12 US11540974B2 – "Smart pill box" – (Wingate)

Summary: Smart pill box with compartments and sensing for movement/door events and possibly whether medication placed/removed. (Google Patents)
Similarities: Compartmented organizer + sensors for "opened/closed/moved" and medication interaction logging.
Differences: Your "white space" is pushing from generic sensing into **explicit multi-sensor ingestion proxies**: weight delta + acoustic impulse + capacitance delta + IMU pattern, plus anomaly codes and confidence scoring.
URL: https://patents.google.com/patent/US11540974B2/en

3.13 US9679113B2 – "Medication adherence monitoring system and method" – (Hanina)

Summary: Adherence monitoring system with "confirmation" framing and analytics/presentation features. ([PubChem](#))
Similarities: Focus on adherence confirmation and reporting.
Differences: Not specific to **camera-free compartment sensing** or to a defined multi-sensor signature timeline (open→tilt→acoustic→weight/capacitance changes).
URL: https://patents.google.com/patent/US9679113B2/en

3.14 US7782189B2 – "System to monitor the ingestion of medicines" – (Spoonhower)

Summary: Ingestion monitoring using digestible RFID tags attached to medication. ([Google Patents](#))
Similarities: Direct interest in "did ingestion occur?"
Differences: Requires **tagged ingestibles** (very different from your privacy-first external device inference). This is good "contrast art": you can position your system as **non-invasive, no ingestible sensors**.
URL: https://patents.google.com/patent/US7782189B2/en

3.15 US6510962B1 – "Programmable automatic pill dispenser" – (Lim)

Summary: Automated dispensing with voice coaching and caregiver alerts if user doesn't respond. ([Google Patents](#))
Similarities: Caregiver alerting, guided adherence support.
Differences: Typically relies on dispensing events and user response, not on multi-sensor evidence to distinguish "dispensed/removed/ingestion-likely" or detect dumping/pocketing.
URL: https://patents.google.com/patent/US6510962B1/en

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4. Commercial / Non-Patent Literature

(Non-patent items are sorted from most relevant to least relevant.)

4.1 AdhereTech (Aidia) – Smart pill bottle adherence system

Summary: Commercial smart pill bottle system focused on adherence reminders + monitoring and interventions. ([Adhere Tech](#))
Relevance: Represents mainstream "connected bottle" adherence tech; good comparator for your "organizer with ingestion-likely inference."
URL: https://adheretech.com/

4.2 AARDEX / MEMS® Cap – Smart pill bottle

Summary: Smart cap that records open/close timing and supports adherence monitoring programs. ([AARDEX Group](#))

Relevance: A "classic" adherence tech baseline (often time-stamp based) that your invention can improve upon via multi-sensor verification and anomaly detection.
URL: https://aardexgroup.com/smart-pill-bottle/

4.3 MedMinder – Smart pill dispenser platform

Summary: Commercial smart pill dispenser with connectivity, reminders, caregiver monitoring services. (MedMinder)
Relevance: Strong market proof; typically emphasizes dispensing/reminders and service layer—your differentiator is **sensor-fused verification + ingestion-likely confidence** without cameras.
URL: https://medminder.com/

4.4 Hero Health – Smart medication dispenser + app

Summary: End-to-end smart dispenser + app + support model. (Hero)
Relevance: Another mainstream reference point; helps frame your invention's unique "camera-free verification" angle.
URL: https://herohealth.com/

4.5 PillsyCap – Bluetooth cap (open/close sensing) – *(MobiHealthNews)*

Summary: Tracks adherence primarily by sensing cap open/close and syncing with an app. (MobiHealthNews)
Relevance: Highlights the known weakness you're solving: "cap opened" ≠ "dose taken."
URL: https://www.mobihealthnews.com/news/pillsy-launches-smart-pill-bottle-and-app-improve-medication-adherence

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4.6 "Key Features of Smart Medication Adherence Products (SMAPs)" – *(Faisal et al., 2023; PMC / JMIR Aging)*

Summary: Survey/review of SMAP capabilities: sensors, logging, reminders, usability, monitoring features. (PMC)
Relevance: Useful "background support" language for a patent spec's problem framing and why higher-confidence verification matters.
URLs:
https://pmc.ncbi.nlm.nih.gov/articles/PMC10762620/
https://aging.jmir.org/2023/1/e50990/

4.7 "Intelligent and privacy-preserving medication adherence system" – (ScienceDirect article)

Summary: Academic framing around privacy-preserving adherence systems (data privacy/security emphasis). (ScienceDirect)
Relevance: Supports your **privacy-first** positioning, especially around minimizing raw sensor data retention (e.g., audio features not raw audio).
URL: https://www.sciencedirect.com/science/article/abs/pii/S2352648318300473

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5. Summary & Analysis

What this landscape suggests

1. **Weight-based adherence exists** (notably in smart caps) and is well-trodden (e.g., load-cell + transmitted weight). (Google Patents)

2. **Capacitance-based pill presence/removal exists** (notably blister-pack sensing loop approaches). (Google Patents)

3. A lot of commercial products (and some patents) still sit in the "**opened / dispensed / reminder**" zone rather than proving ingestion—creating space for your **sensor-correlated event timeline** and **confidence scoring**. (MobiHealthNews)

4. "Ingestion confirmation" prior art often drifts into **invasive** approaches (e.g., ingestible tags) rather than privacy-first external inference—another point of differentiation. (Google Patents)

Where you can strengthen the invention for patentability

These are the areas that look most "claimable" and differentiating versus the above:

- **Time-correlated multi-sensor signature model**: explicitly claim a **sequence** (open → tilt/orientation → acoustic impulse window → weight delta → capacitance delta) with rules for "consistent vs inconsistent signatures."

- **Event taxonomy + state machine**: define clear states and transitions, plus what sensor evidence is required for each transition (e.g., "dose removed requires weight delta in range AND capacitance delta consistent with pill count").

- **Anomaly signatures and explainability**: define "dumping-like," "pocketing-like," "double-dose risk," "forced access," and attach **anomaly codes** to logs (not just a binary tamper flag).

- **Calibration workflow**: medication profile setup that captures baseline signatures per compartment/dose (and how you handle drift, refills, partial removal, and multi-pill dosing).

- **Privacy-by-design implementation details**: storing **derived features** rather than raw audio, on-device classification, encrypted signing of event logs, permissioning model. (This is both differentiating and helps with real-world adoption.)

- **Compartment-level architectures**: claims that cover (a) global base load cell + per-compartment capacitance, (b) zone-based load cells, (c) compartment-specific sensing, (d) cartridge modules with integrated electrodes/ID.

How This Relates to Your Concept

Your concept's strongest white space (based on this pass) is something that is specifically:

- **Camera-free "ingestion-likely" confidence scoring based on *multi-sensor correlation*** (weight + acoustic + capacitance + motion) rather than single-sensor inference or simple "opened" events; and

- **Tamper/anomaly detection that is grounded in contradictory sensor combinations and time signatures** (not just door-open frequency).

What I did not see in this pass is something that is specifically:

- A strong, claim-forward disclosure that **formalizes the multi-sensor event timeline** into a **compartment-level state machine** with **confidence scoring + anomaly codes**, where the device minimizes privacy exposure (e.g., audio features only) while still producing a "trustworthy" adherence record.