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Shutter-less Card Capture

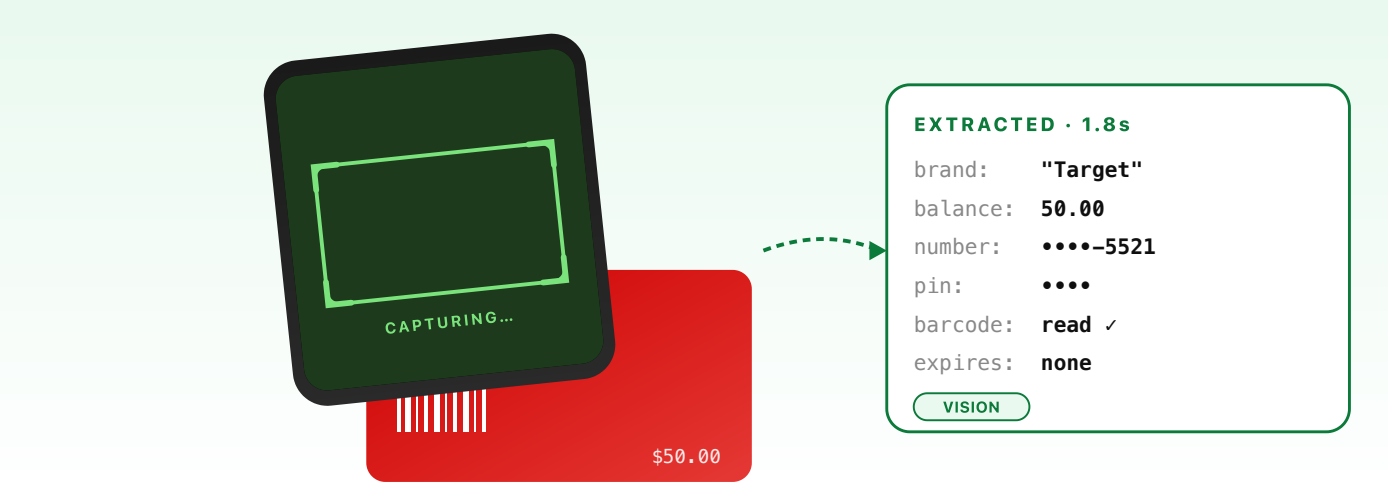
A press-kit deep-dive on CardCue Pro's scan-first "Add Card" flow: why tapping + opens the camera *before* you've decided what to do, how an Apple-Pay-style auto-fire scanner gets a card into your wallet in under three seconds, and the on-device-first / AI-fallback pipeline that makes it work without ever asking you to align a card inside a rectangle.

THE ONE-SENTENCE VERSION

Most wallet apps make you type. CardCue Pro opens the camera the instant you hit the plus button, auto-fires the shutter the moment it sees a readable card, and hands a prefilled form back to you, brand, balance, card number, PIN, barcode, expiration, and redemption item all extracted by an on-device Vision pass, with Claude as a cloud-optional fallback for the cards Vision can't crack.

~280 lines · auto-fire capture · Vision-first OCR · AI fallback · PIN-cover guard · flip prompt · biometric gating

Read the white paper → Source markdown ↓



Tap `+`, point at card, walk away with a filled-in record. No shutter, no alignment grid.

1. Why onboarding is the whole battle

Gift-card wallets have a notorious activation curve: users download them with enthusiasm, get to the "Add your first card" screen, realize they have to type a 16-digit card number, a PIN, a balance, an expiration date, pick a color, choose a category, and close the app. It is the single biggest reason these apps get uninstalled in the first five minutes.

CardCue Pro's bet: **the photo is enough, and even the photo shouldn't feel like a photo.** Tap `+`, point at the card, let the app decide when it's ready. No shutter tap. No alignment grid. No modal spinner. And for the growing share of cards that arrive as an email rather than a piece of plastic, a parallel first-touch: tap Share in Mail, pick CardCue Pro, done. Section 4 covers that second doorway.

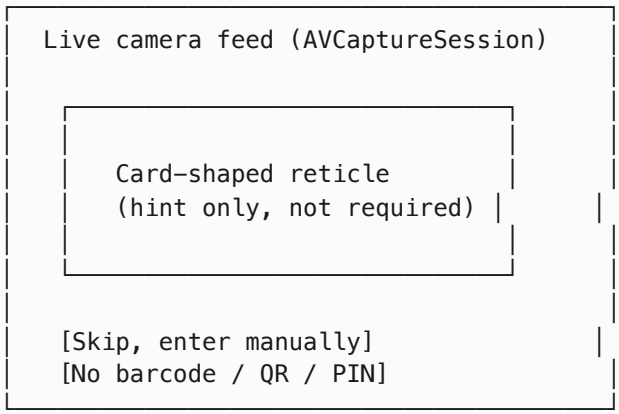
That bet required solving four problems at once:

1. Removing the shutter tap without sacrificing accuracy.
2. Extracting structured card data from one frame, fast.

3. Keeping sensitive data (card number + PIN) off any server by default.
4. Handling cards that lie about what they're carrying, the PIN is under a scratch-off you haven't removed yet, the barcode is on the other side, the balance is actually a free hamburger.

2. The shutter-less moment

The second you tap `+` in the wallet, CardCue Pro presents `AddCardLauncher`, which immediately presents `CardScannerView`. There is no sheet transition to a form first, the camera *is* the first UI. Modeled on Apple Pay's "Add Card" flow, with one crucial difference: we don't need the card to be aligned inside a rectangle.



Under the hood, an `AVCaptureVideoDataOutput` streams frames at full rate; a throttle drops us to ~5 fps of actual analysis. Each analyzed frame runs two reusable Vision requests in parallel:

- `VNDetectBarcodesRequest`, any symbology (Code 128, QR, PDF417, …)
- `VNRecognizeTextRequest`, fast-profile OCR, looking for a run of 10+ digits (card number or stamped ID)

Stable-frame detection confirms the same payload across 2–3 frames before firing. When it fires, `AVCapturePhotoOutput` takes a full-resolution still and hands it back up to `AddCardLauncher`.

Fallbacks, because physics is mean:

- If auto-fire hasn't triggered after ~4 seconds, a manual shutter button fades in. The user can still capture an ugly card.
- DEBUG/simulator builds have no camera feed, so the scanner swaps itself for a `UIImagePickerController.photoLibrary` picker, the same extraction pipeline runs on the chosen image.
- Two escape hatches are always visible: "**Skip, enter manually**" (go straight to a blank form) and "**No barcode / QR / PIN**" (the loyalty path, no extraction attempt, no prefill, user types the card number directly).

State that drives the auto-fire (last-analyzed timestamp, stable-frame counter, `hasFired` flag) is confined to the video capture queue with `dispatchPrecondition` guards, so a rapid double-capture race can't happen even if two frames detect simultaneously. High-frequency delegate callbacks run inside an `autoreleasepool` to keep buffer memory flat under load.

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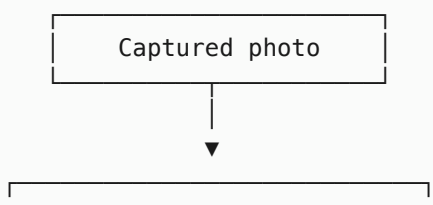
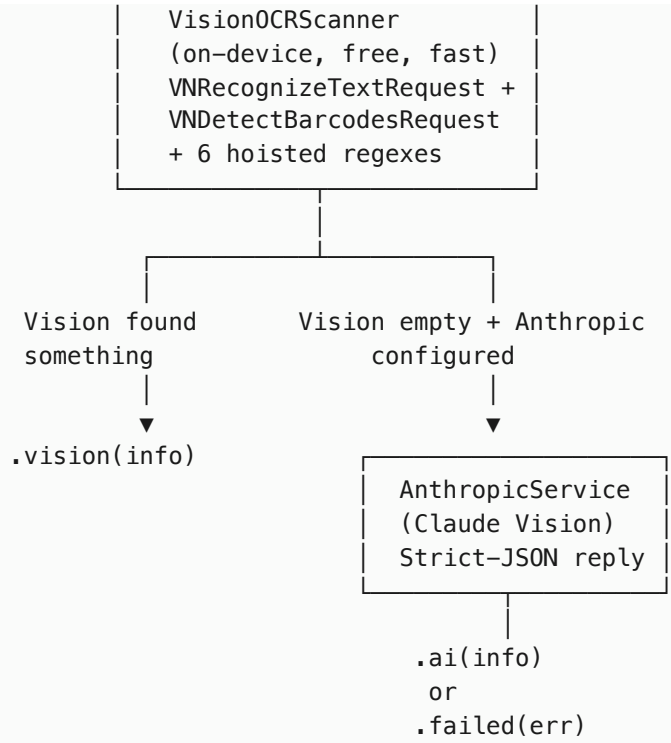
3. The extraction pipeline: Vision first, Claude on standby

Once a photo is captured, it flows through `CardScanService.shared.scan(image:)`:





Engine A: Vision OCR (primary, on-device)

`VisionOCRScanner` runs `VNRecognizeTextRequest` against the still image and pipes the recognized lines through six statically-compiled regexes (hoisted to `static let` so they don't recompile per scan):

- `$NN.NN` balance detection
- Expiration dates (`MM/YY`, `MM/YYYY`, `MM/DD/YYYY`, `exp: …`)
- Card number runs (`\b\d{10,19}\b`)
- PIN lines (`PIN: ####`)
- Balance-check URL / phone
- Redemption phrases (`present this card for …`, `redeem for …`, `good for …`)

It also looks for PIN-related cues without a PIN value ("scratch to reveal," "redemption code under coating," "silver panel") and sets a `pinLikelyCovered` flag, section 5 explains what that triggers.

Vision is the primary engine, not the fallback. For the vast majority of gift cards, a readable brand, a printed balance, a 16-digit number, a barcode. Vision's response is the one that populates the form. No network round-trip, no vendor involved, nothing leaves the phone.

Engine B: Claude Vision (cloud fallback, only when needed)

Claude is called **only when** Vision returns nothing usable *and* the Anthropic API key is configured *and* the user hasn't flipped the "Scan on-device only" privacy toggle. In other words: ornate or unusually-laid-out cards, hand-lettered certificates, or cards with promotional text Vision's regexes don't cover.

When Claude runs, it gets a strict-JSON prompt that enumerates every field CardCue Pro supports:

```
{
  "name": "Starbucks",
  "balance": 27.38,
  "cardNumber": "6011 2338 4401 9921",
  "pin": "4412",
  "barcode": "6011233844019921",
  "expiration": "2026-08-31",
  "balanceCheckURL": "starbucks.com/card",
  "balanceCheckPhone": "1-800-782-7282",
  "cannotBeDigitized": false,
  "digitizabilityReason": null,
  "redeemsFor": null,
  "pinLikelyCovered": null
}
```

Claude's advantage is context: it knows "Present this card at checkout" implies a physical-only restaurant coupon, "Good through 8/31/26" is an expiration, and the logo of a gold cup is a Starbucks card. Only the captured image is sent, no wallet context, no user identity, no device telemetry. The call goes under Anthropic's Zero Data Retention agreement for business customers.

The outcome type

Both engines produce the same `ScannedCardInfo` payload, wrapped in a `CardScanOutcome` so downstream code handles analytics and error copy uniformly:

```
enum CardScanOutcome {
    case vision(ScannedCardInfo)   // on-device hit
    case ai(ScannedCardInfo)       // Claude fallback hit
    case emptyNoAI                 // Vision empty, AI unavailable
    case failed(Error)             // Network or parse error
}
```

4. The second doorway: Share-from-Mail

Not every gift card starts on a piece of plastic. A growing share of them arrive as an email: an Amazon code from a relative, a Starbucks reload from a friend, a Nike promo, a corporate rewards certificate, a birthday e-gift. The camera is a dead end for those. There's nothing to point at.

So CardCue Pro ships a second intake path, built on the iOS 18+ Share Sheet. The user opens the gift-card email in Mail, taps Share, picks CardCue Pro from the app row. The Add Card form opens with the brand, card number, PIN, balance, and expiration already filled in. If a PDF or image was attached, it comes along. The user reviews, corrects anything the parser got wrong, hits Save.

Under the hood: a dedicated iOS Share Extension target receives the email text and any attachments, writes them into the shared App Group, and opens the main app via a `cardcue://intake` deep link. The form reads the pending payload on appear and pre-fills. The extension uses a regex-only parser, the same family of patterns the on-device Vision engine uses for printed cards. If the regexes miss a field, the user fills it in by hand, and the main app's AI scan path stays available as a separate, opt-in route. (The Privacy kit covers the extension's no-key, no-upload architecture in full.)

> One share, one tap to save. Two actions. A card from a Mail thread lands in the wallet inside the three seconds the doctrine budgets for intake, with no network call leaving the extension.

That's the first of the three moments the Right-Moment Doctrine has to clear, intake, cue, redemption, applied to a different starting point. The camera path clears intake because the shutter fires itself. The Share path clears it because the user never had to leave the email, never had to screenshot anything, never had to copy a code and paste it into a form. A share action and a save tap are all the motion the wallet asks for.

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5. The scratch-off guard

Gift cards commonly hide the redemption PIN under a silver scratch-off coating. If the scanner runs on a card whose PIN panel is intact, the card number may read clean but the PIN value will be empty, and the user will save the card, then get frustrated at the register when the code is unusable.

CardCue Pro catches this. Both engines flag `pinLikelyCovered = true` when they see words like *scratch*, *silver panel*, *redemption code below*, *reveal PIN* with no PIN value extracted. `AddCardLauncher` checks the flag on the first pass, if the card type is `.gift`, the scan shows coverage language, and the `pin` field is empty, the flow halts with:

> **Scratch off the PIN**
>
> This gift card's PIN is hidden under a silver scratch-off coating. Peel it off with a coin, then scan again so we can read the code.
>
> `[Scan again]` `[Enter manually]`

This check only runs for gift cards, loyalty and punch cards have no PIN expectation, so they never block here.

6. The smart flip prompt

A common pattern on modern gift cards: **card number on the front, barcode on the back.** Or vice versa. A single-sided scan gets half the data.

After the first scan, `AddCardLauncher` inspects the `ScannedCardInfo` and asks a targeted question only when exactly one side of the pair is missing:

First-pass found	Missing	Prompt shown
cardNumber only	barcode	"We got the card number. Flip the card so we can grab the barcode."
barcode only	cardNumber	"We got the barcode. Flip the card so we can grab the card number."
both	nothing	No prompt, straight to the form
neither	n/a	Straight to the form (user can retry or type)

When the user flips and captures the back, the second `ScannedCardInfo` merges into the first via `ScannedCardInfo.merged(with:)`: fields that live on the back (cardNumber, barcode) let the second pass win; everything else is first-pass wins. A skipped flip prompt routes to the form with whatever the first pass captured.

This is deliberately only prompted for **gift** cards. Loyalty/punch cards have a single identifier that lives on one face; prompting them to flip would be pointless.

7. Brand recognition and auto-styling

Once a name is extracted, `BrandRecognizer` consults a curated table of 200+ merchants with canonical display name, default category, default accent color, and logo asset. That's how a photo of a "Starbucks" card comes out of the scanner already categorized as Coffee, colored green, and showing the Starbucks card gradient without the user picking anything.

For unrecognized brands, a keyword-based category fallback tags cards as Food, Coffee, Grocery, Retail, Pharmacy, Restaurant, Travel, etc. based on words found in the card's text.

A note on the scan photo. The image captured by the scanner is used for data extraction, not display. The card face that shows up in the wallet is rendered from the curated design system (brand gradient + logo) so every card in the wallet visually belongs to the same product. The raw photos, if the user took any as personal references from within `CardEditView`, are stored separately from the scan extraction path; see §12.

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8. The biometric gate for secrets

Extracted card numbers and PINs never land in plain SwiftData. The moment `cardNumber` or `pin` comes back non-empty from the scanner, they're written to the iOS Keychain via `secureCardNumber` / `securePin` accessors. The SwiftData record stores empty strings in those fields and gets the `hasSecrets` gate.

Every UI surface that reads those values, `CardDetailView`'s "Reveal number" button, `CardEditView`'s PIN field, the "Show at Register" flow, wraps the read in an `LAContext` Face ID / Touch ID evaluation. The form shows masked placeholders (`•••• •••• •••• 9921`) until the user explicitly authenticates. Same UX as Apple Pay.

This is the design reason we stuck with scan-as-extraction even when dual-side capture is available: the biometric gate is a stronger safeguard than any amount of "don't display this data" logic, and it applies uniformly whether the data came from Vision, Claude, or manual entry.

9. Single-use reward certificates

The same pipeline extracts a new `redeemsFor` field for cards that trade in items rather than dollars, an In-N-Out "Award of Excellence," a Baskin-Robbins free-scoop coupon, a restaurant "free dessert" card. They carry a card number and PIN (so they trigger the biometric gate), but there's no balance, they redeem for a specific item like "FREE Hamburger or Cheeseburger."

Vision catches these via a cascade of regexes:

- `present this card for (?:one |a )?(.{5,70})`
- `redeem(?:able)? for (?:one |a )?(.{5,70})`
- `good for (?:one |a )?(.{5,70})`

Claude extracts them directly from the prompt schema. Whichever engine returns a hit also auto-flips `cannotBeDigitized = true`, these cards must be physically presented at the register, and the scanner telling the app that up front spares the user a wasted "Show at Register" attempt.

Downstream: the wallet row shows the redemption item instead of "$0.00," and `CardDetailView` swaps its balance hero for a "Redeems For" banner.

10. When the balance isn't on the card: the Check Balance flow

CardCue Pro has a firm rule: **we never invent a number that wasn't on the card.** A scanner that hallucinates your gift-card balance isn't saving you friction, it's lying to you. So the `balance` field is only populated when the amount is visibly printed on the card face (a sticker, a scratch-off, a promo tear-off). For the much more common case, a plastic card that just lists a website and a 1-800 number, the scanner sets up a helper instead.

Most gift cards print **two** ways to check your balance: a URL (`balance.starbucks.com`) and a toll-free phone number. Vision extracts both during the scan into `balanceCheckURL` and `balanceCheckPhone`. On the card detail screen, tapping **Check Balance** does three things at once:

1. **Copies the card number to the clipboard.** The most painful part of checking a balance is typing a 16-digit number into a phone keypad or web form. CardCue Pro skips that step, the number is already in your clipboard, ready to paste.
2. **Offers the two routes the issuer provides.** One tap opens the balance-check URL in Safari; another places the call to the toll-free number. Whichever path the user prefers, they're one tap away.
3. **Hands back to the card with the balance field focused and waiting.** When the user returns to CardCue Pro, the balance field is already open with the numeric keypad up. No menu hunt, no re-tap. The returned amount is saved in seconds.

This is the scanner's honest partner: rather than fake a number we can't see, we turn the five-minute phone tree into a thirty-second round trip. It's also the only path the app takes across the network for balance data, we never ping balance servers on behalf of the user.

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11. What the user actually sees

1. **Tap `+` in the wallet.** Camera opens immediately, no sheet transition, no type picker. The card-reticle hint is a soft rounded rectangle, not a hard align-me-here frame.

2. **Point at the card.** Somewhere in the next ~1.5 seconds, a subtle haptic tick fires and the shutter trips. No tap required.
3. **Spinner flash.** "Reading your card…" over black while the pipeline runs, usually under a second on device, 1–3 seconds when Claude is consulted.
4. **One of three branches:**
   - Scratch-off alert (if the PIN's hidden under silver).
   - Flip prompt (if the barcode or card number wants the other side).
   - Straight to `CardFormView`, prefilled.
5. **Form review.** Every field the pipeline extracted is populated. The user corrects anything off, hits Save.
6. **Biometric prompt** only if a card number or PIN was extracted.
7. **Card in wallet.** Auto-categorized, colored, participating in geofence monitoring and widget snapshots within seconds.

Median end-to-end, for a card that doesn't need a flip: **under five seconds from tapping `+` to a saved card**.

12. Rescanning an existing card

Life happens: you spend $12 on the card, the printed balance on the sticker changes, or you want to refresh the barcode photo. `CardEditView` has a dedicated "**Scan Card to Update Details**" row, a first-class action, visually separated from the optional front/back reference photos.

This separation is deliberate:

Feature	Purpose	Affects saved data?
Scan Card to Update Details	Re-run the full extraction pipeline	Yes, merges fresh values into the form

Feature	Purpose	Affects saved data?
Card Photos (Optional)	Personal reference images	Only saves the image, not extracted fields

Rescan reuses the same `CardScannerView` + `CardScanService` pipeline. On success, it merges authoritative fields the user typically wants refreshed (name, balance, card number, barcode) over the existing values, and only fills fields that are easy to mis-read partially (PIN, URL, phone, redemption item) when they're currently empty, a partial scan can't stomp a correctly-entered PIN.

The rescan action is gated to card types with scannable secrets (gift and cash cards). Loyalty and punch cards don't show the row because they have nothing to re-read.

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13. Accessibility

The scanner is fully VoiceOver-compatible. The overlay escape hatches are real buttons with clear labels. When the photo is processed, the prefilled form reads back every populated field, and a user who couldn't see the preview still gets a complete summary before being asked to confirm.

The shutter-less capture removes a specific accessibility friction: users with fine-motor impairments don't need to tap a small on-screen button while steadying a card. The camera takes its own shot when the frame is good.

Manual entry remains one tap away from every screen that offers a scan. We are **scanner-first, not scanner-only**.

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14. Failure modes we handle explicitly

- **No stable detection after ~4 s.** Manual shutter button fades in; user can force-capture a weirdly-lit or embossed card.
- **Captured frame has no extractable data.** Vision returns nothing; if Claude is configured, it takes a pass. If both come up empty, the user sees "Couldn't read that card, try again in better lighting" with a retry and a "Enter manually" bail.
- **PIN panel intact.** Scratch-off alert blocks the save (gift cards only).
- **One-sided capture.** Flip prompt for gift cards missing exactly one of cardNumber/barcode.
- **Camera permission denied.** Immediate alert with "Open Settings" and "Enter manually" escape.
- **Glare on the balance.** Field defaults to empty. We never hallucinate a balance.
- **Card number extracted but unconvincing.** Luhn checksum must validate. If not, the field stays empty.
- **Simulator/DEBUG builds.** No camera feed available, so the scanner swaps to photo-library picker automatically. Same pipeline, same outcomes.

Every failure mode is exercised by fixture images in `ScannerTests`.

15. Files of record

File	Role
`Views/Cards/AddCardLauncher.swift`	Orchestrator, scanner → pipeline → PIN-covered alert → flip prompt → form handoff
`Views/Cards/CardScannerView.swift`	Apple-Pay-style auto-fire camera with escape hatches and sim fallback
`Services/Services.swift`	`CardScanService`, `VisionOCRScanner`, `AnthropicService`, `ScannedCardInfo` (+ `merged(with:)`)

File	Role
`Services/BrandRecognizer.swift`	Brand → category + color + logo lookup
`Views/Cards/CardFormView.swift`	Scan-result apply, biometric gate on reveal, in-form rescan
`Views/Cards/CardEditView.swift`	Edit-mode rescan action, reference-photo section (separated)
`Models/Models.swift`	`GiftCard.hasSecrets`, `GiftCard.redeemsFor`, `GiftCard.isCertificate`, `GiftCard.cannotBeDigitized`

16. The product bet, restated

Onboarding isn't a chore to make shorter, it's the moment the app has to prove it's smarter than the user expected. CardCue Pro's scan-first architecture is designed so that the *first ten seconds* of using the app feel like the camera is reading the user's mind: they reached for the card, the app already had the camera up, and before they finished aiming, the card was saved.

If we get that right, the user adds a second card that day, and a third within a week. If we get it wrong, a type picker, a shutter tap, a "please align inside the rectangle", they never come back.

THE FIRST TIME

The first time a card comes out of a drawer, the camera is already up before the user has finished aiming, the type, the merchant, the balance, the PIN, and the expiration arrive in the form by themselves, and the card is saved in under thirty seconds, the scanner-first choreography stops reading as a spec. It starts feeling like the camera could read the user's mind, which is the only reason they come back to add a second card that afternoon.

Christian Sorensen, Founder · BigUnit Digital LLC
Read the founder's origin story →

CardCue Pro, by BigUnit Digital LLC. Scanner powered by Apple Vision (on-device, primary) with optional Claude Vision (Anthropic) fallback under Zero Data Retention. No card data leaves your device unless you opt into the cloud scanner, and even then only the captured image is sent, never your wallet, identity, or location.

A note on the writing. The thinking, the stories, and the product opinions are mine. I used AI to edit for grammar, tighten prose, and keep the voice consistent across the series. If a sentence lands cleanly, some of that credit goes to the machine. I figured you should know.

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