System architecture prototype, starting with readily available sensors (phone, smartwatch, ring) and building toward **rich, passive, real-time context inference and evidence capture**.

Below is a comprehensive **tiered sensor + datastream matrix**, organized by device tier, with ideas for how each stream contributes to **detection**, **context inference**, and **forensic reconstruction**.

TIER 1: Smartphone Alone (Baseline MVP)

Native Streams (No Extra Hardware)

Signal	Purpose	Detection Type	Forensic Use
Microphone (ambient audio)	Capture threats, slurred speech, violence, consent	Passive context	✅
Accelerometer / Gyroscope	Detect sudden impact, being dragged, orientation change, specific movement pattern while sedated	Fall/carry detection/inter-course while sedated	✅
GPS / Cell Tower Location	Movement, arrival/departure, security cam reference	Breadcrumb trail	✅
Bluetooth / Wi-Fi Proximity	Nearby known devices, continuity tracking	Who was nearby	🟡
Screen state / unlocks / power	Detect phone tampering	Tamper flag	✅
App usage / notifications	Social & behavioral state	Passive metadata	🟡
Touch patterns / lock screen attempts	Coercion signal	Biometric pressure	🟡

TIER 2: Add Smartwatch (e.g., Apple Watch, Fitbit)

Synchronized Physiological Streams

Signal	Purpose	Detection Type	Forensic Use
Heart Rate (HR)	Stress/sedation markers	Macro-sedation indicator	✅
Heart Rate Variability (HRV)	Loss of autonomic balance = sedation	Advanced marker	✅
Wrist Temperature	Drop = sedative effect	Contextual anomaly	🟡
Movement / Step count / Fall detection	Loss of movement or sudden slump	Key trigger	✅
Watch/phone link state	Separation = likely phone confiscation	Tamper detection	✅
Elevated HR + no movement	Fear/coercion marker	Tonic immobility	🟡

TIER 3: Add Oura Ring (or similar biometric ring)

Signal	Purpose	Detection Type	Forensic Use
Core body temperature	More accurate sedation signal than wrist	Drug effect signature	✅
Detailed HRV & respiration rate	Confirmatory sedation fingerprint	Model input	✅
Sleep staging / motionlessness	Unconsciousness vs. sleep	Contextual clarification	✅
Skin temperature + HR change sync	Shock/trauma physiology	Advanced trigger	✅

Adding Oura improves modeling of unconsciousness vs sleep vs sedation.

TIER 4: Add CGM (Glucose Monitor like Dexcom/*Or Dummy Stand In With Removal Detection*)

Signal	Purpose	Detection Type	Forensic Use
Glucose spikes/crashes	Sedation or unconsciousness event	Biochemical flag	✅
Delayed metabolic drift	Confirms drug response hours later	Forensic evidence	✅
Glucose + temp + HR composite	Unique physiological pattern	Templated model match	✅

*This helps capture the **metabolic shadow** of the event — crucial for DFSA inference. However, the presence of a non-glucose-functional dummy sticker, located under clothing, would likely deter when discovered during clothing removal in an unconscious or sedated state.*

ADDITIONAL (Experimental)

Stream	Source	Purpose
Camera snapshots (front/back)	Phone	Faces, environment, struggle
Speech pattern deviation	Phone mic	Detect consent confusion, slurring
Voiceprint recognition	ML layer on audio	Identify non-user speakers
Environmental audio classification	ML layer	Recognize bar, car, stairwell, etc.
Wearable chemical patch	Sweat/ISF	Lactate, pH, drug metabolite flags
Phone/ring watch re-orientation	3D vector change	Dragged, pushed, turned over
Bluetooth crowd fingerprinting	Passive scan	Estimate how many people were nearby
Barometric pressure	Phone	Infer indoors/outdoors/floor level

Fusion Modeling Potential

When these streams are **combined and time-aligned**, SentinelWear can infer with high probability:

Event	Streams Required
Loss of consciousness	HRV ↓, HR ↓, no movement, temp ↓, audio mute
Sedation onset	HRV ↓, EDA flat, glucose ↓, temp ↓
Non-consensual encounter (attempt)	HR ↑, no movement, ambient distress audio
Coercion	HR ↑, speech stress, wrist temp spike, app screen tampering
Tampering / removal	Phone-watch disconnect, sensor dropout
Presence at location where rape event is suspected of taking place	GPS + ambient audio
Device confiscation or struggle	Mic distortion + IMU spike + power/screen activity

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