

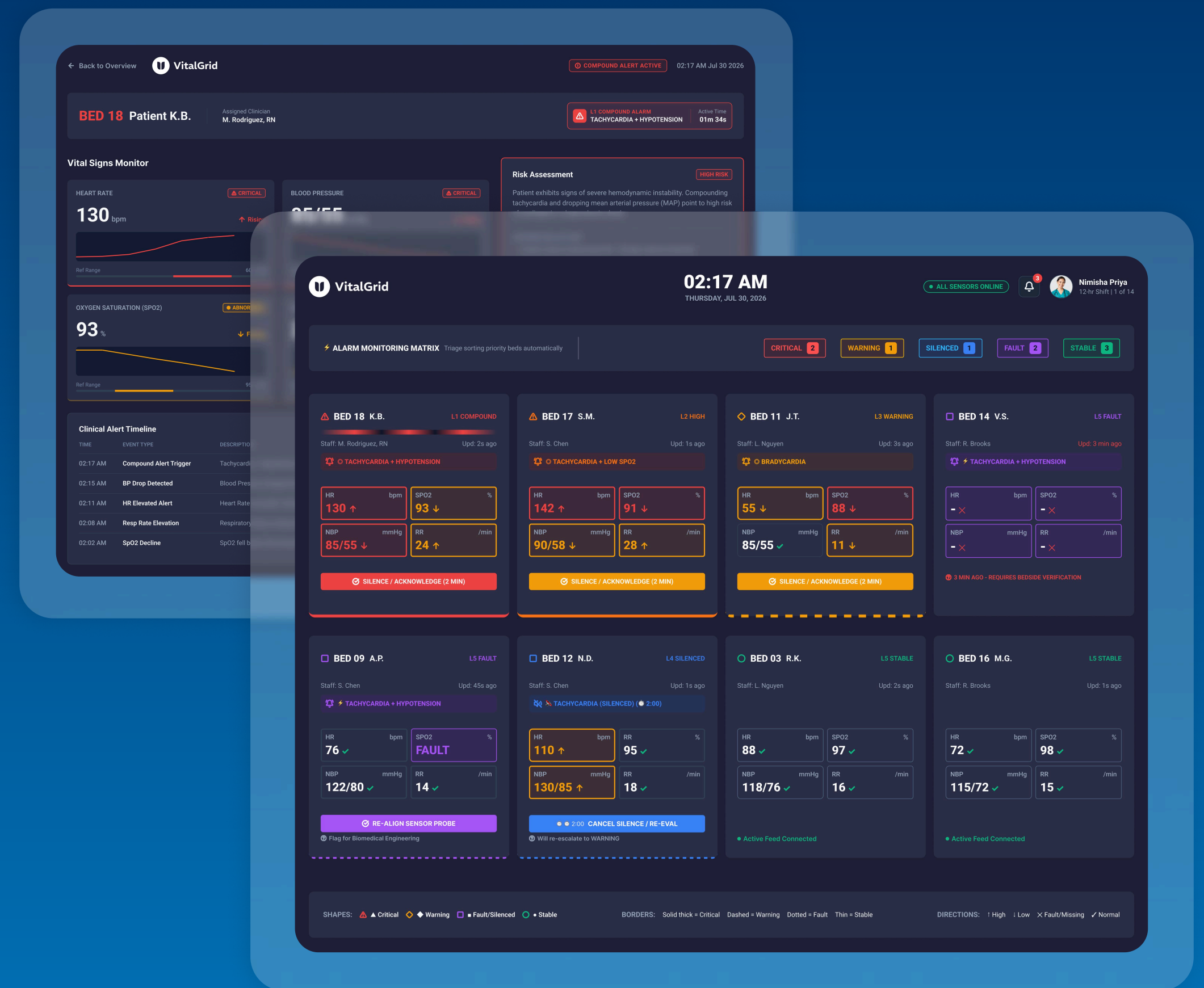


VitalGrid

VitalGrid

Critical Care Monitoring Interface

V- 1.0





Problem Statement

Standardizing the Clinical Workspace for Central ICU Monitoring Stations

ICU charge nurses at central monitoring stations are responsible for simultaneously overseeing **12–20 critically ill patients**, yet the current interface presents vital signs as an undifferentiated wall of numbers and alarms. With **85–99% of ICU alarms being non-actionable** (false or clinically insignificant), nurses experience severe **alarm fatigue** — a dangerous desensitization that causes true emergencies to be missed or delayed.

The core cognitive challenge is to redesign the Central Station Overview so a charge nurse can determine within **3 seconds** which patient needs immediate attention and why.

The User

ICU Charge Nurse

Responsible for safety, flow, and patient care standards across the unit. Oversees a panel of 12–20 high-acuity beds from a central desk while managing junior nursing staff.

SHIFT COMPOSITION

12-Hour Shift • Continuous Multitasking • High Interruption Frequency

Cost of a Miss

Patient Deterioration or Death

A delayed response to a genuine critical alarm can result in irreversible tissue damage, cardiac arrest, or death.

Alarm fatigue directly contributes to desensitized medical personnel, leading to a documented patient-safety crisis across modern ICUs worldwide.

Condition of Use

1. High-Stress Clinical Environment

No room for slow interpretation; decisions are measured in milliseconds.

2. High Viewing Distance

Monitors must remain legible and interpretable from up to 6 feet away.

3. Continuous Auditory Noise

Severe ambient hum and alarm chimes from neighboring equipment.

4. Cognitive Load

Processing multiple asynchronous waves and data streams simultaneously.

Design Goal

THE 3-SECOND TRIAGE PRINCIPLE

Which bed needs me first, and why?

Produce a single central station overview screen that lets a charge nurse scan 20 patient tiles and determine immediately who is in distress and what physiological factor is triggering the alert.

Clinical Scannability Triage Benchmark

Patient Deterioration or Death

COGNITIVE PATHWAY TRANSITION

✗ Current: Wall of Numbers (No Hierarchy)

✓ Redesign: Smart Priority Triage Map

CURRENT STAT OVERVIEW

High Alarm Fatigue



REDESIGNED HIERARCHY

<3 Second Scanning



Alarm Priority Hierarchy Model

How the system ranks beds when multiple alarm types coexist



Not all alarms are equal. The hierarchy separates physiological emergencies from technical faults and noise.

TIER	NAME	DESCRIPTION	EXAMPLE BED	VISUAL ENCODING
T1	CRITICAL: Compound Physiological Alarms	Two or more abnormal vitals indicating systemic deterioration.	Bed 18 - Tachycardia + Hypotension	  CRITICAL
T2	HIGH: Signal Lost / Total Disconnect	Complete loss of telemetry data - clinically ambiguous and dangerous.	Bed 14 - Lead disconnect, all vitals null	  DISCONNECT
T3	WARNING: Single Physiological Alarms	One vital sign outside normal parameters, clinically significant but isolated.	Bed 11 - Bradycardia (HR 55)	  WARNING
T4	ATTENTION: Silenced But Unresolved	Alarm acknowledged but the clinical condition persists.	Bed 12 - Tachycardia silenced, rate remains high	  ACKNOWLEDGED
T5	NOTICE: Sensor / Technical Faults	Equipment malfunction, not a physiological event.	Bed 09 - SpO2 sensor fault	  FAULT
T6	BASELINE: Stable / No Alarm	All vitals within normal parameters, good signal quality.	Bed 03 - Stable vitals	  STABLE

Key Rules

-  Staleness modifier: data older than 30s gets a warning; older than 2m triggers a "STALE" badge.
-  Compound detection: 2+ abnormal vitals promotes to Tier 1, even if each would be Tier 3 individually.
-  Auto-re-escalation: silenced alarms return to original priority after 2 minutes if the condition remains unresolved.



User Persona



Nimisha Priya

ICU CHARGE NURSE

AGE

38

ROLE

Night Lead

LOCATION

Whitefield



EXPERIENCE

12 years in critical care



SHIFT DURATION

12-Hour Night Shifts



RESPONSIBILITY

Monitors 12-20 ICU Beds



"When everything is an emergency, nothing is. I need the system to think with me, not scream at me."

PROFESSIONAL BIO

Sarah oversees the central monitoring station during her 12-hour night shifts. She manages a team of 4 bedside nurses and is the first escalation point for any patient deterioration. She's seen alarm fatigue cause near-misses and is deeply skeptical of systems that cry wolf.

ENVIRONMENT & CONTEXT



Central Console Overload

Central station with multiple monitors, viewed from a 6+ feet distance.



Auditory Chaos

Constant alarm soundscape and frequent bedside nurse/doctor phone call interruptions.



High Cognitive Friction

Must predict & juggle multiple patients' critical trajectories simultaneously.

GOALS & NEEDS



Instant Triaging Priorities

Immediately distinguish which patient is in critical danger vs needing standard care.



Signal over Noise

Differentiate actual emergency crises from sensor faults and non-actionable alarms.



Persistent Awareness

Maintain tracking of silenced alerts that remain unresolved so they are not forgotten.



Cognitive Unburdening

Reduce the mental load of interpreting raw sensor data during high-stress scenarios.

FRUSTRATIONS



85-99% Non-Actionable Alarms

Constant auditory pollution from sensor disconnects and redundant alert sequences.



Invisible Sensor Faults

No intuitive UI differentiation between actual cardiac events vs a loose lead.



Forgotten Silences

Silenced alarms disappear from focus entirely, letting active issues drift unmonitored.



Data Staleness Illusion

3-minute-old static data looks identical to a live stream, presenting grave clinical risks.



Flat Urgency Hierarchy

Every level of alert behaves as critically urgent, creating an exhausting crying-wolf dynamic.

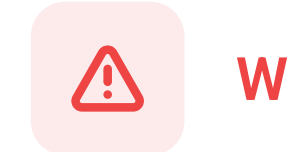


SWOT Analysis



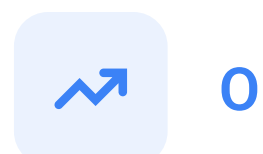
Strengths

- Displays all core vital signs for every bed
- Real-time data feed with sub-second updates
- Centralized view from one station
- Established nurse trust and familiarity
- Proven sensor hardware reliability



Weaknesses

- Alarm fatigue: 85-99% non-actionable alarms
- No priority hierarchy for alerts
- Cannot distinguish sensor faults from emergencies
- No data staleness indicators
- Silenced alarms vanish without follow-up
- Color-only differentiation (not accessible)
- Wall-of-numbers layout - poor scannability at 6+ feet distance



Opportunities

- Visual priority hierarchy for true emergencies
- Compound alarm detection for multi-parameter risk
- Staleness indicators for data trust
- Colorblind-safe, multi-modal alert encoding (shape, position, pattern)
- Smart silence workflow with auto-re-alert
- Glanceable card-based layout optimized for distance viewing
- AI-assisted alarm classification



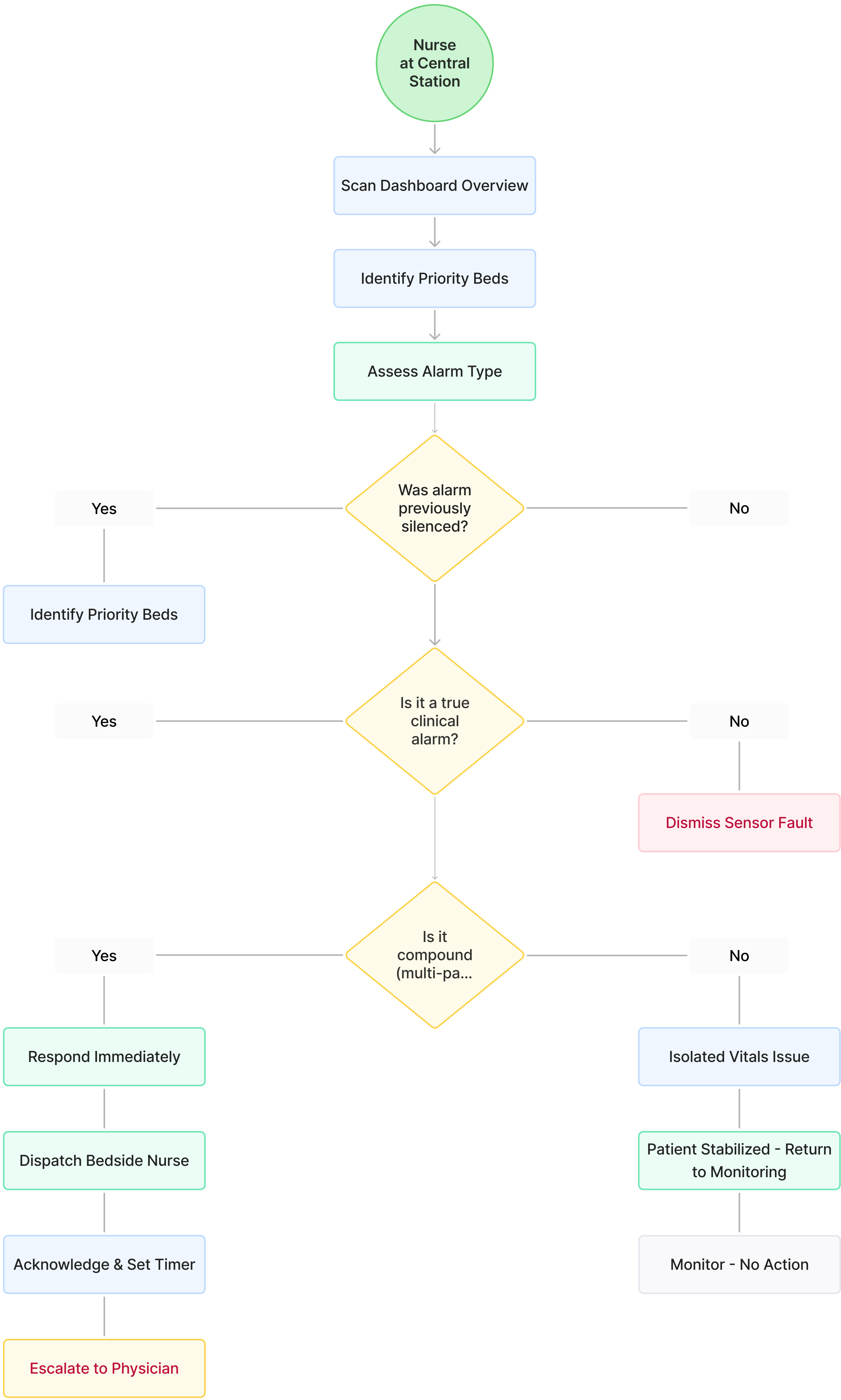
Threats

- FDA/IEC regulatory constraints on alarm changes
- Hospital EMR/EHR integration complexity
- Nurse resistance to workflow changes
- Liability risk if redesign causes missed alerts
- Hospital IT budget constraints
- Competing vendor lock-in



User Flow Diagram

Central Station Alarm Response Workflow - Clinical Decision Tree & Priority Escalation





User Journey Map

Clinical Telemetry Triage & Cognitive Flow Analysis // VitalGrid v2.0



Nimisha Priya

ICU CHARGE NURSE // NIGHT SHIFT

Age / Experience:

34 // 8 Years in Critical Care

Shift Pattern:

12-Hour Night Shift (19:00 - 07:00)

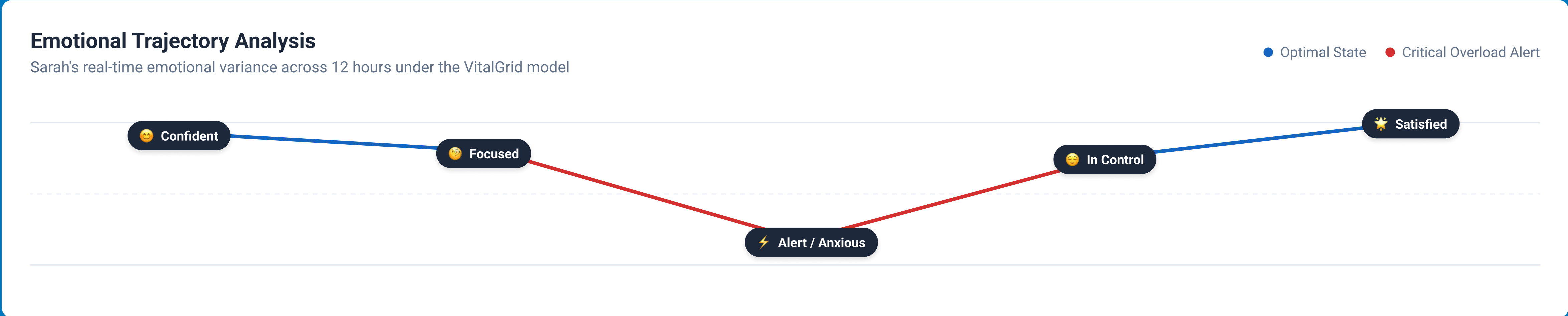
Responsibility:

Monitors 8 Active Critical Care ICU Beds

"When everything is flagged as an emergency, nothing is. I need a central telemetry console that thinks with me and triages cognitive overload, rather than just screaming at me."

Sarah's Core Operational Need

PHASE 1 // 19:00 Shift Handover	PHASE 2 // 19:30 Active Monitoring	PHASE 3 // 01:15 Critical Event	PHASE 4 // 01:45 Alarm Triage	PHASE 5 // 07:00 Shift Handover
ACTIONS • Reviews patient handover logs & charts. • Logs into VitalGrid central monitoring hub. • Reviews past 24-hr historical alarms.	ACTIONS • Scans severity-prioritized triage dashboard. • Validates sensor signal freshness feeds. • Flags Bed 09 technical SpO2 sensor fault.	ACTIONS • Triage alarm triggers on Bed 18 (Hypotension + Tachycardia). • Analyzes co-trending historical telemetry charts. • Dispatches nurse to bed for immediate response.	ACTIONS • Inputs audit triage reason codes into hub. • Silences stable Bed 12 monitor with 2-min countdown. • Reviews auto-re-escalation timers.	ACTIONS • Accesses automated shift alert analytics logs. • Hands over clear summary of critical alarms. • Successfully logs out of central panel.
THOUGHTS "Let me see what I'm walking into tonight. Hopefully telemetry didn't have false alarm spikes."	THOUGHTS "Nice. Stable beds are grouped cleanly so I can quickly identify patient risk priorities."	THOUGHTS "Two vital trends degrading at once. This is a legitimate deterioration, not sensor drift."	THOUGHTS "Perfect. The system holds me accountable to silenced alerts so patients are never forgotten."	THOUGHTS "No alarm fatigue tonight. Every notification was clinically validated and properly logged."
😊 Confident	🧐 Focused	⚡ Alert / Anxious	😌 In Control	🌟 Satisfied
PAIN POINT Old monitoring consoles reset history upon login, causing a complete lack of shift trend context.	PAIN POINT Standard setups sort rigidly by bed number, burying severely sick patients near the bottom.	PAIN POINT Severe alarm fatigue causes real cardiac and blood pressure emergencies to be tuned out.	PAIN POINT Silenced alarms frequently get completely forgotten without any automated safety re-alarm loop.	PAIN POINT Shift reports miss persistent alarms, losing critical longitudinal patient state details.
VITALGRID FIX Persistent user sessions display preceding shifts' telemetry alarms & trends seamlessly.	VITALGRID FIX Real-time physiological triage sorting floats unstable patients to high-visibility layout slots.	VITALGRID FIX Multi-parameter compound alarm correlation filters noise & suppresses single-vital errors.	VITALGRID FIX Mandatory reason codes + countdown alerts trigger immediate re-escalation if unresolved.	VITALGRID FIX Automated telemetry reporting logs patient alerts, creating audit handovers for incoming nurses.





Central Station Dashboard

02:17 AM

THURSDAY, JUL 30, 2026

ALL SENSORS ONLINE

3

Nimisha Priya
12-hr Shift | 1 of 14

⚡ ALARM MONITORING MATRIX

Triage sorting priority beds automatically

CRITICAL 2

WARNING 1

SILENCED 1

FAULT 2

STABLE 3

⚠️ BED 18 K.B.

L1 COMPOUND

Staff: M. Rodriguez, RN

Upd: 2s ago

🔔 TACHYCARDIA + HYPOTENSION

HR

bpm

130 ↑

SPO2

%

93 ↓

NBP

mmHg

85/55 ↓

RR

/min

24 ↑

🔕 SILENCE / ACKNOWLEDGE (2 MIN)

⚠️ BED 17 S.M.

L2 HIGH

Staff: S. Chen

Upd: 1s ago

🔔 TACHYCARDIA + LOW SPO2

HR

bpm

142 ↑

SPO2

%

91 ↓

NBP

mmHg

90/58 ↓

RR

/min

28 ↑

🔕 SILENCE / ACKNOWLEDGE (2 MIN)

⚠️ BED 11 J.T.

L3 WARNING

Staff: L. Nguyen

Upd: 3s ago

🔔 BRADYCARDIA

HR

bpm

55 ↓

SPO2

%

88 ↓

NBP

mmHg

85/55 ✓

RR

/min

11 ↓

🔕 SILENCE / ACKNOWLEDGE (2 MIN)

🚫 BED 14 V.S.

L5 FAULT

Staff: R. Brooks

Upd: 3 min ago

🔔 TACHYCARDIA + HYPOTENSION

HR

bpm

- ×

SPO2

%

- ×

NBP

mmHg

- ×

RR

/min

- ×

🕒 3 MIN AGO - REQUIRES BEDSIDE VERIFICATION

🚫 BED 09 A.P.

L5 FAULT

Staff: S. Chen

Upd: 45s ago

🔔 TACHYCARDIA + HYPOTENSION

HR

bpm

76 ✓

SPO2

%

FAULT

NBP

mmHg

122/80 ✓

RR

/min

14 ✓

🔧 RE-ALIGN SENSOR PROBE

🔔 Flag for Biomedical Engineering

🚫 BED 12 N.D.

L4 SILENCED

Staff: S. Chen

Upd: 1s ago

🔔 TACHYCARDIA (SILENCED) (🕒 2:00)

HR

bpm

110 ↑

RR

%

95 ✓

NBP

mmHg

130/85 ↑

RR

/min

18 ✓

🕒 2:00 CANCEL SILENCE / RE-EVAL

🔔 Will re-escalate to WARNING

🟢 BED 03 R.K.

L5 STABLE

Staff: L. Nguyen

Upd: 2s ago

Active Feed Connected

HR

bpm

88 ✓

SPO2

%

97 ✓

NBP

mmHg

118/76 ✓

RR

/min

16 ✓

🟢 BED 16 M.G.

L5 STABLE

Staff: R. Brooks

Upd: 1s ago

Active Feed Connected

HR

bpm

72 ✓

SPO2

%

98 ✓

NBP

mmHg

115/72 ✓

RR

/min

15 ✓

SHAPES: ⚠️ ▲ Critical ⚠️ ◆ Warning 🚫 ■ Fault/Silenced 🟢 • Stable

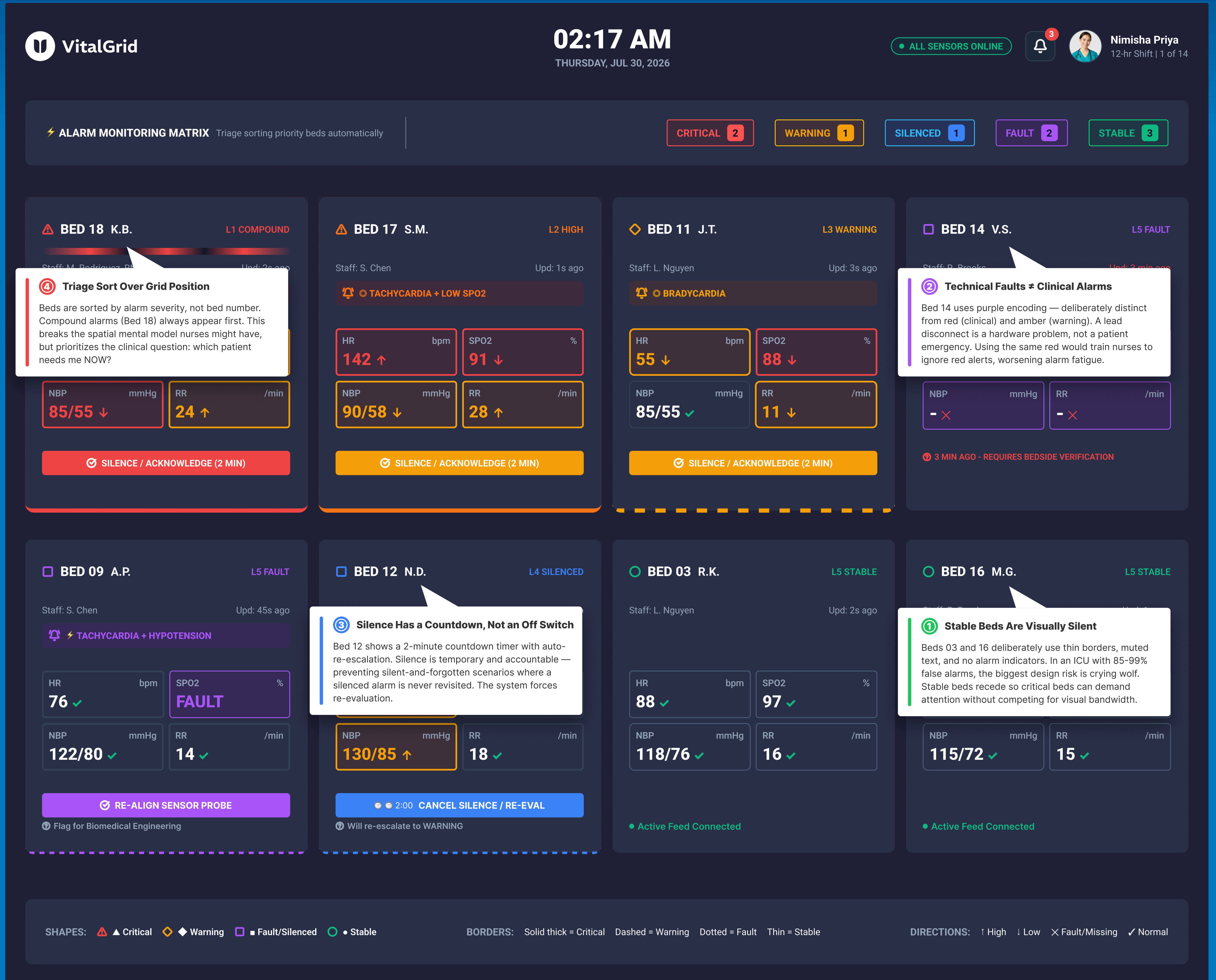
BORDERS: Solid thick = Critical Dashed = Warning Dotted = Fault Thin = Stable

DIRECTIONS: ↑ High ↓ Low × Fault/Missing ✓ Normal

V- 1.0



Annotations: 3-4 key decisions directly on the screen





VitalGrid

Thank you.