MAKEATHON 8

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Idea Title: PulseGuard: LLM-Driven Handoff Intelligence

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Track: Health, Care & Access

Problem Statement: Nurse Shift Handoff Disaster Prevention

A tired night nurse forgets to mention a blood thinner during handoff. The next nurse gives a routine medication. Two hours later internal bleeding.

This isn't a rare scenario. It happens because modern healthcare still relies on **spoken handoffs**, fragmented notes, and human memory at the most fatigue-prone moment of a nurse's shift.

Core Issues

- 80% of serious medical errors occur during handoffs
- Spoken conversations lose critical context
- Existing templates = rigid, incomplete
- Hospitals lack **temporal understanding across shifts**

The problem is NOT documentation
The problem is the loss of continuous clinical memory across shifts

Healthcare tools capture what nurses say but never analyze what they forget to say

Current Systems

- Transcribe speech
- Use checklists
- Store isolated notes

What They DON’T Do

- Track risk evolution
- Detect missing information
- Connect multiple shifts into one patient story

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Proposed Solution

PulseGuard: LLM-Driven Handoff Intelligence

- **Concept:** An AI system that listens to, understands, and reasons over unstructured clinical speech.
- **Beyond Transcription:** It doesn't just turn speech to text; it interprets clinical intent, identifies risks, and flags inconsistencies with explainable alerts

Pipeline:

1. Audio → Structured Clinical Summary
2. Cross-Shift Memory Graph
3. Negative Reasoning Engine
4. Risk Trajectory Timeline

Key outputs:

- Structured patient handoff
- Explainable risk alerts
- Visual risk evolution

Not a transcription tool but a Clinical Safety Brain

Innovation #1 – Cross-Shift Memory Graph

Most systems treat each shift as an isolated event

```
Shift A → Shift B → Shift C (isolated)
```

Knowledge Graph: We build a continuous patient knowledge graph that tracks medication starts/stops and symptom progression across multiple days.

- Medications started/stopped
- Symptoms progression
- Pending tests
- Vitals trends

Example: Detecting if an antibiotic discontinued two shifts ago is mistakenly mentioned again, preventing "zombie" prescriptions

Innovation #2 – "What Was NOT Said" Analyzer

- **Negative Reasoning:** This is our most unique feature. The LLM analyzes the *absence* of critical information

- **Contextual Awareness:** For a high-risk diabetic patient, if the nurse never mentions glucose levels, the system outputs: *"Potential Omission: Glucose monitoring not discussed"*

- **Safety Audit:** It ensures that standard protocols for specific conditions are actually verbally verified

Innovation #3 – Risk Trajectory Timeline

- **Visual Patient Risk Curve:** Moving beyond static alerts to a predictive timeline

- **Pattern Recognition:** The model predicts risk evolution by correlating oxygen drops, medication delays, and vitals across the last 3–5 shifts

This demonstrates advanced temporal reasoning, predicting *how* a patient is trending, not just *what* they are right now.

Technical Approach

Layered Architecture:
Speech-to-text (Whisper / Azure Speech)

LLM Reasoning:

- Entity extraction
- Temporal reasoning
- Negative reasoning prompts

Memory Layer:
Vector DB / Graph DB

Risk Engine:
Clinical rules + LLM explanation

User Experience – From Speech to Action

Input: Natural nurse speech (e.g., "Mr. Sharma, Bed 4A... gave Warfarin at 4 AM...")

Output: A structured dashboard showing:

- Action Items**:** (e.g., Check INR before next dose).
- High-Risk Flags**:** (e.g., "Blood pressure dropping + anticoagulant = possible internal bleed")

Clarity: The incoming nurse sees the "Risk Flag" immediately, ensuring nothing is missed during the rush of a shift change.

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Expected Impact

For Nurses
- Less cognitive load
- Structured summaries
- Clear action points

For Hospitals
- Compliance-ready documentation
- Reduced liability

For Patients
- Prevent medication interactions
- Early detection of hidden risks

Empowering nurses with AI to ensure information survives the handoff intact

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Thank You