THEME - 1. MULTIMODAL AI

CORTEX MD

DOCTOR'S DIAGNOSIS CO-PILOT

PROBLEM STATEMENT-AI MODELS IN HEALTHCARE OFTEN FUNCTION AS BLACK BOXES. MEDICAL PRACTITIONERS HESITATE TO TRUST AI PREDICTIONS WITHOUT CLEAR, VERIFIABLE REASONING.

PROBLEM STATEMENT

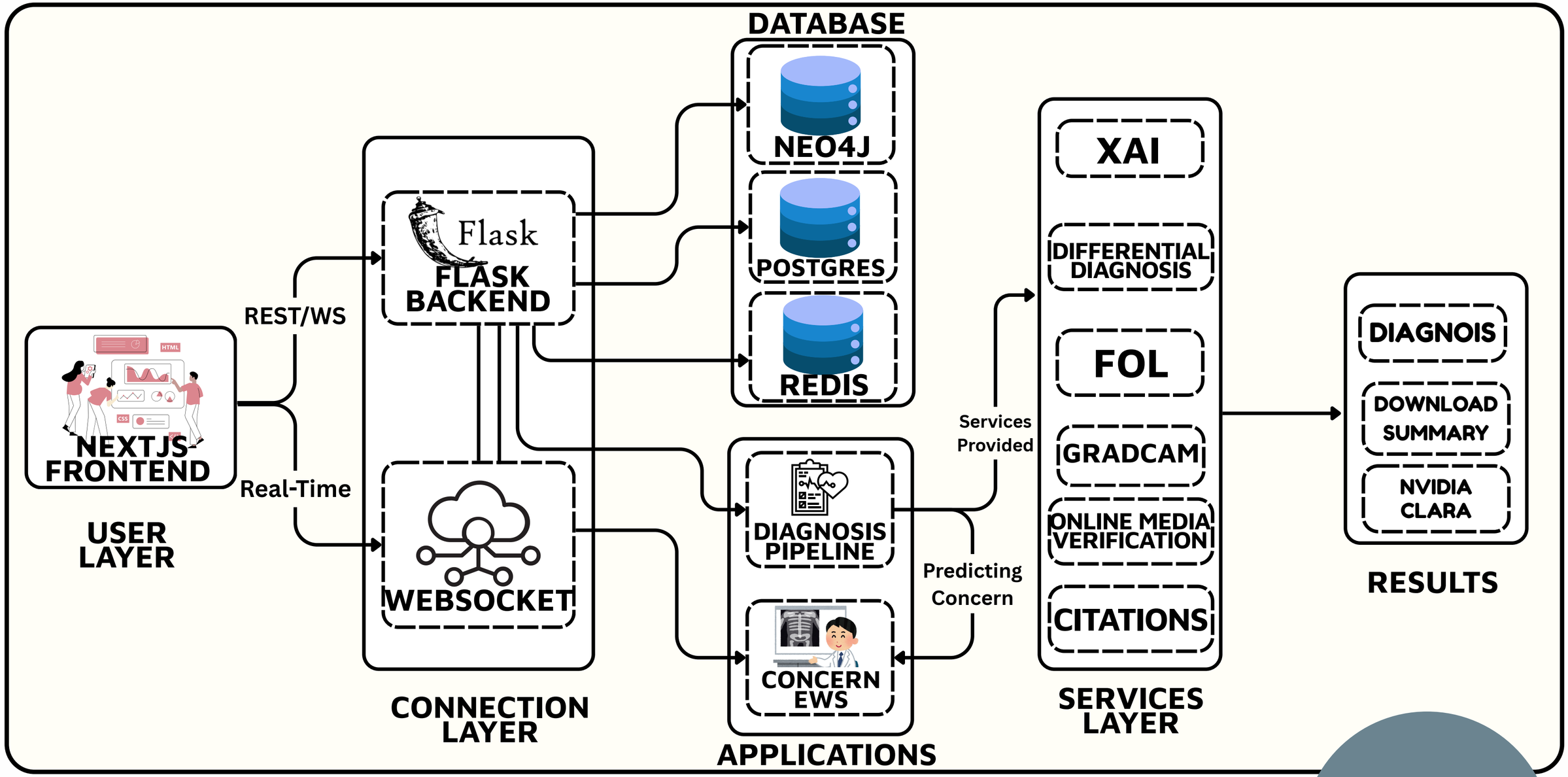
- **Life-and-Death Stakes**: Doctors can't trust AI diagnoses without knowing the reasoning, and patients deserve clear explanations.
- **No Structured Validation**: Most AI diagnosis methods lack a step to break explanations into verifiable, logic-based statements.
- **Opaque Inference**: Powerful models like ChatGPT, Gemini and others find patterns and produce conclusion but hide their decision-making process.
- **Hallucination Risk**: LLMs often generate convincing but false medical logic, which can mislead doctors.

SOLUTION

- **Diagnosis & Diverse Reasoning Paths:** Use MedGemma to generate a diagnosis, then employ a secondary LLM to produce multiple possible reasoning paths for that decision
- **FOL-Based Verification :** Convert XAI explanations by secondary LLMS into boolean logic statements and verify each against patient data & medical ontologies.
- **Confidence Scoring** : Present the diagnosis along with verified explanations and their confidence levels, enabling doctors to make informed decisions.

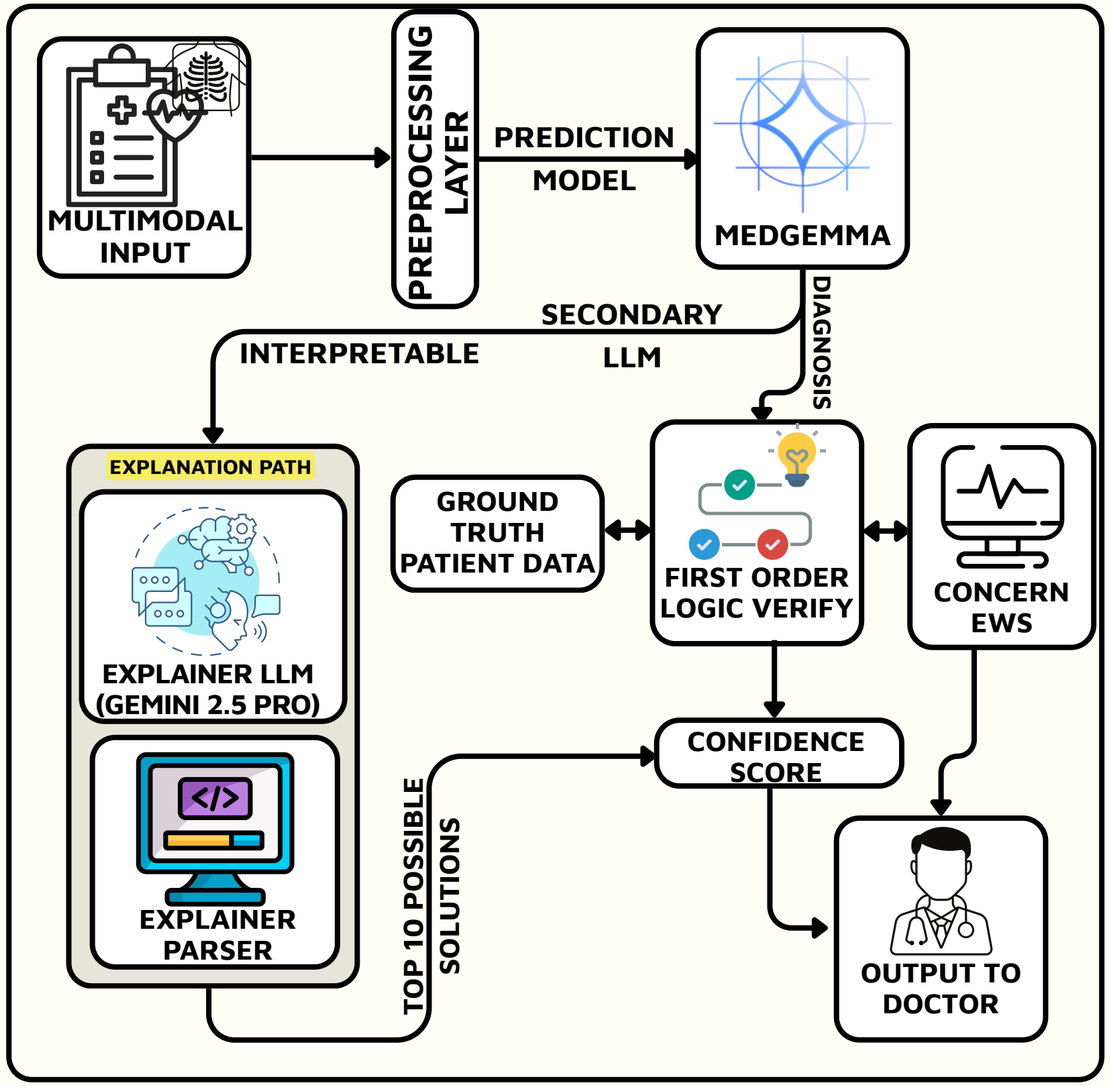
SYSTEM DESIGN OVERVIEW

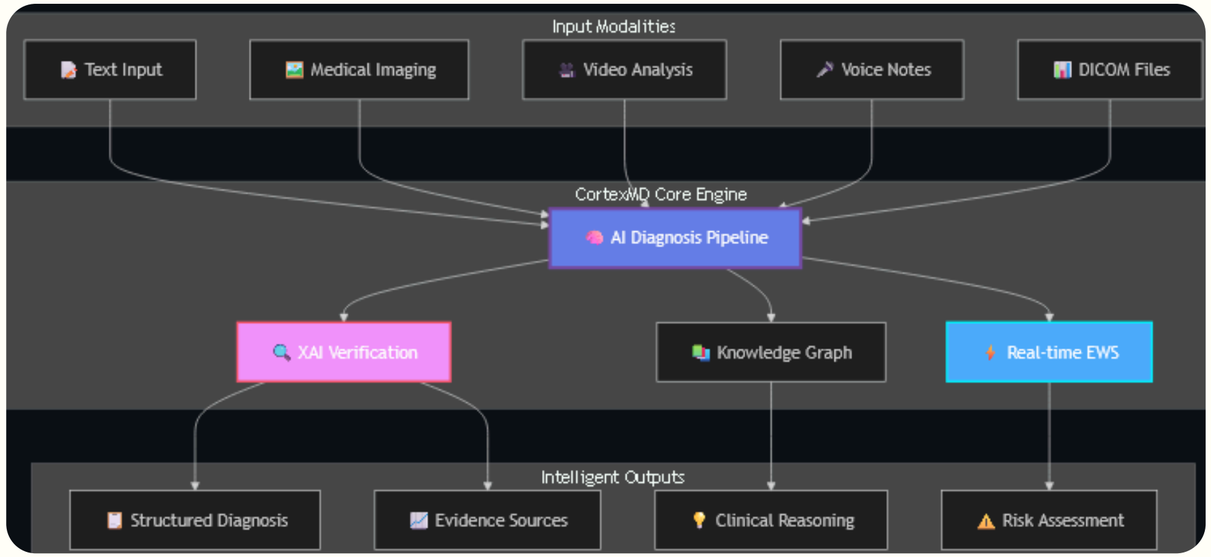
THE WHOLE SYSTEM TOGETHER, DEPLOYED ON GCP → WEBSITE



SYSTEM DESIGN OVERVIEW

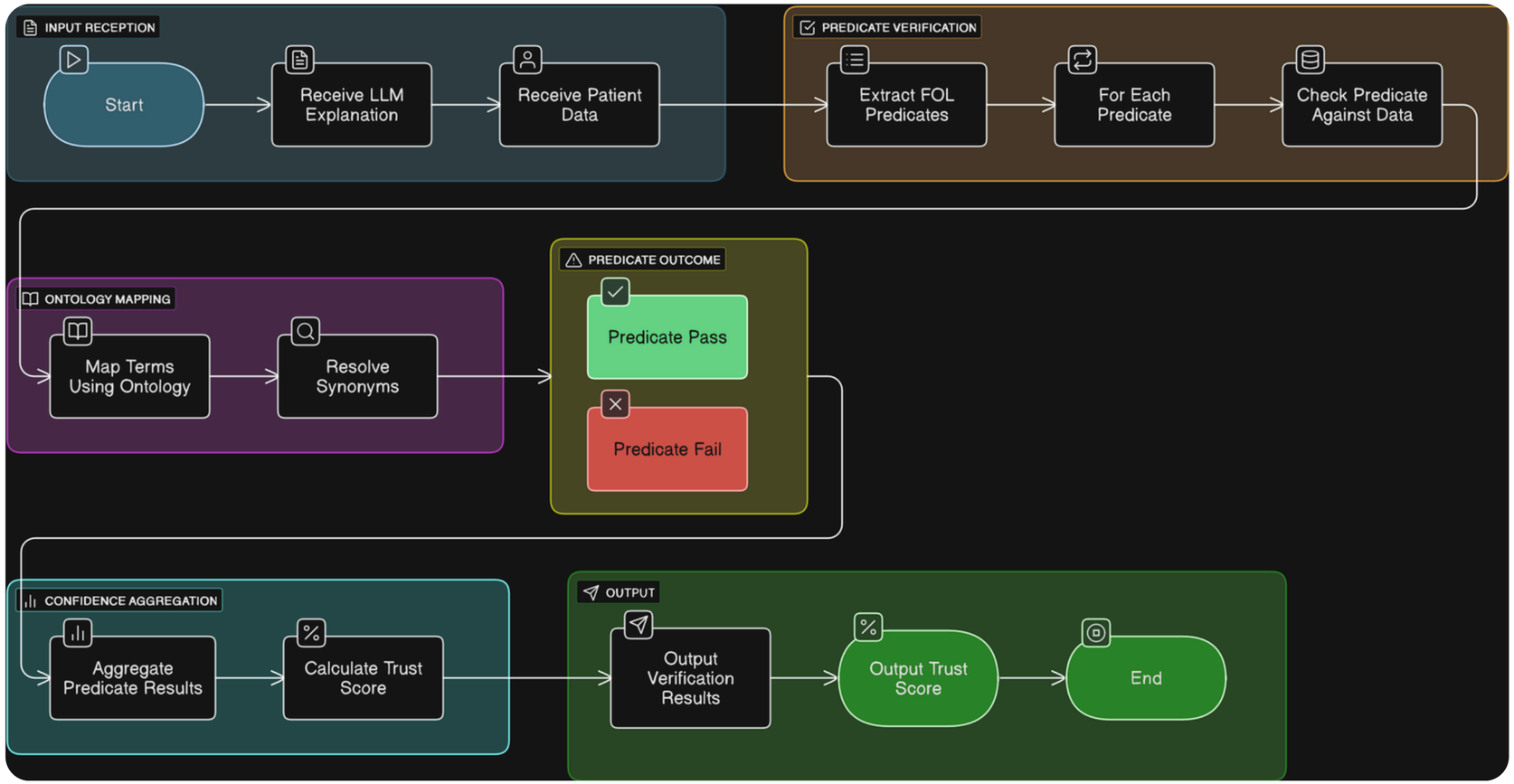
MEDGEMMA & XAI





- **Multimodal Integration & Synergy –** Fuses medical text, FHIR records, multi-specialty imaging for richer diagnostic context. Also compatible with AR Image processing.
- **Reasoning Depth -** Check LLM explanations against patient data and medical knowledge bases, ensuring trust and interpretability.
- **Technical Sophistication & Creativity** – Novel fusion of symbolic logic and neural models for real-time, reliable decision support.

HOW CORTEXMD ACHIEVES KEY GOALS



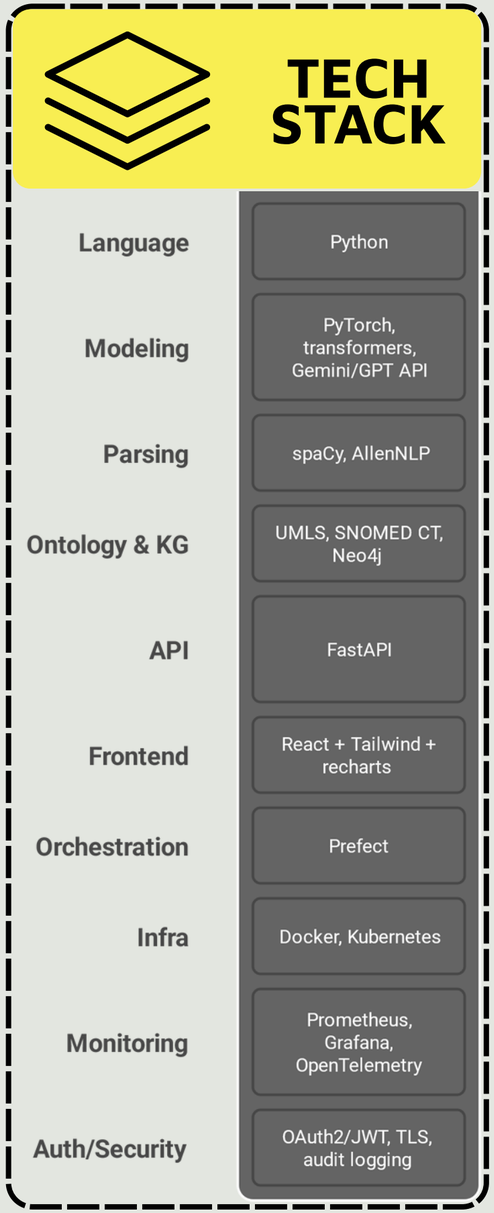
- SECONDARY LLM GENERATES MULTIPLE REASONING PATHS PER DIAGNOSIS
- FOL VERIFICATION ENSURES EXPLANATIONS ARE LOGICALLY CONSISTENT AND GROUNDED IN ACTUAL PATIENT DATA..

INNOVATION HIGHLIGHTS

- **Interpretability & Explainability**: We move beyond basic XAI. Instead of just highlighting a region on a map, we provide causal, semantic explanations.
- **Novel Data Augmentation/ Synthesis**: This is a powerful secondary benefit. The process of decomposing explanations into FOL predicates creates a new, structured, symbolic knowledge base. We are essentially using GenAI to synthesize high-quality, verified training data.
- **Real-Time Processing & Responsiveness:**Each FOL predicate can be checked independently and in parallel, dramatically speeding up the process.

TRUSTED AI, BETTER OUTCOMES

Aspect	SOTA	Our Approach
Black-Box Models	**High predictive accuracy but no insight into why a decision was made, making them hard to trust in clinical settings.**	**Adds a verification layer that produces fact-checked, transparent reasoning, turning an opaque AI into a reliable clinical assistant.**
Traditional XAI	**Highlights where the model is focusing but not why. Often requires expert interpretation.**	**Provides logical, human-understandable explanations that directly connect to clinical reasoning.**
Unguided LLM Explanations	**Can produce plausible but factually wrong justifications (hallucinations) with no way to verify them.**	**Grounds every explanation in First-Order Logic, checks against patient data and filters out incorrect reasoning before output.**



CLINICAL AND SOCIETAL IMPACT-

- Boosts clinician confidence, reduces diagnostic errors, and enables safe adoption of advanced AI for better patient outcomes.
- Increases transparency, builds trust, and empowers patients with clear, understandable health insights.

Estimated Cost of Project : ₹4,70,000

TEAM DETAILS
TEAM NAME-WINDOWS 12 DEVS
MEMBER 1- PRATHMESH SAYAL
MEMBER 2- KSHIRAJA NELAPATI
MEMBER 3-OMKAR
RAMAIAH INSTITUTE OF TECHNOLOGY

Reference to research showing our approach beats doctors-https://arxiv.org/html/2505.14963v1