🏥 MODULE 1: AI-POWERED DIAGNOSTICS (Core Wow Factor)

🎯 Problem Solved

Early disease detection in **resource-limited hospitals**.

🔧 What We Build

An **AI Diagnostic Agent** that:

- Accepts X-ray / MRI / retinal image

- Detects disease

- Generates doctor-friendly explanation

🧠 How Tech Is Used (Step-by-Step)

1️⃣ Image Upload

- Patient uploads image via web/mobile

- Stored in **Google Cloud Storage**

```
gs://aarogya-medical-images/patient123/xray.png
```

2️⃣ Vision Model (Vertex AI)

- Use **Vertex AI AutoML Vision** or **Gemini Vision**

- Model trained on:

- Pneumonia

- Tuberculosis

- Diabetic Retinopathy

```
prediction = vertex_vision_model.predict(image_uri)
```

3️⃣ Gemini Explanation (Key Differentiator)

Gemini converts prediction into **human-readable medical insight**:

```
"You are a medical AI assistant.
Explain this diagnosis in simple terms for a rural doctor.
Include confidence score and warning signs."
```

4️⃣ Output to Doctor Dashboard

- Highlight affected regions (heatmaps)

- Confidence %

- Suggested next steps

✅ **Impact:**
Early diagnosis, fewer missed cases, faster treatment

💊 MODULE 2: PERSONALIZED TREATMENT & DRUG REPURPOSING

🎯 Problem Solved

One-size-fits-all medicine **does not work**.

🔧 What We Build

A **Treatment Recommendation Agent** that:

- Reads patient data

- Suggests dosage

- Finds alternative drugs

🧠 Tech Flow

1️⃣ Data Input

From **BigQuery**:

- Age, weight

- Medical history

- Lab reports

2️⃣ GenAI Reasoning (Gemini)

Gemini synthesizes **clinical + research data**

```
"Based on patient vitals, labs, and medical history,
recommend optimal dosage and safer alternatives.
Cite known drug interactions."
```

3️⃣ Safety Layer (ADK)

ADK agent checks:

- Allergy conflicts

- Overdose risk

- Ethical constraints

```
if risk_level > threshold:
    escalate_to_doctor()
```

4️⃣ Final Output

- Dosage recommendation

- Known side effects

- Alternative medicines

⚠️ **Important:**
System always says:

> *"Final decision rests with medical professional"*

🧘‍♂️ MODULE 3: MENTAL HEALTH COMPANION (High Emotional Impact)

🎯 Problem Solved

Mental health support is:

- Expensive

- Stigmatized

- Not always available

🤖 What We Build

A **Mental Health AI Companion** with:

- CBT exercises

- Mood tracking

- Crisis escalation

🧠 Tech Flow

1 Conversational AI (Gemini)

Acts as **non-judgmental listener**

```
"You are a compassionate mental health assistant.
Use CBT techniques. Avoid diagnosis.
Encourage professional help if risk detected."
```

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2 ADK Risk Detection Agent

Detects:

- Self-harm signals

- Severe anxiety

- Depression

```
if "suicide" in conversation:
    trigger_emergency_protocol()
```

3️⃣ Escalation Logic

- Notifies human counselor

- Shares conversation summary

- Preserves privacy

4️⃣ Daily Well-Being Plan

- Breathing exercises

- Sleep reminders

- Journaling prompts

❤️ **This wins judges emotionally**

🏥 MODULE 4: HOSPITAL WORKFLOW OPTIMIZATION (Business Value)

🎯 Problem Solved

Hospitals lose time & money due to:

- Long queues

- Poor scheduling

- Medicine shortages

🔧 What We Build

An **Operations Optimization Agent**

🧠 **Tech Flow**

1️⃣ Data Collection

From hospital systems:

- OPD visits

- Surgery schedules

- Pharmacy usage

Stored in **BigQuery**

2️⃣ Prediction Model (Vertex AI)

Time-series forecasting:

```
predict_patient_load(next_7_days)
```

3️⃣ ADK Planning Agent

Optimizes:

- Doctor allocation

- Operation theater slots

- Inventory ordering

```
optimize(schedule, constraints)
```

4️⃣ Dashboard Output

- Expected rush hours

- Staff recommendations

- Inventory alerts

📈 **Results:**

- Reduced waiting time

- Lower operational cost

🔐 PRIVACY, ETHICS & SAFETY (Very Important)

Judges LOVE this section.

- No raw data sent to LLMs

- De-identified patient records

- Human-in-the-loop for:

    - Diagnosis

    - Medication

    - Mental health emergencies