RADIANT RAIDERS

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Project Title : AI Integrated Smart Bio – Adhesive MXene Hydrogel for Implant Integration

Team Name : Radiant Raiders

Team Members:

- Rithikkaa S J (ML for material optimization, Electrospinning of Material and ML for Dental Implant)
- Keerthana N (APP Development and Electrospinning of Material)

Theme Chosen : Healthcare

Git Hub: HWG-RADIANT-RAIDERS

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PROBLEM STATEMENT & TARGET AUDIENCE

Problem We're Solving

PROBLEM:

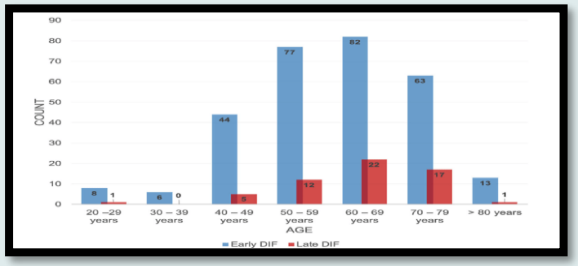
- **5-10% of implants fail** due to infection and poor biocompatibility.
- Current coatings **lack conductivity & bioactivity**, slowing healing.

Why It Matters:

- Patients endure **painful revision surgeries, high costs and long recovery times**.
- Surgeons need **a smarter, infection resistant coating** for better implant success.

Target Users

Patients with **heart, orthopedic, and neural implants** face risks of **rejection, infection, and slow recovery** due to poor biocompatibility and lack of bio-conductivity.



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OUR UNIQUE SOLUTION

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Our project aims to tackle implant-related complications by developing a Smart Bio-Adhesive Hydrogel, composed of MXene and gelatin, that ensures enhanced healing, infection prevention, and tissue integration. By integrating AI and electrospinning fabrication, this coating promises a new generation of implants that are intelligent, safe and faster healing.

Key Features

1. AI-Powered Material Optimization:
   Fine-tunes biocompatibility, conductivity and stability.
2. Electrospinning-Based Coating:
   Forms a uniform nanoscale bio-layer for superior adhesion.
3. Smart, Infection-Resistant Hydrogel :
   Actively prevents infections while. promoting healing.

Why It's Different

1. MXene-Gelatin Hydrogel: Conductive, bioactive and antimicrobial.
2. AI-Driven Optimization: Ensures the best stability & bio-integration.
3. Electrospinning Coating: Forms a nanoscale bioactive layer for faster healing.

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TECH STACK + ARCHITECTURE

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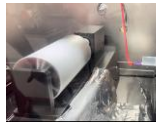
TECH STACK



Architecture

AI-Driven Material Optimization → Uses AI/ML to fine-tune hydrogel properties for biocompatibility, conductivity and stability.

Precision Mixing & Crosslinking → Ensures uniform MXene dispersion in the biopolymer for maximum adhesion & conductivity.

Electrospinning Fabrication → Creates nanostructure fibers that mimic natural tissue for better implant integration.

Electrochemical & Mechanical Testing → Validates coating strength, stability and bioactivity.

Final Integration & AI Monitoring → Tracks implant function post-surgery for real-time adjustments.

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FEASIBILITY AND SHOWSTOPPERS

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FEASIBILITY

Skills:

- Interdisciplinary team (AI, biomaterials, hardware).
- Experience in hydrogel formulation, electrospinning, and software optimization.
- Proficient in research, prototyping, and rapid development.

Tools & Tech:

- AI for material optimization (can be simulated or modeled).
- Lab access for hydrogel and electrospinning.
- Presentation-ready assets: website, GitHub, and video channels.

Why It Can Be Built Within Hackathon Timeline

•**Prototype Exists**: Already moved beyond ideation.

•**Defined Scope**: Focus on coating + smart healing layer.

•**Modular**: AI model, hydrogel coating, and validation steps can be executed in parallel.

SHOWSTOPPERS

1. AI-based tuning requires larger training datasets

2. Regulatory clearance and **clinical trials** are time-consuming

ADVANTAGES

1. 50% fewer implant failures due to improved bonding and infection control

2. 2x faster healing from conductive support

3. Biodegradable – no removal needed after healing

4. Scalable Production – Electrospinning enables easy manufacturing

5. AI-Optimized – Customizable for different implants

6. The bioresorbable implant market is projected to hit **$13.54B by 2032**