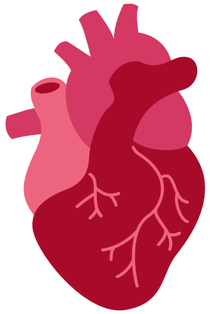


HeartGuard: Predictive Cardiac Care

Aldo Peña 635861 & Pablo Celedón 597730

Integración de Aplicaciones Computacionales

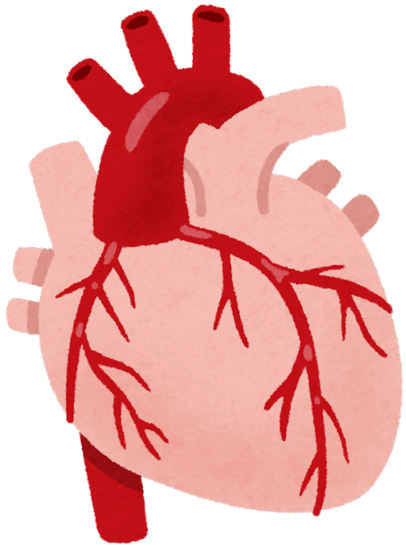
PhD. Raúl Morales Salcedo

November 13 2025

Context and Problem

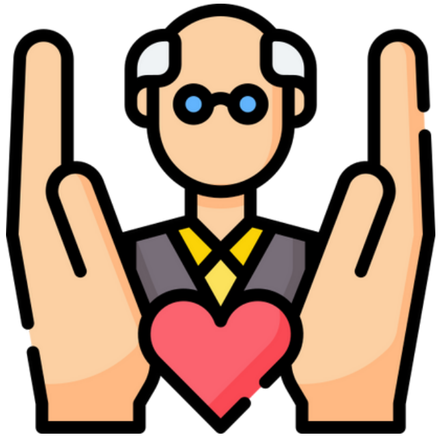
Cardiovascular disease is the leading cause of death in Mexico (INEGI, 2021).

- 226,000 cardiovascular deaths annually—one every 2 minutes (INEGI, 2021)
- Intermittent monitoring fails to capture continuous vital sign changes before emergencies escalate
- 13.6-minute average response resulted in 0% survival in documented cardiac arrests (Morales-Cané et al., 2015)

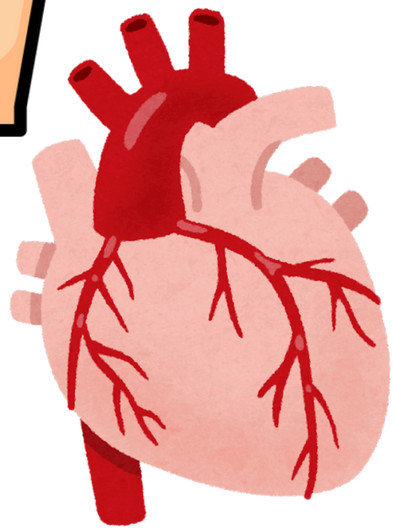


Objective

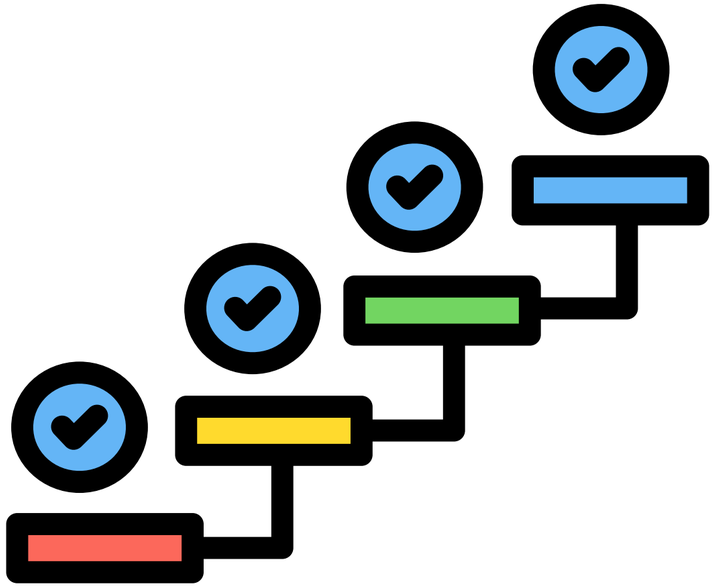
Automate and centralize cardiovascular emergency monitoring to enable faster, data-driven medical responses.



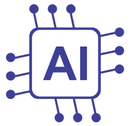
- Reduce response time to critical alerts from minutes to seconds.
- Minimize human errors in data entry and patient monitoring.
- Provide real-time, reliable health data for doctors and administrators.
- Improve patient outcomes through early risk detection.



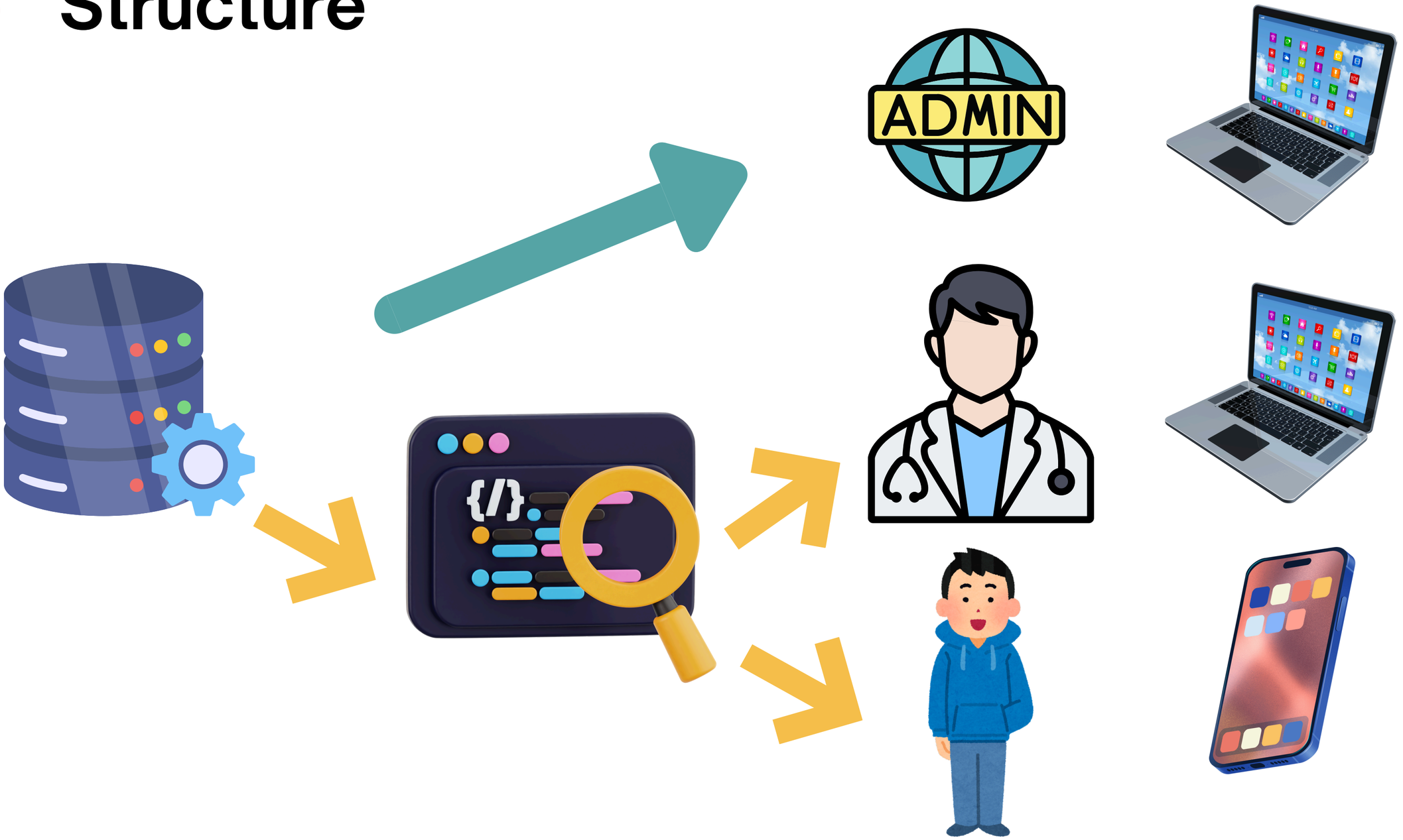
SOLUTION



How it works



Structure



Monitored Vital Signs

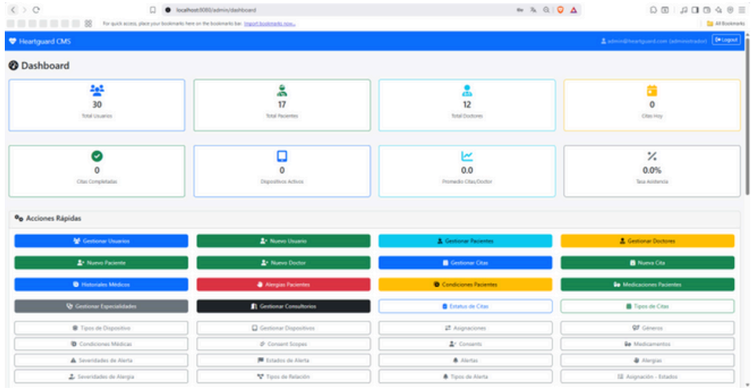
Heart Rate: Can spot irregular rhythms or early signs of a heart attack.

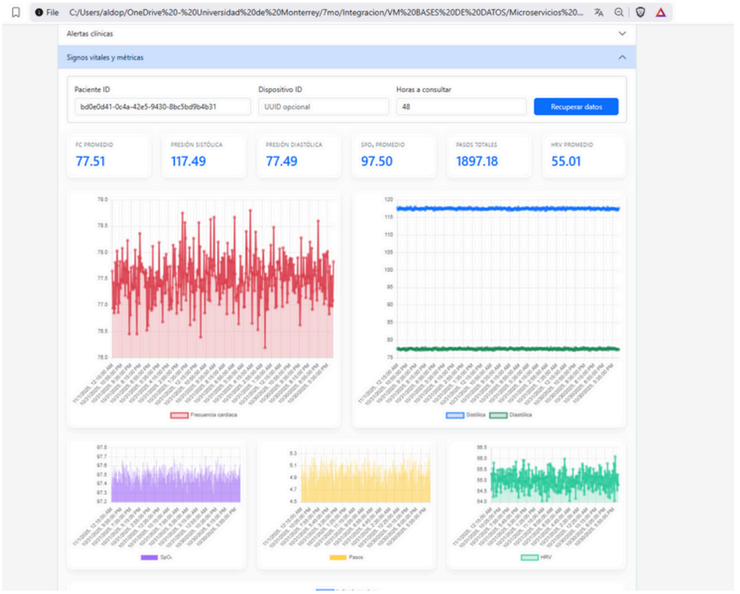
Blood Pressure: Warns if pressure gets dangerously high or low.

SpO_2 (Oxygen): Shows if the heart or lungs aren't working well.

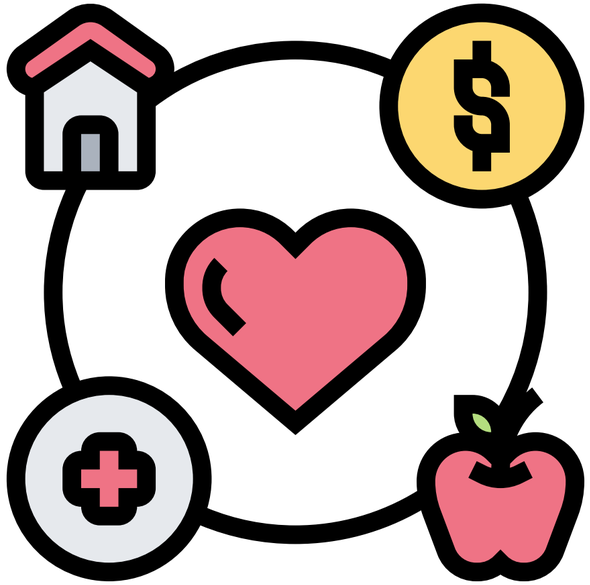
Posture: Detects sudden falls that might happen from fainting.

Steps: Fewer steps can mean the person's health or strength is declining.





Benefits



Quantitative

Response Time Reduction:

- From 13.6 minutes average to <30 seconds for critical alerts
- 49+ minutes saved per patient per day in monitoring time (PMC study, 2023)

Error Reduction:

- 100% elimination of manual data entry errors
- 80-95% fewer false alarms with AI pattern analysis (Implicity European Heart Journal study; VirtuSense VSTOne, 2024)

Quantitative

Survival Impact:

- Response <5 minutes increases cardiac arrest survival from 0% to 40-50% (American Heart Association, 2020)
- Early detection reduces cardiovascular emergency hospitalizations by 30-40% (Koehler et al., 2018)
- 23% reduction in hospital readmissions for heart failure patients (Geisinger Health Plan study, 2012)

Qualitative

✓ Better Patient Experience: Continuous monitoring provides peace of mind, reduces unnecessary hospital visits

✓ Data-Driven Decisions: Complete historical data enables more accurate diagnoses and evidence-based treatment adjustments

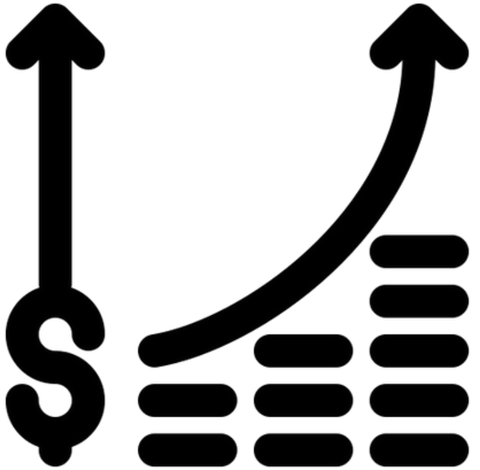
✓ Less Manual Dependency: System works 24/7 without additional staff, scales without proportional hiring

ROI

Investment: $150,000 - $200,000 USD

Annual Returns: $280,000 - $350,000 USD

- Avoided hospitalizations: $200k/year (20-30 events @ $10k each, based on Brockton Hospital achieving zero readmissions and $27k+ per patient savings)
- Monitoring staff savings: $50k/year
- Increased capacity: $80k/year (based on 5x patient capacity increase)
- Reduced malpractice risk: $50k/year



ROI

Payback Period: 6-8 months

- Studies show 90% of healthcare executives report positive ROI from RPM programs (Sage Growth Partners, 2024), with programs typically breaking even at 2-3 months.

Scope

In Scope (Core Functionality):

- Remote Patient Monitoring (RPM) Platform.
- Centralized Doctor/Admin Dashboard.
- Real-time vital sign tracking (HR, BP, SpO2, Posture, Steps).
- AI-powered predictive alerts for cardiovascular events.

Out of Scope (Current Limits):

- Not an automated diagnostic tool (it provides data to doctors).
- Not a hardware/wearable manufacturer (it integrates existing tech).
- Not an emergency dispatch service (it generates the alert).

Scope

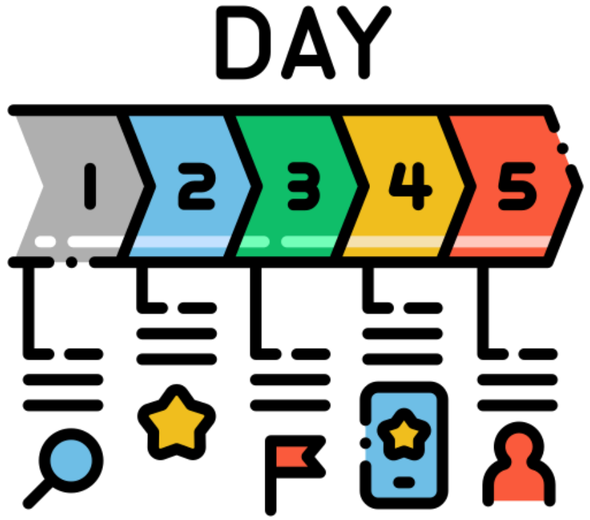
Stakeholders:

- Development: Academic Project (Computational Application Integration).
- Target Users: Physicians, Hospital Administrators, and Patients.

Next Steps:

- Complete prototype validation (Live Demo).
- Present as Final Evaluation Project (PEF) for the course.
- Explore clinical validation or post-graduate development.

Roadmap



Phase 1: Analysis & Design (Aug - Sep)

- Defined problem, objectives, and architecture.

Phase 2: MVP Development (Sep - Oct)

- Built Dashboard, APIs, and data integration.

Phase 3: Testing & Demo Prep (Oct - Nov)

- Conducted internal testing and prepared the live demo.

Phase 4: Final Presentation (Nov 13, 2025)

- Live demo and final delivery.

Resources & Budget

Team (Projected Roles):

- Project Lead / Management
- Full-Stack Developers
- Data Scientists (for AI model)
- QA & Testing

Budget (Projected Commercial Investment):

- Total Investment: $150,000 - $200,000 USD
- Covers: Infrastructure (Cloud), R&D / Development, API Licenses.

Implementation Model:

- Current: Internal Academic Development.
- Future: Internal development to operate as a SaaS (Software as a Service) platform.

Risks & Mitigation

- Risk: Low User Adoption
  - Mitigation: Focus on usability and demonstrating clear value.
- Risk: Data Integration Failure
  - Mitigation: Standardize APIs and prioritize key devices first.
- Risk: AI Inaccuracy (False Alarms)
  - Mitigation: Continuous model training and validation.
- Risk: Data Privacy Breach
  - Mitigation: Implement robust encryption and access controls.

Next steps

- Required Approvals (Audience):
  - Approval of the Final Evaluation Project.
  - Validation of the prototype and live demo.
- What is Needed from the Audience:
  - Feedback on the project's technical and clinical viability.
  - Define the project's potential for future development (post-graduate or incubation).

References

INEGI (2021) - Cardiovascular mortality statistics in Mexico
Morales-Cané et al. (2015) - Response times in cardiac emergencies
American Heart Association (2020) - CPR and Emergency Cardiovascular Care Guidelines
Koehler et al. (2018) - Efficacy of telemedical interventional management in heart failure patients
PMC (2023) - Impact of Remote Patient Monitoring Systems on Nursing Time
Implicity/European Heart Journal - AI reduction of false positivity rate by 80% with 99% sensitivity
VirtuSense (2024) - VSTOne 95% reduction in false alarms with 98% detection accuracy
Geisinger Health Plan (2012) - 23% reduction in hospital readmissions for heart failure
Business Wire (2024) - Brockton Hospital study showing $27,000+ per patient cost savings
Sage Growth Partners (2024) - Survey of 141 healthcare executives on RPM ROI


THANKS