4401111 “Advanced Software Development Methods”

FINAL PROJECT: CompanionBot

Andrey Malyukov | Anton Voronov | Nikita Podstrelov

Aleksandr Grinbaum | Solomon Naftaliyev | Bogdan Zachepa

Nikita Popilin

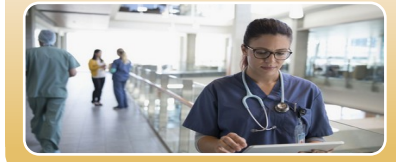
PROJECT’S DESCRIPTION

- **The project provides a complete development framework — including methodology, tools, design strategies, and AI technologies — for building an interactive AI-powered robot, Companion Bot, aimed at helping seniors stay socially connected, manage their health, and stay mentally active. It speaks naturally, recognizes emotions, reminds users about medications, and makes it easy to share moments with family — all through a friendly voice and touch interface.**

THE CHALLENGE: 4 Barriers to normal life

Loneliness

- Many seniors live alone with limited social contact



Health Risks

- Missed medications, unmanaged chronic issues

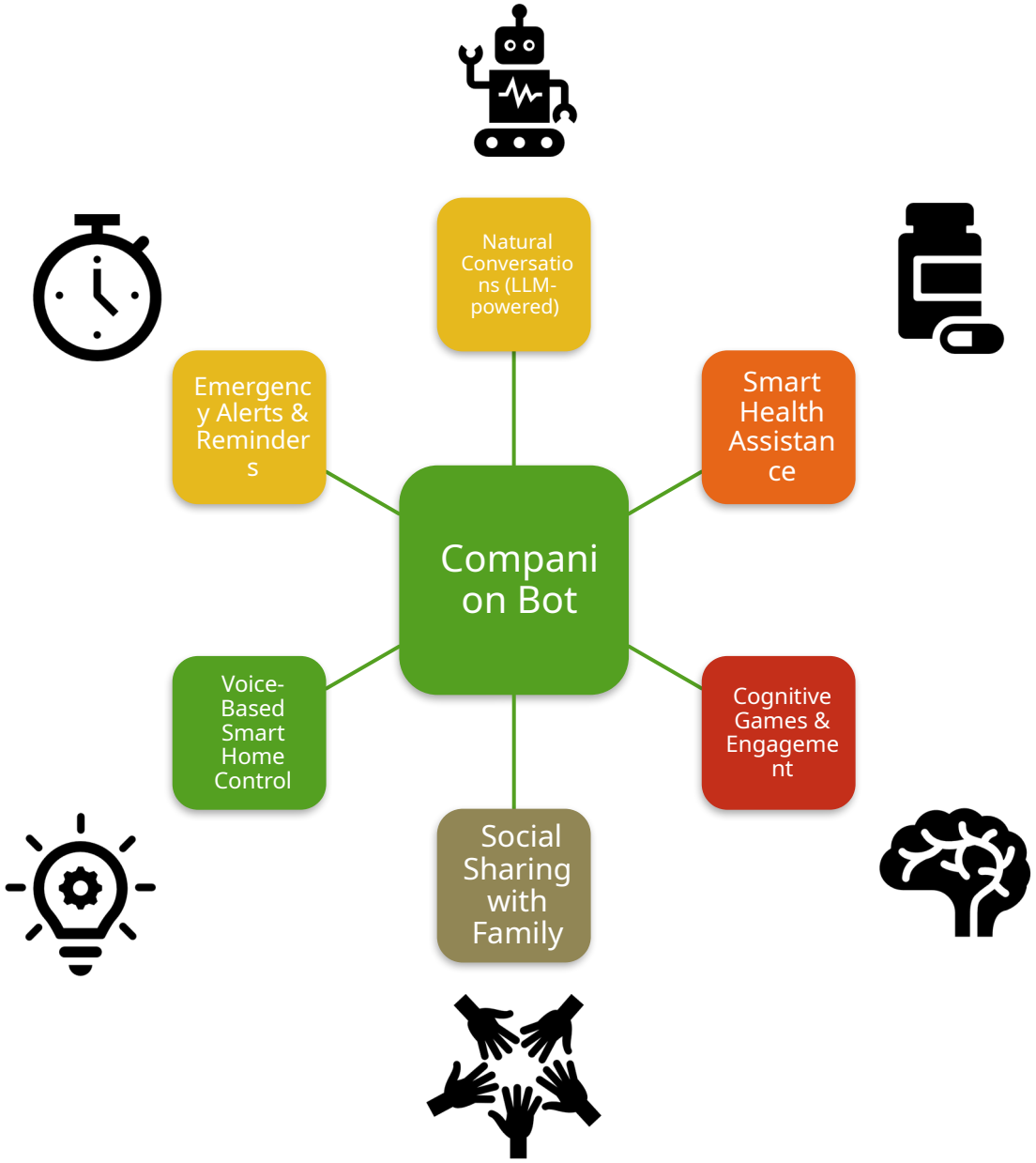
Tech Frustration

- Current tech is not intuitive for elderly users

Cognitive decline

- Memory loss and mental fatigue are usual old people

OUR SOLUTION: Companion Bot



Companion Bot is an AI-driven digital companion designed to enhance the quality of life for seniors by addressing several critical challenges in elderly care

COMPANION BOT: Key features

Conversational AI

Medication Reminders

Cognitive Games

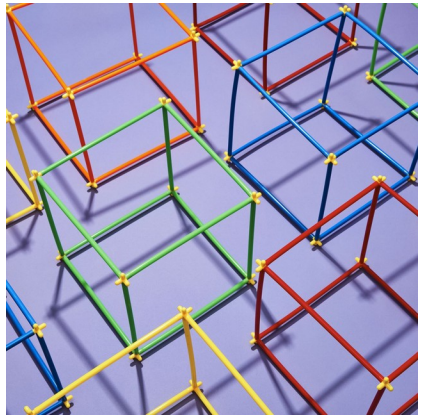


Photo and Video Sharing

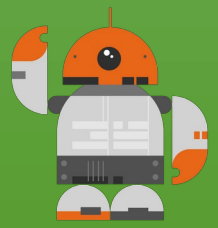
Smart Home Control

Emergency Alerts

COMPANION BOT : Advanced AI capabilities

Emotion Recognition

- ❑ Detects tone and facial expression to respond empathetically



LLM-Powered Conversations

- ❑ Speaks naturally, remembers preferences, adapts to mood

Context Awareness

- ❑ Understands user habits, environment, and daily routines

Multi-Modal Input

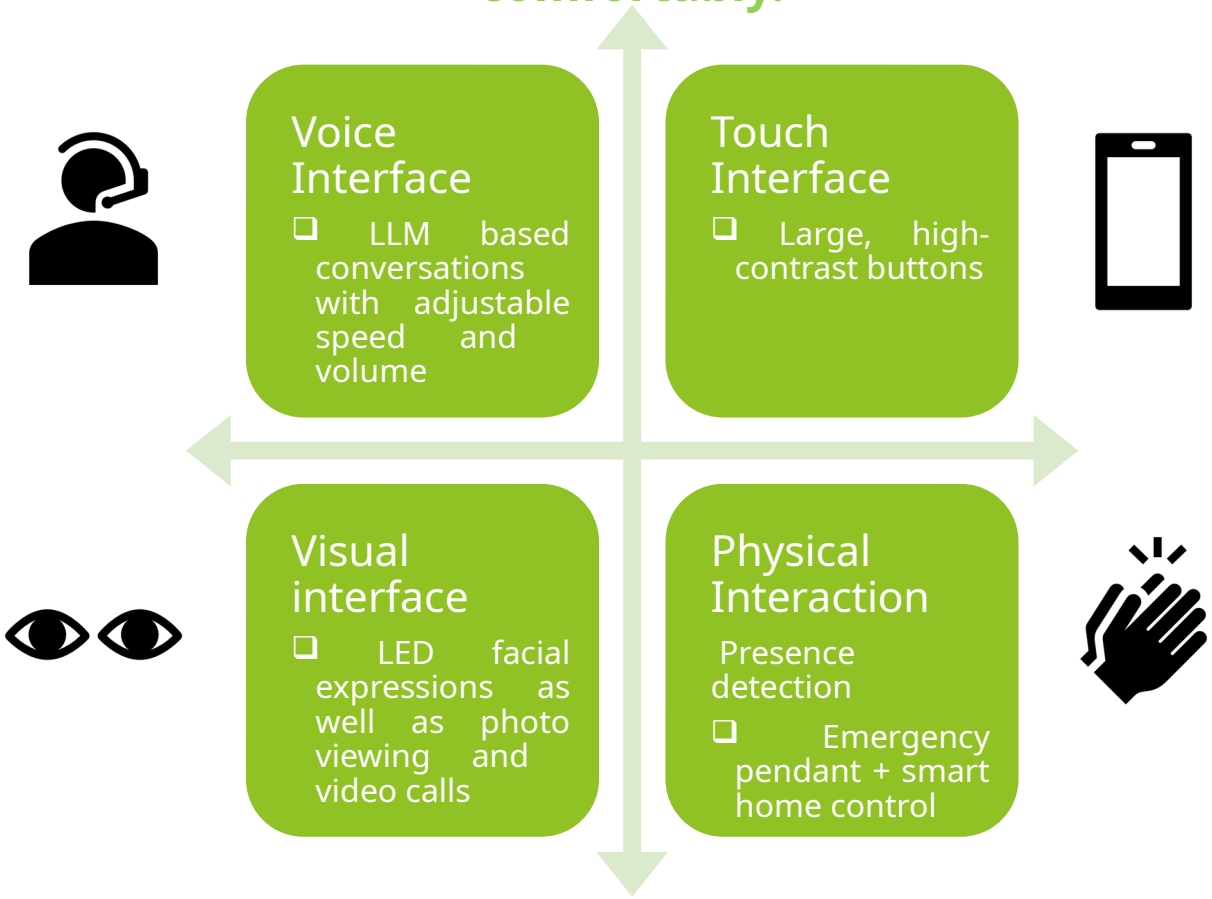
- ❑ Works via voice, touch, gesture, and visual cues

Proactive Engagement

- ❑ Starts conversations when user seems lonely or disengaged

COMPANION BOT: User - centered interaction design

Companion Bot supports users with hearing, vision, mobility, or cognitive challenges by offering multiple ways to interact — simply, intuitively, and comfortably.



COMPANION BOT: Users of the system

Companion Bot serves as a bridge - not a replacement - between seniors and the people who care about them most.

Primary Users

- Independent Seniors
- Seniors with Mild Cognitive Decline
- Socially Isolated Elders

Secondary Users

- Family Members and Caregivers
- Healthcare Professionals
- Social Workers and Coordinators

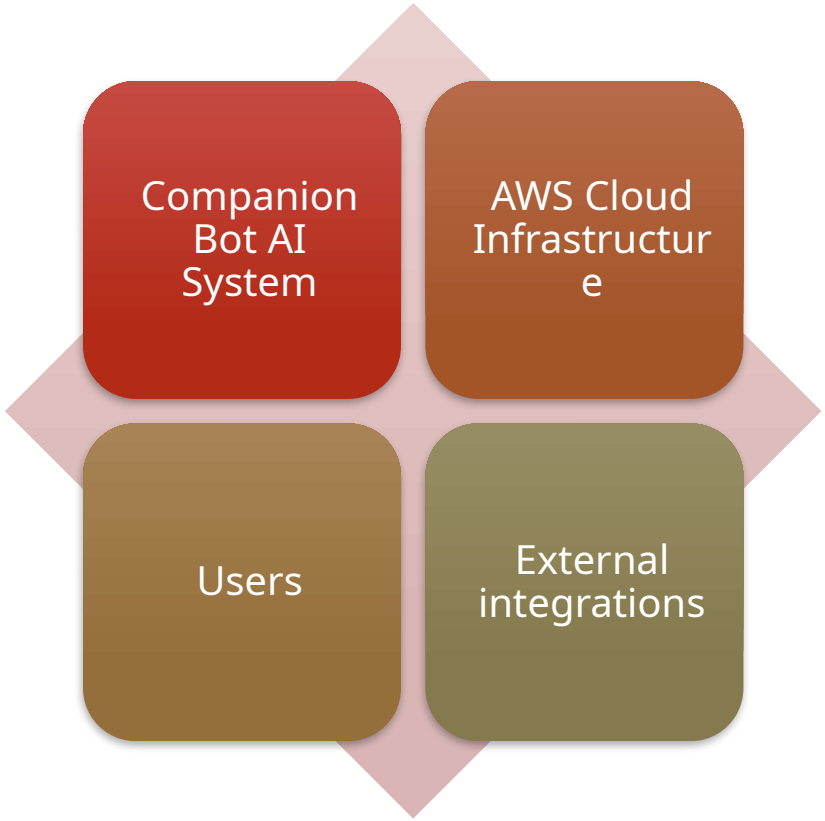
COMPANION BOT: Stakeholders

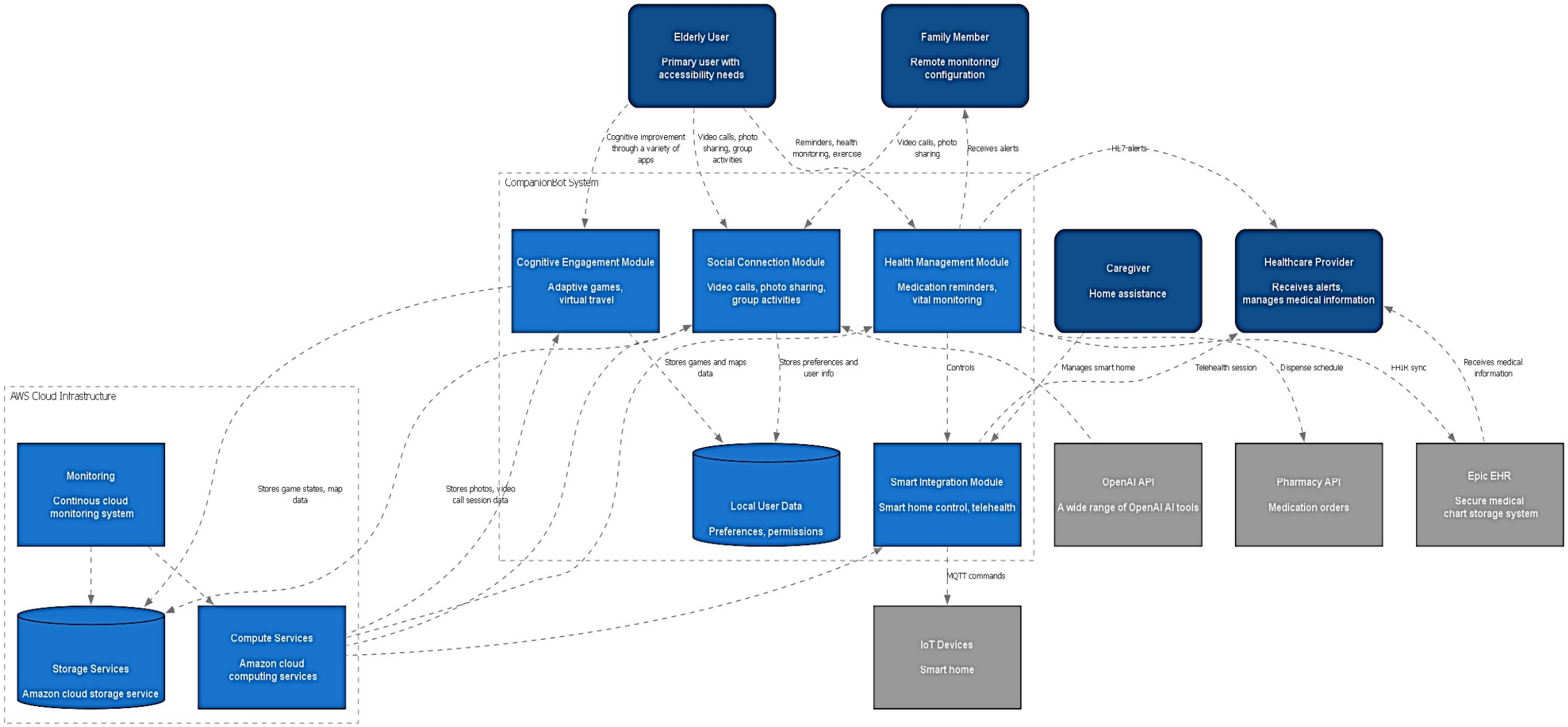
Stakeholder	Interests	Influence
Elderly Users	Ease of use, dignity, trust	Highest – product success depends on adoption
Families & Caregivers	Safety alerts, remote connection	High – often choose & support the system
Healthcare Providers	Data reliability, compliance	Medium – recommend or discourage adoption
Regulators	HIPAA/GDPR*, accessibility	Very High – can block/approve deployment
Investors	ROI, scalability, innovation	High – control strategic direction
Development Team	Clarity, feasibility, timelines	High – deliver the system's core
NGOs / Advocates	Inclusion, affordability	Medium – support adoption, outreach
Insurance providers	Risk mitigation, preventive care, fewer hospitalizations through early intervention	Medium to High - insurance providers may subsidize Companion Bot or offer it as part of a health plan if it lowers claims and improves elderly care outcomes.

* *HIPPA - Health Insurance Portability and Accountability Act* (USA)
GDPR – General Data Protection Regulation (EU)

COMPANION BOT: Architecture diagram

Companion Bot integrates real-time voice, health, and emotion data into a privacy-compliant AI system that runs locally and, in the cloud, — ensuring safety, intelligence, and adaptability.





CompanionBot System Architecture

COMPANION BOT: System development plan

Companion Bot's development follows a user-centered, AI-enhanced roadmap — ensuring each feature is grounded in real-world needs and built with ethical, accessible tech.

Foundation.
Focus: Define user personas, interaction needs, system goals
Key Roles: UX Designer, Gerontologist
Resources: Stakeholder interviews, co-design council

Core Development
Focus: Build conversational UI, health reminders, emotion recognition
Key Roles: AI/ML Engineers, Speech Pathologist, Doctors
Resources: LLM, emotion datasets, voice SDKs, NLP engine

Integration
Focus: Link features (video call, photo sharing, smart home, games)
Key Roles: Software Developer, Cognitive Psychologist, Embedded Engineer
Resources: Camera, IoT SDKs, puzzle/game

Validation
Focus: Clinical testing, usability review, privacy/security checks
Key Roles: QA Team, Clinical Advisors, Privacy Officer
Resources: Elderly testers, test labs, HIPAA

Pilot
Focus: Deploy in test homes, train families and caregivers
Key Roles: Ops Team, Support Staff, Training Specialist
Resources: 10–20 pilot units, online modules, dashboards

Launch
Focus: Go-to-market, customer support, onboarding
Key Roles: Marketing, Sales, Support Team
Resources: CRM, webinars, NGO partnerships

COMPANION BOT: Key risks and mitigations

Our proactive risk plan ensures Companion Bot can be delivered securely and on time — even under changing technical or organizational conditions.

Risk	Mitigation Strategy
Human Resource Risks Skill Gaps in Specialized Roles	Maintain expert advisory pool, invest in parallel onboarding, cross-train team members.
Hardware (sensors, facial LEDs, components) Supply Delays	Pre-order critical parts, diversify suppliers, use modular design
GPU Infrastructure Limitations High computational demand for LLM inference could exceed available GPU resources, affecting emotion-aware responses	Optimize model size, use cloud scaling, secure compute credits
Regulatory Delays HIPAA/CE audits take longer than expected	Start compliance early (in parallel with development), maintain parallel documentation
Budget Overrun	Reserve contingency fund, secure grants, automate audit steps
User Dropout in Pilot Phase Due to confusion or poor onboarding	LLM-based training assistant, real-time sentiment tracking
Team Turnover Loss of key staff disrupts continuity	Cross-train members, maintain full documentation, succession plan

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CompanionBot