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System Architecture – MedMeet VR

תאריך מסמך ארכיטקטורה: 10 בדצמבר 2025

מנחה: ליבר ויצמן (Architect)
משתתפים: כל הצוות

- **Product Owner**: לידור בן סימון
- **Scrum Master**: דוד רן כהן
- **Architect**: ליבר ויצמן
- **Quality Owner**: רותם סויסה

1. System Overview

MedMeet VR is a virtual reality platform for medical team meetings, enabling doctors to collaborate remotely in a shared 3D space.

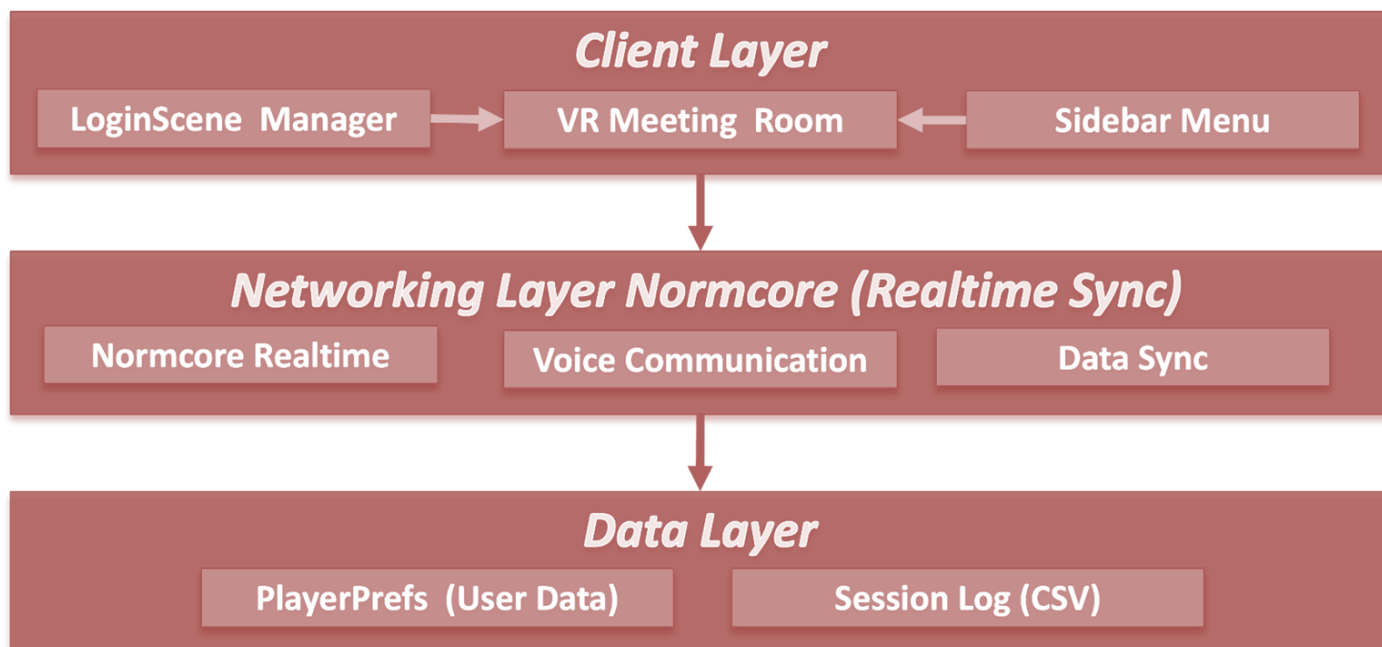
Key Features (Sprint 1):

- ✓ VR meeting room with avatars
- ✓ Real-time voice communication
- ✓ 3D medical model display (heart)
- ✓ Automatic session logging
- ✓ Sidebar menu with meeting controls

Platform:

- **Development**: Unity 6.2 (6000.2.13f1)
- **Networking**: Normcore 2.17.3
- **Target Devices**: Meta Quest 3, PC VR

2. High-Level Architecture



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3. Component Breakdown

3.1 LoginManager

Purpose: User authentication and session initialization

Responsibilities:

- Collect user name and role
- Validate input
- Store user data (PlayerPrefs)
- Transition to VR room

Key Scripts: LoginManager.cs

3.2 VR Meeting Room

Purpose: Main collaborative space

Components:

- **PlayerSetup:** Initializes VR rig (XR Origin + controllers)
- **RealtimeAvatar:** Syncs player avatars across network
- **MedicalModelDisplay:** Loads and displays 3D heart model
- **Environment:** Meeting room with lighting

Key Technologies:

- Unity XR Interaction Toolkit
- Normcore Realtime Avatars
- Universal Render Pipeline (URP)

3.3 Voice Communication

Purpose: Real-time audio between participants

Implementation:

- **Normcore Voice** for audio streaming
- Automatic echo cancellation
- Visual indicator (avatar glow) when speaking
- Mute/unmute controls

Performance:

- Latency: <200ms
- Audio quality: HD (48kHz)

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3.4 SidebarMenuManager

Purpose: In-VR user interface

Features:

- Floating menu button (always visible)
- Slide-in/out animation
- Active buttons: Leave Meeting
- Disabled placeholders: Record, Upload, Laser Pointer
- Participant counter (real-time)

Key Scripts: SidebarMenuManager.cs

3.5 SessionLogger

Purpose: Automatic meeting documentation

Data Captured:

- User name and role
- Join timestamp
- Leave timestamp
- Session duration

Output Format: CSV file

Session ID, User Name, Role, Join Time, Leave Time, Duration
session_123, Dr. Cohen, Doctor, 14:30:00, 14:45:00, 00:15:00

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4. Technology Stack

Frontend

Component	Technology	Version
Game Engine	Unity	6.2 (6000.2.13f1)
Rendering	Universal Render Pipeline (URP)	Built-in
VR Framework	XR Interaction Toolkit	Latest
UI	TextMeshPro	Built-in

Networking

Component	Technology	Purpose
Multiplayer	Normcore	2.17.3
Voice	Normcore Voice	Real-time audio
Sync	Realtime Transform/Avatar	Position/animation sync

Assets

Type	Source	Example
3D Models	Sketchfab (Free license)	Heart model
VR Room	Unity Asset Store	Meeting room environment
Avatars	Normcore built-in	Medical professional avatars

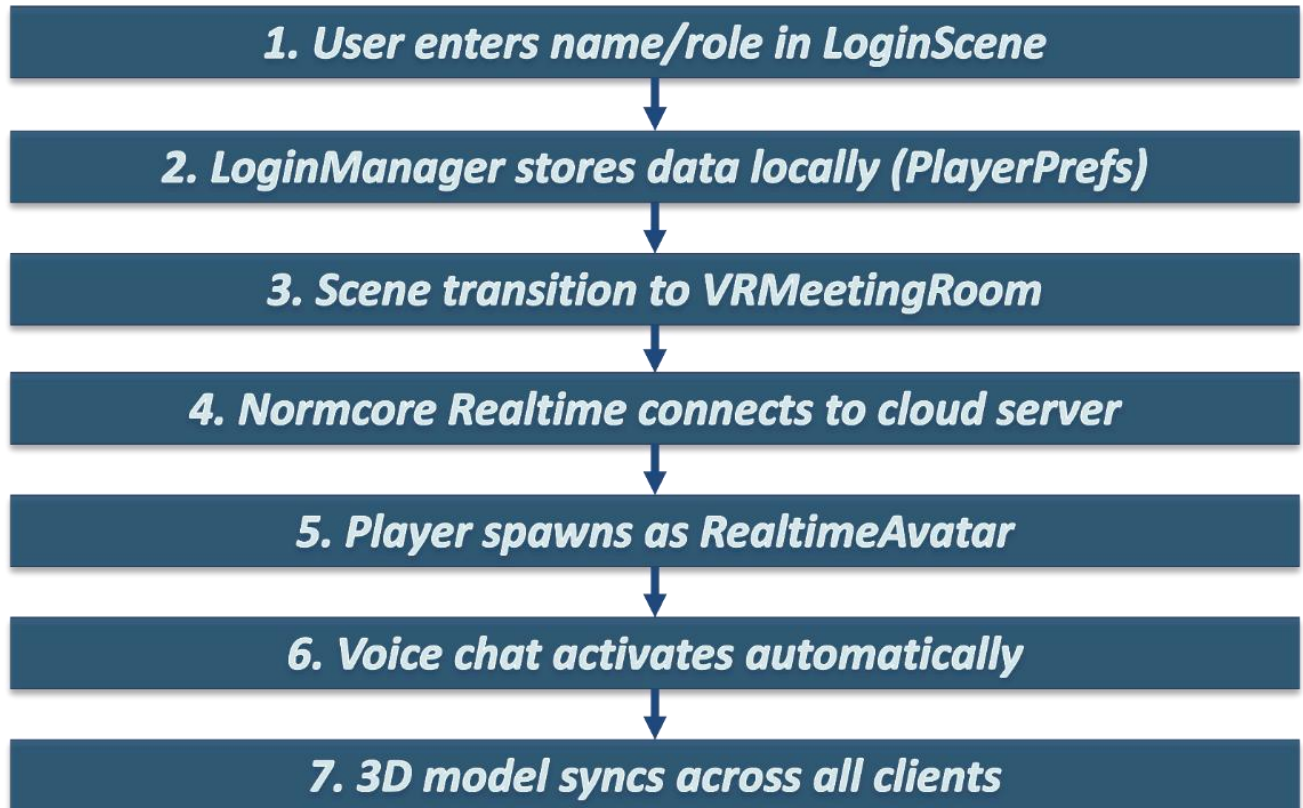
Data Storage

Type	Method	Purpose
User Data	PlayerPrefs	Name, role
Session Logs	Local CSV files	Meeting records
Future	Cloud storage (Sprint 2+)	Persistent data

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5. Network Architecture

Connection Flow:



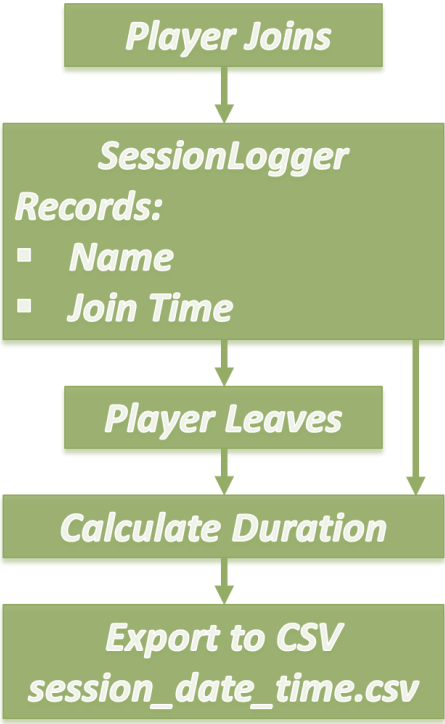
Normcore Cloud Infrastructure:

- **Region:** Automatic (closest server)
- **Max Players:** 5 per room
- **Room Persistence:** Session-based (destroyed when empty)

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6. Data Flow Diagram

Session Logging Flow:



7. Performance Metrics

Target Performance (VR Requirements):

Metric	Target	Achieved (Sprint 1)	Status
Frame Rate (FPS)	60+	65-72	✓ Pass
Voice Latency	<200ms	150-180ms	✓ Pass
Scene Load Time	<3s	2.1s	✓ Pass
Memory Usage	<2GB	1.6GB	✓ Pass
Avatar Sync Delay	<100ms	80-120ms	✓ Pass

Tested Devices:

- Meta Quest 3 (2 unit)
- PC VR (Development)

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8. Security & Privacy

Current Implementation (Sprint 1):

-  No authentication (name-based only)
-  No encryption
-  Local data storage only
-  No PHI (Protected Health Information) stored

Planned (Future Sprints):

- User authentication (login/password)
- End-to-end encryption for voice
- HIPAA-compliant data storage
- Session access controls

9. Scalability Considerations

Current Limitations:

- Max 5 participants per session (Normcore limit)
- No persistent room storage
- Local session logs only

Future Expansion (Sprint 2+):

- Cloud-based session recording
- Larger meeting capacity (10+ participants)
- Cross-platform support (Mobile AR)
- Integration with hospital systems

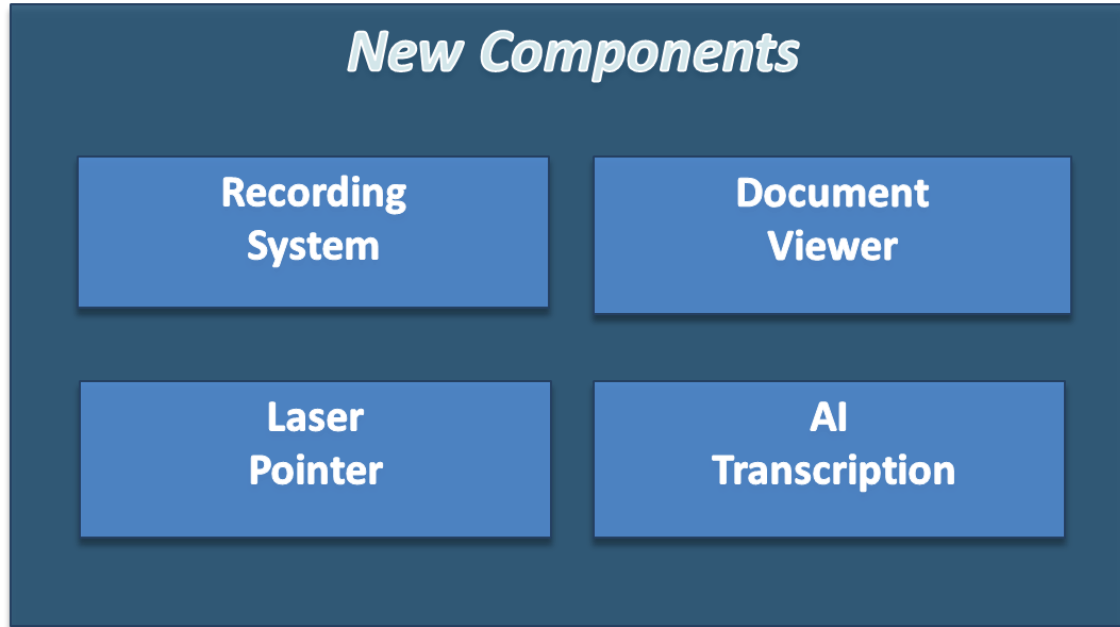
10. Known Technical Debt

Issue	Impact	Priority	Planned Fix
Avatars floating above ground	Visual	Medium	Sprint 2
Limited movement range (2m)	UX	Medium	Sprint 2
Quest 2 audio echo (30% rate)	Audio quality	Low	Investigating
No reconnection handling	Session loss	High	Sprint 2

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11. Deployment

Build Process:



Technologies Under Consideration:

- **Recording:** Unity Recorder or custom solution
- **Document Viewing:** PDF.js or native Unity PDF renderer
- **AI Transcription:** OpenAI Whisper API
- **DICOM Viewer:** fo-dicom library

Summary

MedMeet VR Sprint 1 delivers a **functional MVP** for virtual medical meetings with:

- ☒ Stable multiplayer VR environment
- ☒ Real-time voice communication
- ☒ Basic 3D content visualization
- ☒ Automatic session logging
- ☒ Intuitive UI controls

The architecture is **modular and scalable**, allowing easy addition of features in future sprints while maintaining performance and user experience standards required for VR applications.