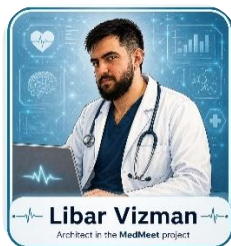


Architecture Document - MedMeet Sprint 3

System Architecture -MedMeet Sprint 3



תאריך מסמך ארכיטקטורה: 3 יוני 2026

גרסה: 3.0

מנחה: ליבר ויצמן (Architect)

משתתפים:

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

תוכן עניינים

1. System Overview
2. High-Level Architecture
3. Component Breakdown -Sprint 3
4. Technology Stack
5. Network Architecture
6. AI Integration Architecture
7. Avatar & Movement Sync Architecture
8. Voice Command Architecture
9. Data Flow & Storage
10. Performance & Scalability
11. VR Compatibility & Risk Mitigation





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System Overview 1.1

1.1 מהו MedMeet VR&AR?

MedMeet VR&AR היא פלטפורמה למפגשים רפואיים במציאות מדומה ורבודה, המאפשרת לצוותים רפואיים, סטודנטים ומתמחים להיפגש, ללמוד, להתאמן ולתקשר בסביבה תלת-מימדית משותפת. בספרינט 3 הפכה הפלטפורמה לכלי הדרכה רפואי מקיף עם נגישות, בינה מלאכותית ותרומה חברתית.

Key Features (Sprint 3) 1.2

Core Infrastructure (Sprint 1 + 2):

- VR meeting rooms with avatars
- Real-time voice communication (Normcore)
- 3D model display & full interaction
- Multi-room system & navigation
- AI transcription (Whisper) + People Analytics
- 3D Recording & Playback
- Collaboration tools (Laser, Annotations)

New in Sprint 3:

- Real-time Sign Language translation (accessibility + AI)
- Interactive medical training & surgery simulation rooms
- Medical Learning Center (presentations, panels, content)
- Basic medical procedure simulations (blood test, throat exam)
- AI Assistant -ask a question, get an answer (Whisper + GPT)
- Avatar Movement Sync -hands, head & locomotion
- Voice Commands -open/close menu, navigate to rooms
- Social Impact & Sustainability showcase (multilingual)

Removed from Sprint 3: Custom Avatar Enhancements (Epic 5) - הוסר מהספרינט והוחלף בתכונות חדשות (עוזר AI, סנכרון תנועות, ציווי קולי).

Platform Support 1.3

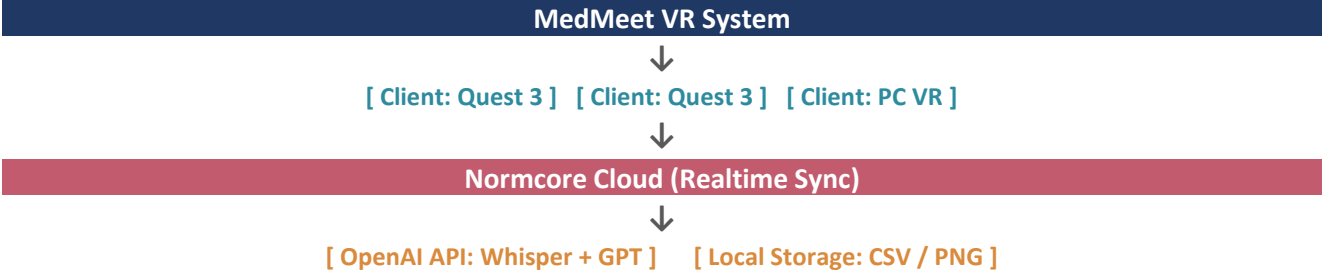
- **Development:** Unity 6.2 (6000.2.13f1)
- **Primary Target:** Meta Quest 3
- **Secondary Target:** Meta Quest 2 / PC VR (SteamVR, Oculus Runtime)
- **Networking:** Normcore 2.17.3
- **Cloud Services:** OpenAI API (Whisper-1 + GPT Chat Completions)



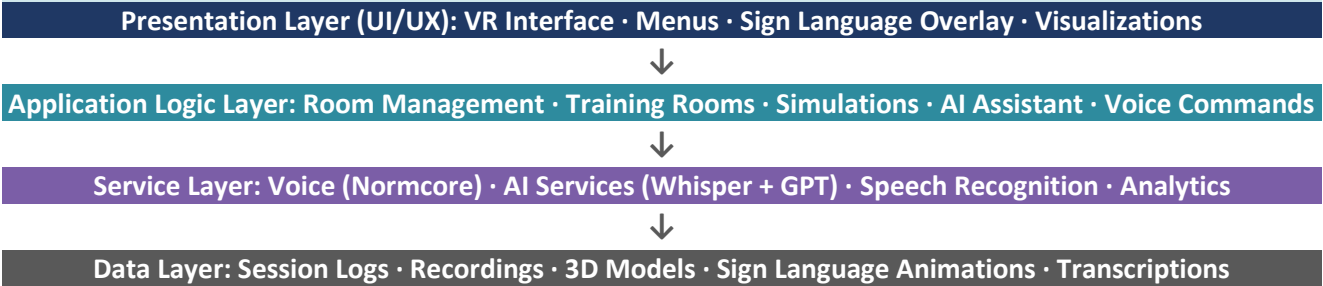
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High-Level Architecture .2

System Architecture Diagram 2.1



Architecture Layers 2.2





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Component Breakdown -Sprint 3 .3

Sign Language System 3.1

Component: SignLanguageManager.cs

Responsibilities:

- Capture audio → send to Speech Recognition
- Map recognized sentence → sign animation
- Play animation on overlay avatar
- Hebrew & English support

Architecture:

```

SignLanguageManager
├── currentLanguage (enum)
├── signDictionary (Dictionary<string, AnimationClip>)
├── RecognizeSpeech() → Whisper API
├── MapSentenceToAnimation(string)
├── PlaySignAnimation(AnimationClip)

```

Key Technologies: OpenAI Whisper · Unity Animation · TextMeshPro overlay

Medical Training & Simulation Rooms 3.2

Component: TrainingRoomManager.cs / SurgeryTutorialManager.cs

Responsibilities:

- Room selection menu (heart / lungs / brain)
- Teleportation / scene switching between rooms
- Step-by-step surgery animation on 3D models
- Forward/backward animation control with guiding UI

Integration Points: LobbyManager → TrainingRoomManager → SceneSwitcher; Normcore Room sync

AI Assistant 3.3

Component: AIAssistantManager.cs

Responsibilities:

- Receive question (text or voice)
- Send request to OpenAI Chat Completions API
- Display answer on interactive panel
- Error & rate-limit handling

```

AIAssistantManager
├── askQuestion(string prompt)
├── SendToGPT(prompt) → OpenAI API
├── DisplayAnswer(response)
├── HandleError(code)

```



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Avatar Movement Sync 3.4

Component: AvatarSyncManager.cs

Responsibilities:

- Sync hand movements & gestures
- Sync head orientation
- Sync locomotion (walking position)
- Inverse Kinematics (IK) for natural arms

Synchronization (Normcore):

RealtimeAvatar → Head + Hands (sync rate 30 Hz)
 RealtimeTransform → Locomotion (sync rate 20 Hz)
 Custom IK Solver → Elbow / arm pose (local, on-change)

Voice Commands 3.5

Component: VoiceCommandManager.cs

Responsibilities:

- Capture voice → transcribe (Whisper)
- Match transcription to command keywords
- Execute action (open/close menu, navigate to room)
- Confidence threshold + fallback

```

VoiceCommandManager
├── commandKeywords (Dictionary<string, Action>)
├── Transcribe() → Whisper API
├── MatchCommand(text, confidence)
└── ExecuteAction()
  
```

Medical Learning Center & Simulations 3.6

Component: LearningCenterManager.cs / ProcedureSimManager.cs

- Interactive info panels, presentations with paging, medical content
- Procedure simulations (blood test, throat exam) with XR grab interaction & visual feedback



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Technology Stack .4

Frontend -Unity VR 4.1

Unity 6.2 Engine

- Rendering: URP (Universal Render Pipeline)
- VR Framework: XR Interaction Toolkit
- Physics: Unity Physics
- Audio: Unity Audio + Normcore Voice
- UI: TextMeshPro + Canvas

Key Packages:

- com.unity.xr.interaction.toolkit -VR interactions
- com.unity.render-pipelines.universal -Graphics
- com.unity.textmeshpro -UI text
- com.unity.xr.management -XR settings

Networking -Multiplayer 4.2

Normcore 2.17.3

- Realtime (Scene Sync)
- RealtimeView (Component Sync)
- RealtimeTransform (Transforms / Locomotion)
- RealtimeAvatar (Head + Hands)
- Normcore Voice (Audio)

Cloud Infrastructure: Auto Region Selection · WebRTC for voice · 5 concurrent users max

AI Services 4.3

OpenAI API

- **Whisper-1:** Speech-to-text (Hebrew, English) -Sign Language & Voice Commands
- **GPT Chat Completions:** AI Assistant Q&A
- **Format:** WAV, MP3 · Max Size: 25MB

POST /v1/audio/transcriptions (Whisper)

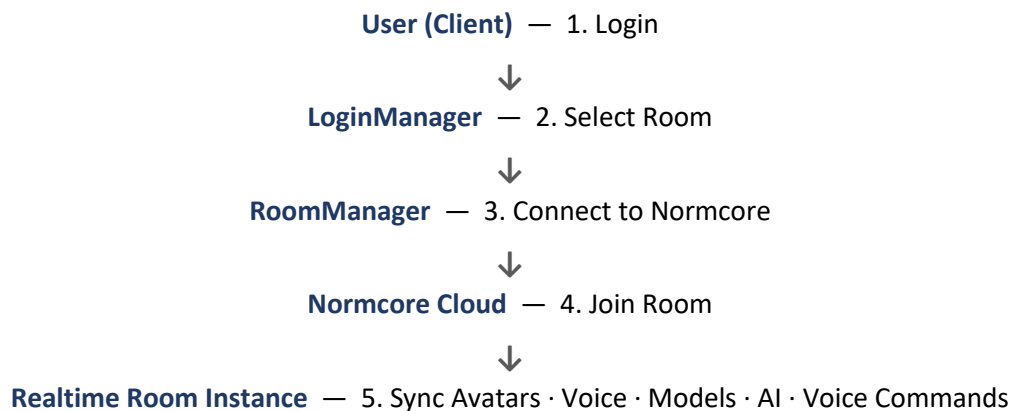
POST /v1/chat/completions (GPT Assistant)



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Network Architecture .5

Connection Flow 5.1



Data Sync Architecture 5.2

RealtimeView Components:

RealtimeAvatar → Head + Hands (30 Hz)
RealtimeTransform → Locomotion + Models (20 Hz)
Custom Sync → Sign Language state (on-change)
Voice → Normcore Voice (audio stream)

Bandwidth (per user): ~75 Kbps total (Voice ~50 · Transforms ~15 · Avatar ~10)

Room Management 5.3

Room Name → Unique identifier
Max Clients → 5
Persistence → Session-based



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AI Integration Architecture .6

Sign Language Pipeline 6.1

Microphone Audio



Whisper API → Text Transcription



Sentence → Animation Mapping



Sign Language Avatar (overlay) plays animation

AI Assistant Pipeline 6.2

User Question (text / voice)



(if voice) Whisper → Text



GPT Chat Completions API



Answer displayed on AI Panel

Request Format 6.3

POST <https://api.openai.com/v1/chat/completions>
Headers: Authorization: Bearer sk-...
Body: { model: 'gpt-...', messages: [...] }
language: he / en



Avatar & Movement Sync Architecture .7

Tracked Data Points 7.1

Data Point	Method	Sync Rate
Head position & rotation	RealtimeAvatar	30 Hz
Both hands (controllers)	RealtimeAvatar	30 Hz
Body locomotion (walking)	RealtimeTransform	20 Hz
Elbow / arm pose	Custom IK Solver	Local + on-change

Inverse Kinematics (IK) 7.2

.(IK Solverhead + 2 hands

Interpolation & Smoothing 7.3

- RealtimeTransform interpolation -למניעת "קפיצות" בתנועה
- Snapshot buffering -החלקת תנועה תחת packet loss



Voice Command Architecture 8

Command Flow 8.1

Voice Input (push-to-talk / wake)



Whisper Transcription



Keyword Matching + Confidence Check



Execute Action (Menu / Navigation)

Supported Commands (examples) 8.2

Command (HE)	Action
פתח תפריט	Open menu
סגור תפריט	Close menu
קח אותי לחדר הלב	Teleport to heart room
חזור ללובי	Teleport to lobby
פתח עוזר	Open AI assistant

Fallback: פקודה לא מזוהה (מתחת לסף ביטחון) מציגה הודעה "לא הבנתי, נסה שוב".



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Data Flow & Storage .9

Local Storage (Quest / PC) 9.1

/MedMeet/

- Logs/ → Session_2026-05-06.csv
- Recordings/ → Recording_v1.mrec
- Transcripts/ → Transcript_2026-05-06.txt
- SignLang/ → sign_animations/ (clips)
- AllLogs/ → assistant_history.csv

Cloud / API Data 9.2

- Audio → Whisper (transient, not stored by app)
- Prompts/Answers → GPT (logged locally for analytics)



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Performance & Scalability.10

Targets 10.1

Metric	Target	Achieved	Status
Frame Rate (Quest 3)	60+ FPS	65-88	✓
Memory	<2.5 GB	~2.1 GB	✓
AI Response	<4s	~3.1s	✓
Avatar Sync Latency	<100ms	~80ms	✓

Optimizations 10.2

- LOD + texture compression (ASTC) for 3D surgery models
- Pooling for sign-language animation clips
- Debounce on AI requests to avoid rate limits
- IK computed locally, only 3 points synced over network



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VR Compatibility & Risk Mitigation.11

Quest 2 + Quest 3 Compatibility 11.1

- Build Target: Android · Texture Compression: ASTC
- שמירה על תאימות מלאה בין שני הדגמים

Lab Access Risk 11.2

מיידי ולבדוק על המשקפיים ללא שינויי קוד Build, כך שניתן לבצע VR Device Simulator עם XR Device Simulator VRUnity Editor

Modular Design Benefit 11.3

ManagerAISprint 1 + 2.