Deliverable 2

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1 Introduction

1.1 Purpose

CareSync is being developed to provide an affordable and efficient digital solution for small independent clinics, including solo practitioners, dentists, and general practitioners. These clinics often lack the resources for comprehensive enterprise-level healthcare management systems, leading to inefficiencies in appointment scheduling, patient communication, and administrative tasks. The system aims to bridge this gap by offering streamlined appointment management, AI-assisted preliminary checkups, prescription monitoring, and virtual consultations.

1.2 Scope

1.2.1 Identification

The system under consideration is CareSync, a digital clinic management solution designed specifically for small independent medical practices.

1.2.2 Problem Statement

Based on the needs analysis, small independent clinics, including solo practitioners, dentists, and general practitioners, face significant challenges:

1. They lack access to affordable comprehensive healthcare management systems
2. Manual appointment scheduling and patient communication processes are inefficient and time-consuming
3. Administrative tasks occupy valuable time that could be spent on patient care
4. Limited resources prevent adoption of enterprise-level solutions
5. Poor coordination between preliminary assessments and actual consultations
6. Difficulty in managing prescriptions and follow-ups effectively

In light of these challenges, the system will include:

1. Web-based appointment booking and management
2. AI-guided preliminary checkup using decision trees
3. Automated patient notifications and reminders
4. Digital prescription monitoring and management
5. Virtual consultation capabilities via third-party integration
6. Role-based access control for different user types

The system will not include:

1. Advanced diagnostic AI requiring extensive medical datasets

2. Complex Electronic Health Record (EHR) functionality
3. Insurance processing and billing systems
4. Multi-location clinic management features

1.2.3 Application

CareSync will be deployed as a cloud-based clinic management application accessible through web browsers. The system aims to achieve the following:
Top-level Benefits:

1. Reduced administrative overhead through automation
2. Improved patient engagement and satisfaction
3. Enhanced clinical efficiency and resource utilization
4. Lower operational costs compared to enterprise solutions
5. Better coordination of care delivery

Objectives and Goals:

1. Achieve 50% reduction in administrative task time
2. Maintain 99.9% system availability
3. Reduce patient wait times by 40%
4. Decrease no-show rates by 30%
5. Enable 24/7 patient access to basic healthcare services
6. Ensure HIPAA compliance and data security
7. Support at least 1000 concurrent users
8. Process 500+ appointments daily per clinic

1.3 Product Overview

1.3.1 Product Perspective

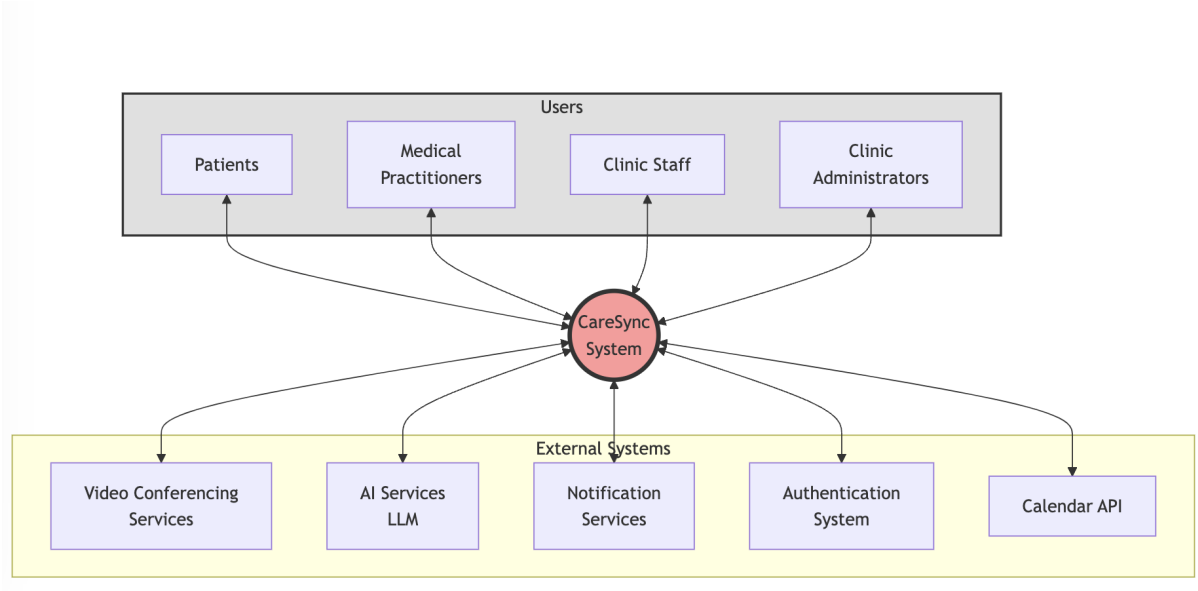
CareSync operates as a standalone system but integrates with external services where necessary:

1. **Video Conferencing Integration:** The system integrates with established platforms like Zoom or Google Meet for virtual consultations
2. **AI Services:** Utilizes a Large Language Model for parsing patient responses during preliminary checkups
3. **Notification Services:** Interfaces with email and SMS gateways for automated communications

4. **Calendar Services:** Provides a visual calender displaying empty and booked appointment slots, additionally allows the user to download the calender to be imported into their own respective calenders

5. **Authentication System:** Provides secure user authentication and role-based access control

The system is designed as a cloud-based solution, requiring only a web browser for access. This minimizes infrastructure requirements and maintenance overhead for small clinics.



1.3.2 Product Functions

CareSync delivers five core functional areas that together create a comprehensive clinic management solution:

Appointment Management System

1. Implements a smart scheduling engine that optimizes clinic utilization through intelligent time slot allocation

2. Provides automated conflict resolution to prevent double-bookings while maximizing provider availability

3. Maintains a waitlist management system with automatic notification of openings

4. Integrates a reminder system using email and SMS to reduce no-shows

5. Enables dynamic schedule modifications with automated patient notifications

AI-Assisted Clinical Assessment

1. Conducts preliminary patient evaluations using structured decision trees

2. Generates standardized pre-appointment health assessments
3. Provides intelligent symptom analysis with severity assessment
4. Creates detailed reports for healthcare providers prior to appointments
5. Maintains an adaptive questioning system based on patient responses
6. Includes emergency detection algorithms with automatic alerts for critical symptoms

Clinical Documentation Management

1. Manages digital prescription
2. Maintains comprehensive patient records
3. Generates clinical documentation from consultation notes
4. Tracks prescription lifecycle including renewals and expiration
5. Implements secure document sharing between providers and patients

Telehealth Service Platform

1. Delivers integrated video consultation capabilities with failover mechanisms
2. Supports real-time document sharing during virtual consultations
3. Provides virtual waiting room management
4. Enables secure messaging between providers and patients
5. Includes emergency backup communication channels
6. Offers technical support integration for session management

Practice Operations Management

1. Implements role-based access control with granular permission settings
2. Provides comprehensive analytics and reporting capabilities
3. Maintains regulatory compliance tracking and reporting

1.3.3 User Characteristics

The system caters to four primary user groups:

1. **Patients:** General public with varying levels of technical proficiency. May access the system through both desktop and mobile devices. Requires an interface with clear instructions.
2. **Medical Practitioners:** Healthcare professionals with limited time for technical training. Need efficient workflows and minimal system complexity.
3. **Clinic Staff:** Administrative personnel handling day-to-day operations. Require straightforward interfaces for managing appointments and patient records.
4. **Clinic Administrators:** Responsible for system oversight and configuration. Need access to reporting and management functions.

1.3.4 Limitations

The CareSync system operates under the following limitations and constraints:

Regulatory and Policy Requirements

1. Mandatory compliance with HIPAA Security and Privacy Rules
2. Adherence to GDPR data protection requirements for EU deployments
3. Compliance with PHIPA regulations for Canadian market
4. Conformance to DEA requirements for electronic prescriptions
5. Implementation of state-specific healthcare data regulations

Hardware and Infrastructure Limitations

1. Web browser-based access requiring HTML5 compatibility
2. Minimum 10 Mbps internet connectivity for video consultations
3. Storage capacity limited to 10,000 patient records per clinic
4. Maximum concurrent video streams based on bandwidth availability
5. Local printer and scanner compatibility requirements

Interface Constraints

1. REST API limitations for third-party integrations
2. WebRTC protocol restrictions for video conferencing
3. HL7 FHIR standards compliance for health data exchange
4. SMTP/IMAP protocols for email notifications
5. SMS gateway API limitations for mobile notifications

Operational Constraints

1. Single-clinic deployment model
2. Asynchronous data synchronization requirements
3. Automated backup scheduling limitations
4. Maximum 100 concurrent user sessions
5. Business hours availability requirement of 99.9

Quality and Performance Requirements

1. Maximum 3-second response time for standard operations
2. 500ms latency threshold for video consultations
3. Maximum 4-hour recovery time objective
4. Daily backup completion within maintenance window

Security and Safety Considerations

1. Mandatory multi-factor authentication
2. TLS 1.3 encryption requirement for all data transmission
3. 90-day password rotation policy
4. Maximum 15-minute session timeout

Human Factors

1. Basic technical literacy requirement for staff
2. Accessibility compliance with WCAG 2.1 guidelines
3. Language support limited to English
4. Maximum 2-hour training requirement for basic system operation

External System Dependencies

1. Cloud infrastructure provider SLA limitations
2. External authentication service availability
3. SMS/Email gateway delivery constraints
4. Real-time video conferencing platform dependencies

Parallel Operations

1. Limited support for parallel database operations
2. Constraint on simultaneous video conference sessions
3. Resource allocation limitations during peak usage periods

Control Functions

1. Administrative privileges limited to designated system administrators
2. Granular permission settings for clinical staff
3. Restricted modification capabilities for patient-facing interfaces

1.4 Definitions

1. **AI Decision Tree:** A structured algorithm that guides patients through a series of questions to assess symptoms and provide preliminary health assessments
2. **EHR:** Electronic Health Record - digital version of a patient's medical history
3. **HIPAA:** Health Insurance Portability and Accountability Act - U.S. legislation that provides data privacy and security provisions for medical information
4. **RBAC:** Role-Based Access Control - security approach that restricts system access based on users' roles
5. **Telehealth:** Delivery of healthcare services through telecommunications technologies
6. **Virtual Consultation:** Remote medical consultation conducted via video conferencing

2 References

The following sources were consulted during the development of this specification:

1. HIPAA Technical Safeguards Guidelines, U.S. Department of Health and Human Services
2. GDPR Healthcare Data Protection Requirements, European Data Protection Board
3. ISO 27001:2013 Information Security Management Systems Requirements
4. HL7 FHIR Standard for Healthcare Data Exchange, Release 4.0
5. Telehealth Implementation Guidelines, American Medical Association

3 Requirements

3.1 Functions

3.1.1 Appointment Management

1. The system shall allow patients to select available time slots for appointments with their preferred doctors.
2. The system shall allow patients to reschedule appointments.
3. The system shall allow patients to cancel appointments.
4. The system shall prevent double-booking of appointment slots.
5. The system shall enable doctors to set their availability schedules.
6. The system shall enable doctors to modify their availability schedules.

7. The system shall send automated appointment reminders via email.
8. The system shall send automated appointment reminders via SMS.
9. The system shall allow receptionists to view appointment schedules.
10. The system shall allow receptionists to modify appointment schedules.

3.1.2 User Authentication and Access Control

The system shall implement secure authentication and authorization mechanisms:

1. The system shall require user authentication through username and password.
2. The system shall implement role-based access control for different user types.
3. The system shall enforce password complexity requirements.
4. The system shall automatically log out inactive sessions after 15 minutes.
5. The system shall maintain audit logs of all system access.

3.1.3 Preliminary AI Checkup

The system shall provide AI-assisted preliminary health assessments:

1. The system shall present patients with relevant symptom assessment questions.
2. The system shall generate structured reports based on patient responses.
3. The system shall clearly indicate that AI assessments are preliminary only.
4. The system shall allow doctors to review AI-generated assessments before appointments.
5. The system shall maintain records of all preliminary assessments.

3.1.4 Virtual Consultations

The system shall facilitate remote medical consultations:

1. The system shall integrate with third-party video conferencing platforms.
2. The system shall generate secure meeting links for scheduled consultations.
3. The system shall enable doctors to access patient information during virtual consultations.
4. The system shall record consultation duration and basic metadata.
5. The system shall provide fallback options if video conferencing fails.

3.2 Performance Requirements

The system shall meet the following performance criteria:

3.2.1 Response Time

1. The system shall load web pages within 3 seconds under normal conditions
2. The system shall process standard transactions within 2 seconds
3. The system shall handle video streaming with less than 500ms latency

3.2.2 Capacity

1. The system shall support at least 100 concurrent users
2. The system shall handle 1000 appointments per day
3. The system shall store up to 10,000 patient records

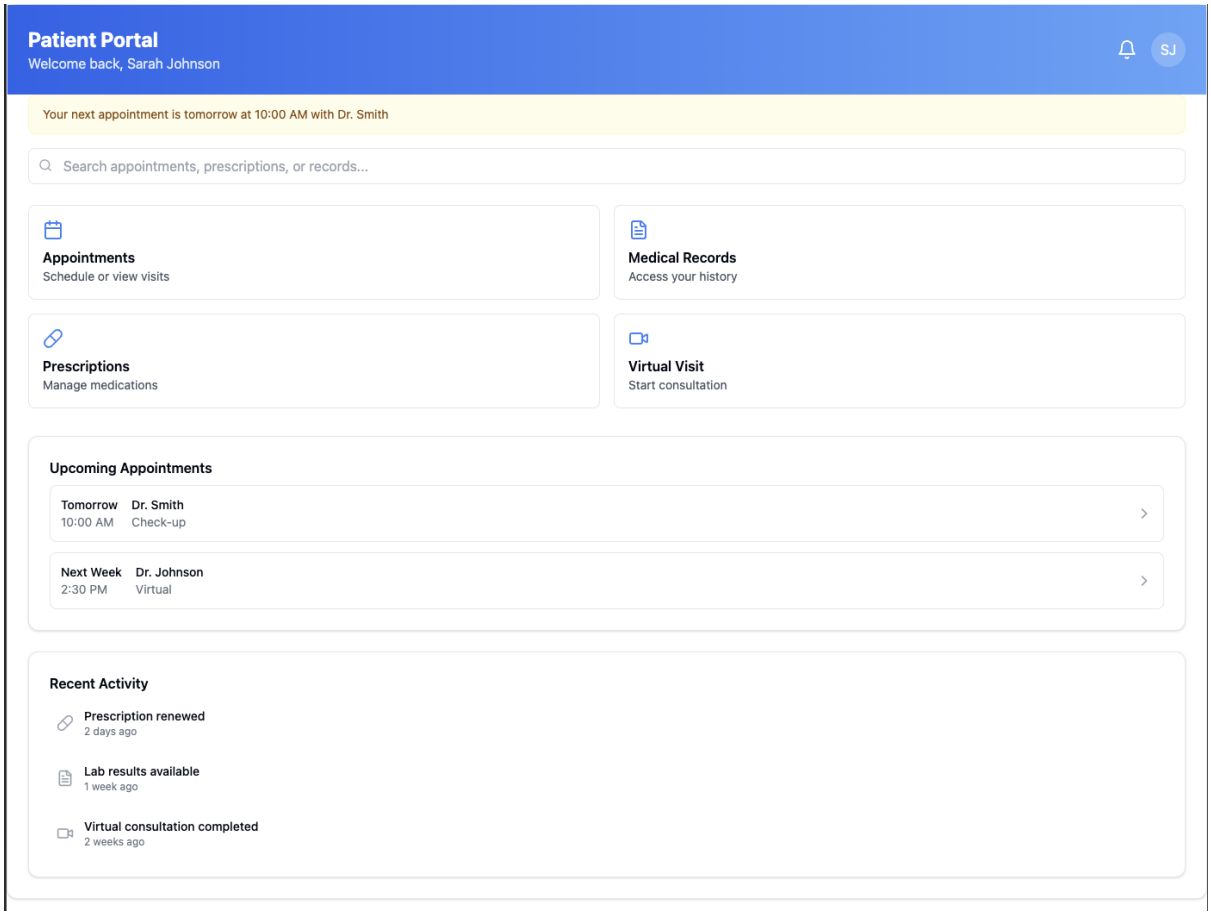
3.2.3 Reliability

1. The system shall maintain 99.9% uptime during business hours
2. The system shall perform automated backups daily
3. The system shall recover from failures within 30 minutes

3.3 Usability Requirements

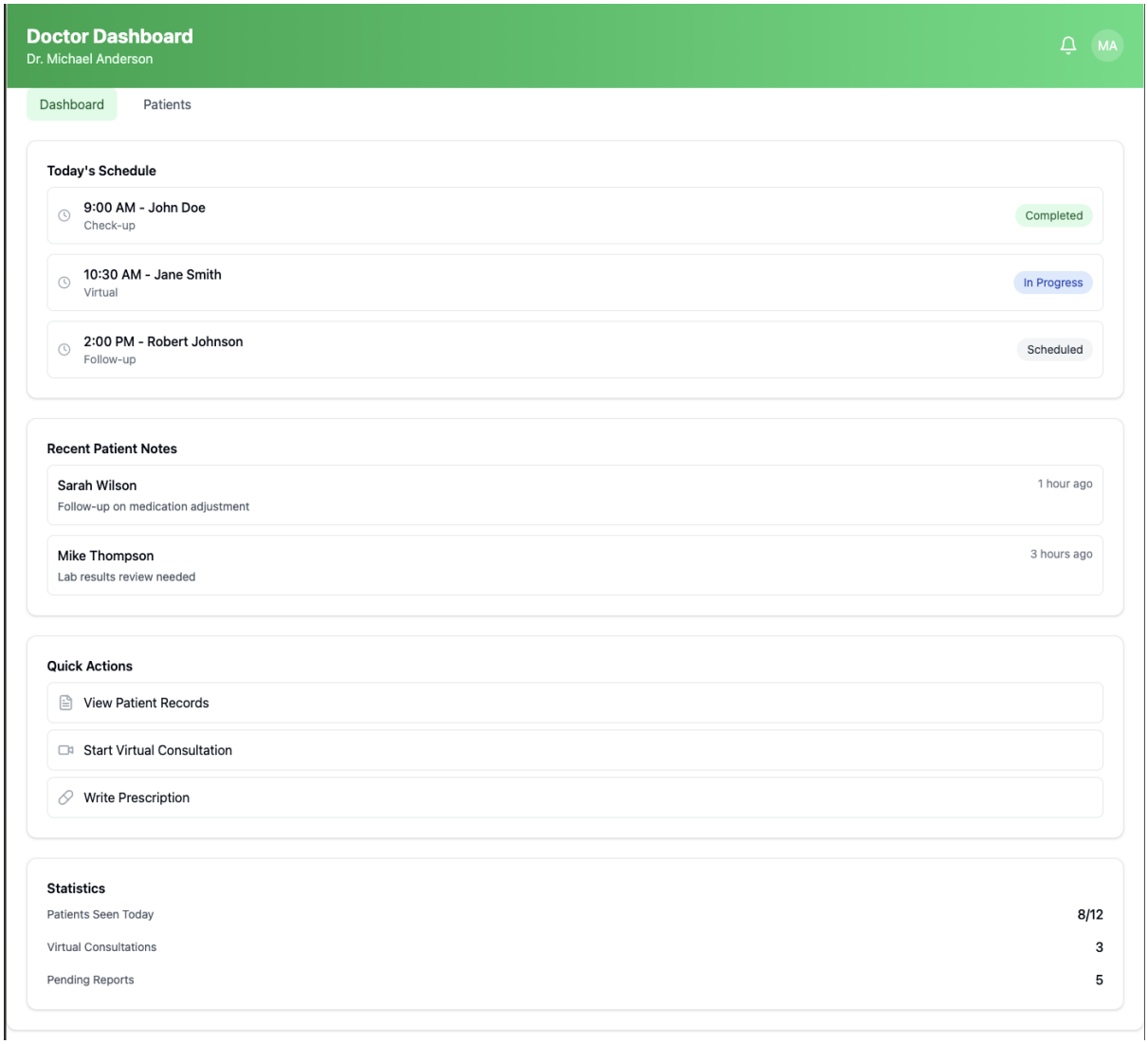
3.3.1 Patient Portal

1. The system shall display a minimalist interface.
2. The system shall implement a step-by-step appointment booking process with clear progress indicators.
3. The system shall provide one-click access to patient medical records from the dashboard.
4. The system shall display prescriptions in an easy-to-read format with clear instructions.
5. The system shall enable joining virtual consultations with a single click.
6. The system shall provide clear error messages.



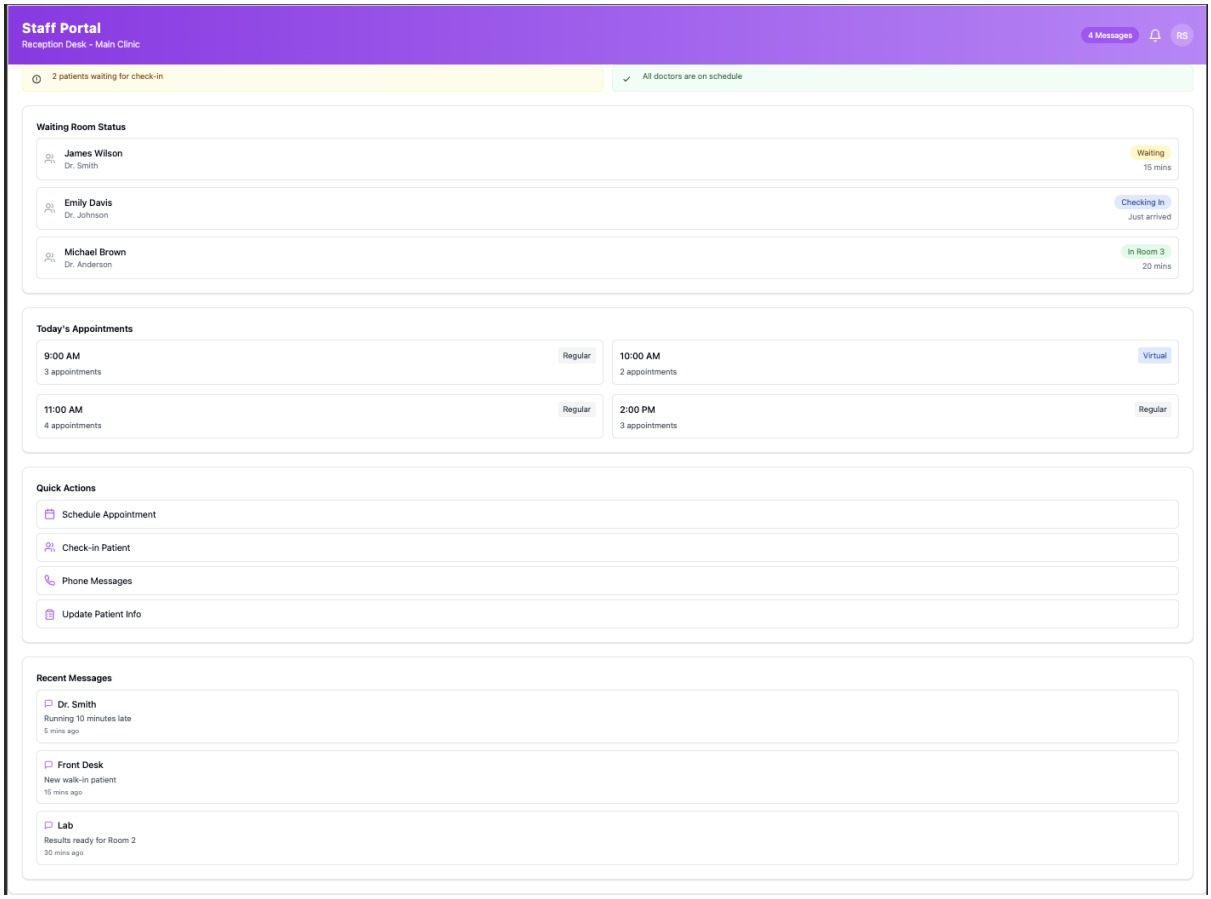
3.3.2 Doctor Dashboard

1. The system shall display today's appointments prominently on the dashboard.
2. The system shall provide quick search functionality for patient records.
3. The system shall enable prescription creation through a structured form interface.
4. The system shall integrate video consultation controls directly into the appointment view.
5. The system shall provide a calendar interface for managing availability.



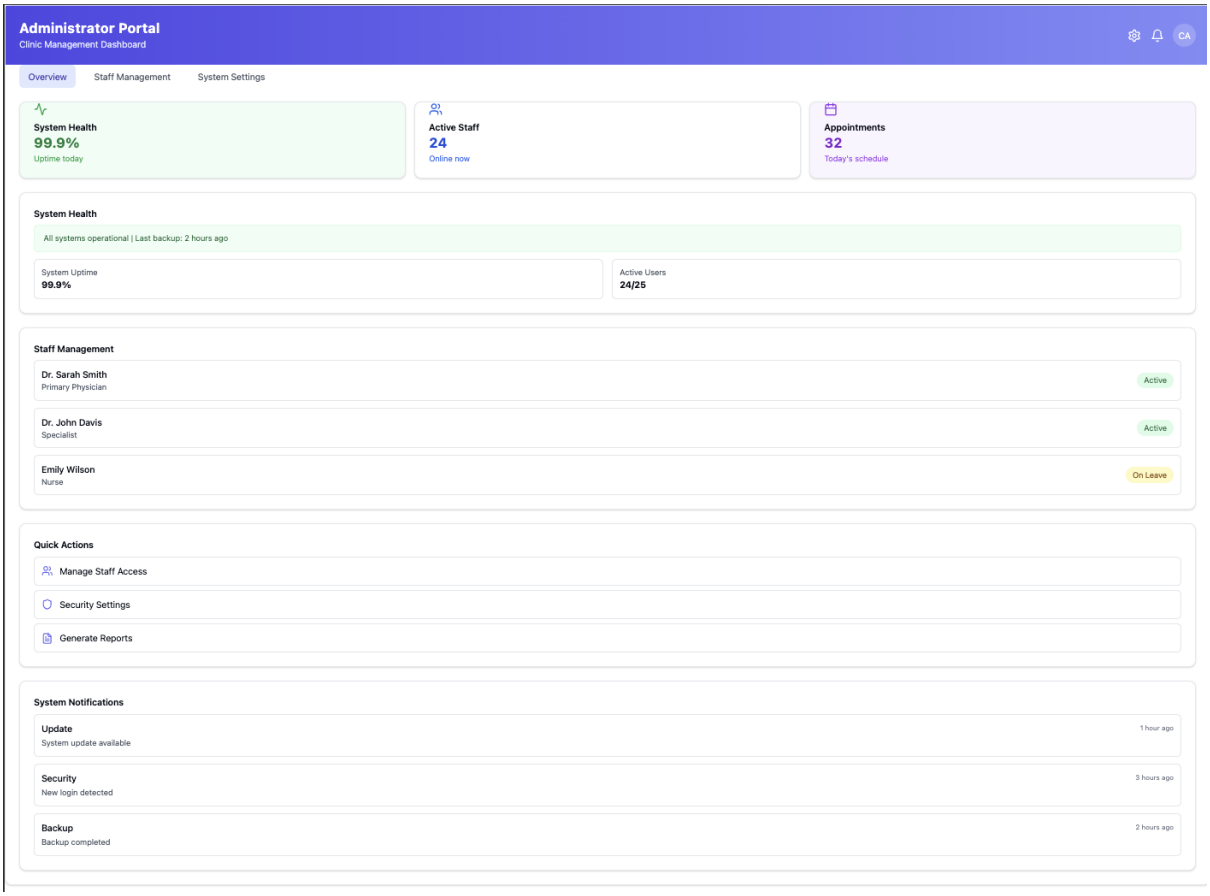
3.3.3 Clinical Staff Portal

1. The system shall display real-time patient wait times in the waiting room.
2. The system shall display the real-time current status of the waiting room.
3. The system shall provide alerts for patients requiring immediate check-in attention.
4. The system shall enable staff to manage patient check-in processes.
5. The system shall enable staff to manage patient check-out processes.
6. The system shall display appointment schedules organized by time slots.
7. The system shall enable quick access to patient information updates.
8. The system shall display notification alerts for doctor schedule changes.



3.3.4 Clinic Administrator Portal

1. The system shall provide real-time monitoring of system performance metric.
2. The system shall display staff attendance in real-time.
3. The system shall display availability status in real-time.
4. The system shall enable administrators to manage user access rights.
5. The system shall provide backup status.
6. The system shall provide maintenance notifications.
7. The system shall generate automated alerts for security-related events.
8. The system shall display the clinic's appointment volume metrics.
9. The system shall display the clinic's staff utilization metrics.
10. The system shall provide administrative controls for system configurations.
11. The system shall maintain an audit log of all system access.
12. The system shall enable administrators to generate operational reports.
13. The system shall provide a centralized interface for managing clinic-wide notifications.



3.4 Interface Requirements

The system shall support the following interfaces between CareSync and external systems or users:

3.4.1 User Interface Requirements

Patient Portal Web Interface

- **Purpose:** Primary interface for patients to access appointment booking, medical records, and telehealth services
- **Source/Destination:** Web browsers (Chrome, Firefox, Safari, Edge) on desktop and mobile devices
- **Valid Range:** Screen resolutions from 320px to 4K (3840px width)
- **Accuracy/Tolerance:** 99.9% rendering accuracy across supported browsers
- **Timing:** Maximum page load time of 3 seconds; real-time updates for appointment status changes
- **Relationships:** Interfaces with authentication system, appointment database, and notification services
- **Data Format:** HTML5, CSS3, JavaScript, responsive design with mobile-first approach

- **Command Format:** RESTful API calls with JSON payloads
- **Data Items:** User credentials, appointment details, medical history, prescription information, consultation records

Medical Practitioner Dashboard

- **Purpose:** Interface for doctors to manage patient appointments, access records, and conduct telehealth sessions
- **Source/Destination:** Web browsers on clinical workstations and tablets
- **Valid Range:** Screen resolutions from 768px to 4K (3840px width)
- **Accuracy/Tolerance:** 99.99% data accuracy requirement for medical information
- **Units of Measure:** Time in 24-hour format (HH:MM), measurements in metric system with imperial conversions
- **Timing:** Near real-time updates (maximum 5-second delay); sessions valid for 15 minutes before timeout
- **Relationships:** Integrates with patient records, scheduling system, and video conferencing service
- **Data Format:** HTML5, CSS3, JavaScript, with printable PDF report generation
- **Command Format:** RESTful API calls with authenticated JWT tokens
- **Data Items:** Patient demographics, medical history, appointment schedule, consultation notes, prescription details, lab results

3.4.2 External Communication Interfaces

Email Notification Interface

- **Purpose:** Send automated notifications and reminders to patients and staff
- **Source/Destination:** From CareSync system to user email clients
- **Valid Range:** Maximum email size of 100KB including attachments
- **Accuracy/Tolerance:** Delivery confirmation required for critical notifications
- **Units of Measure:** Time intervals for reminders (days, hours, minutes)
- **Timing:** Appointment reminders sent 48 hours, 24 hours, and 2 hours before scheduled time
- **Relationships:** Triggered by appointment scheduling system and notification rules engine
- **Data Format:** MIME-compliant messages in both HTML and plain text formats
- **Command Format:** SMTP protocol with TLS encryption
- **Data Items:** Recipient address, subject line, message body, appointment details, clinic contact information, cancellation/rescheduling links

SMS Gateway Interface

- **Purpose:** Deliver urgent notifications and appointment reminders via text message
- **Source/Destination:** From CareSync system to patient mobile devices
- **Valid Range:** Maximum 160 characters per SMS
- **Accuracy/Tolerance:** Delivery confirmation with 99% success rate
- **Units of Measure:** Message count, character count
- **Timing:** Critical alerts within 30 seconds, standard notifications within 5 minutes
- **Relationships:** Triggered by appointment system and emergency notification rules
- **Data Format:** UTF-8 text with URL shortening for web links
- **Command Format:** RESTful API calls to SMS gateway with JSON payloads
- **Data Items:** Recipient phone number, message content, sender ID, delivery priority flag

Video Conferencing Interface

- **Purpose:** Enable secure telehealth consultations between patients and providers
- **Source/Destination:** Bidirectional between patient devices and provider workstations
- **Valid Range:** Resolution from 480p to 1080p based on bandwidth availability
- **Accuracy/Tolerance:** Maximum 500ms latency, 99.5% uptime during business hours
- **Units of Measure:** Resolution (pixels), frame rate (fps), bitrate (kbps)
- **Timing:** Session setup within 10 seconds, maximum session duration of 60 minutes
- **Relationships:** Integrated with appointment scheduling and electronic health records
- **Data Format:** WebRTC protocol with H.264 video and Opus audio codecs
- **Command Format:** SDP for session negotiation, DTLS-SRTP for media encryption
- **Data Items:** Audio/video streams, chat messages, screen sharing content, session metadata

3.5 Logical Database Requirements

The system requires a structured database architecture to efficiently manage healthcare information while maintaining security, integrity, and compliance with regulatory standards. The following defines the key logical database requirements:

3.5.1 Patient Information Management

Types of Information: Patient demographics, contact details, medical history, allergies, insurance information, consent records, emergency contacts, and preferred communication methods.

Frequency of Use

- High-frequency read access during business hours (8AM-6PM): 30-50 reads per patient record per day
- Moderate write frequency: 2-5 updates per patient record per week
- Peak usage during morning hours (9AM-11AM) and evening hours (4PM-6PM)
- Batch processing for reports during off-hours (12AM-5AM)

Accessing Capabilities

- Role-based access with granular permission levels
- Read-only access for clinical support staff
- Read-write access for treating physicians and authorized nurses
- Patient self-service portal with limited read-write capabilities
- Administrative access restricted to clinic administrators

Data Relationships

- One-to-one relationship between patient and primary demographic record
- One-to-many relationship between patients and appointments
- One-to-many relationship between patients and prescriptions
- Many-to-many relationship between patients and treating physicians

Integrity Constraints

- Unique patient identifiers enforced through database constraints
- Mandatory fields: name, date of birth, contact information
- Referential integrity between patient records and dependent entities
- Validation rules for contact information (phone, email, address)
- Prevention of duplicate patient records through identity verification

Data Retention Requirements

- Core patient records retained for minimum 7 years after last activity
- Archived patient data maintained in compliance with HIPAA requirements
- Automated archiving process for inactive patient records
- Legal hold mechanism for records involved in ongoing care or litigation

3.5.2 Appointment Management System

Types of Information Appointment timestamps, duration, service type, provider assignment, room allocation, appointment status, check-in/check-out times, cancellation records, and rescheduling history.

Frequency of Use

- Very high read frequency: 100-200 reads per minute during business hours
- High write frequency: 20-30 writes per minute during peak scheduling periods
- Constant access throughout business hours (8AM-6PM)
- Low activity during off-hours with occasional after-hours emergency bookings

Accessing Capabilities

- Full access for reception and scheduling staff
- Provider-specific views for medical practitioners
- Limited creation/modification rights for patients through web portal
- Batch processing capabilities for recurring appointment generation
- Real-time synchronization with provider calendars

Data Relationships

- Many-to-one relationship between appointments and patients
- Many-to-one relationship between appointments and providers
- One-to-one relationship between appointments and scheduled rooms
- One-to-many relationship between appointments and notifications

Integrity Constraints

- Time slot validation preventing double-booking
- Business hours enforcement with override capability for emergencies
- Required fields: patient, provider, time, duration, and service type
- Status transition constraints (e.g., cannot transition from "cancelled" to "checked-in")
- Consistency checks between provider availability and appointment scheduling

Data Retention Requirements

- Appointment history maintained for 2 years in active database
- Archived appointment data retained for 5 additional years
- Statistical aggregation data retained indefinitely
- Appointment metadata maintained for audit and analytics purposes

3.5.3 Prescription and Medication Management

Types of Information Medication details, dosage instructions, prescription dates, issuing provider, refill information, pharmacy destination, medication history, contraindication alerts, and prescription status.

Frequency of Use

- Moderate read frequency: 10-20 reads per hour during clinic operations
- Low write frequency: 5-10 new prescriptions per hour
- Periodic batch verification for prescription expirations and refill eligibility
- Automated daily checks for drug interaction warnings

Accessing Capabilities

- Creation limited to authorized prescribing providers
- Read access for pharmacists through secure portal
- View-only access for nursing staff
- Patient access limited to their own current prescriptions
- Digital signature requirements for all modifications

Data Relationships

- Many-to-one relationship between prescriptions and patients
- Many-to-one relationship between prescriptions and prescribing providers
- Many-to-many relationship between prescriptions and medications
- One-to-many relationship between prescriptions and refill records

Integrity Constraints

- Digital signature validation for all new prescriptions and modifications
- DEA number verification for controlled substances
- Dosage range validation based on medication standards
- Duplicate prescription prevention
- Automated drug interaction checking
- Prescription lifecycle state management

Data Retention Requirements

- Prescription records retained for 10 years per regulatory requirements
- Controlled substance prescriptions subject to extended retention periods
- Immutable audit trail of all prescription activities
- Version history maintained for modified prescriptions

3.6 Design Constraints

3.6.1 Technical Standards

1. The system shall implement HTML5 and CSS3 standards for web interface development.
2. The system shall maintain compatibility with major browsers including Chrome, Firefox, Safari, and Edge.
3. The system shall utilize responsive design principles for optimal mobile device display.
4. The system shall employ TLS 1.3 or higher for all encrypted communications.

3.6.2 Regulatory Compliance

1. The system shall implement all security measures required by the HIPAA Security Rule.
2. The system shall incorporate data protection mechanisms compliant with GDPR standards.
3. The system shall maintain compliance with PHIPA requirements for Canadian deployments.

3.6.3 Hardware Compatibility Requirements

1. The system shall perform efficiently on standard clinic computing hardware.
2. The system shall maintain functionality over mobile network connections.
3. The system shall support integration with common clinical printing equipment.
4. The system shall support integration with common clinical scanning equipment.

3.7 Software System Attributes

3.7.1 Security

1. The system shall implement end-to-end encryption for all data transmissions.
2. The system shall require multi-factor authentication for accessing sensitive operations.
3. The system shall undergo regular security audits.
4. The system shall maintain comprehensive audit logs of all system activities.
5. The system shall include automated intrusion detection and prevention mechanisms.

3.7.2 Reliability

1. The system shall perform daily incremental backups through automated systems.
2. The system shall implement failover capabilities for all critical components.
3. The system shall provide error reporting mechanism.
4. The system shall maintain continuous system health monitoring.
5. The system shall implement disaster recovery procedures with a recovery time objective of 30 minutes.

3.7.3 Maintainability

1. The system shall utilize a modular architecture to facilitate updates.
2. The system shall include comprehensive system documentation.
3. The system shall support automated deployment procedures.
4. The system shall implement clear version control.
5. The system shall undergo regular performance optimization.

3.7.4 Portability

1. The system shall support cloud-based deployment for scalability.
2. The system shall provide browser-based access without local installation requirements.
3. The system shall implement platform-independent design principles.
4. The system shall support standard data formats for import operations.
5. The system shall support standard data formats for export operations.
6. The system shall utilize containerized services for flexible deployment options.

3.8 Additional Information

3.8.1 Sample Input/Output Formats

The system utilizes standardized formats for data exchange:

- **Appointment Booking Request Format:**

```
{
  "patientId": "P10042",
  "doctorId": "D2035",
  "appointmentType": "FOLLOW_UP",
  "preferredDate": "2025-03-15",
  "preferredTimeSlots": ["09:00-10:00", "14:00-15:00"],
  "reasonForVisit": "Blood pressure monitoring"
}
```

- **Appointment Confirmation Response Format:**

```
{
  "appointmentId": "APT20250315001",
  "patientId": "P10042",
  "doctorId": "D2035",
  "appointmentType": "FOLLOW_UP",
  "scheduledDateTime": "2025-03-15T09:30:00",
```

```
  "duration": 30,
  "location": "Virtual",
  "preparationInstructions": "Please complete health questionnaire
   before appointment. Have blood pressure readings from last week ready.",
  "virtualMeetingLink": "https://caresync.com/v/APT20250315001"
}
```


3.8.2 Problem Context Background

Small independent medical practices face unique challenges in the current healthcare ecosystem:

- Increasing administrative burden amid changing healthcare regulations
- Limited IT infrastructure and technical support capabilities
- Growing patient expectations for digital engagement
- Regulatory compliance requirements disproportionately impacting small practices
- Market pressure from hospital-owned practices and corporate healthcare chains
- Time constraints limiting direct patient care opportunities

This system addresses these challenges through automation, simplified workflows, and accessible technology integration, enabling small practices to remain competitive while focusing on patient care rather than administrative tasks.

3.8.3 Deployment and Security Packaging Requirements

The software deployment package must adhere to the following requirements:

- All code repositories must implement RBAC with granular permission controls
- Deployment packages must be digitally signed and verified before installation
- Database initialization scripts must include data masking for test environments
- All deployments must include automated verification of HIPAA Security Rule controls
- System must support multi-tenant isolation with separate encryption keys per clinic
- Backup and disaster recovery procedures must be included with all deployments
- Installation media must support secure boot verification on clinic workstations
- Configuration management must enforce principle of least privilege by default

4 Verification

The system shall undergo comprehensive verification through the following approaches:

4.1 Functional Testing

1. Automated unit testing for all system components
2. Integration testing of system interfaces
3. End-to-end testing of complete workflows
4. User acceptance testing with stakeholder involvement

4.2 Security Testing

1. Penetration testing by certified security professionals
2. Vulnerability scanning and assessment
3. Compliance audit verification
4. Privacy impact assessment

4.3 Performance Testing

1. Load testing under expected usage patterns
2. Stress testing to determine system limits
3. Endurance testing for long-term stability
4. Recovery testing from various failure scenarios

5 Appendices

5.1 Assumptions and Dependencies

5.1.1 Assumptions

The system development assumes:

1. Availability of reliable internet connectivity
2. Access to secure cloud hosting services
3. Compatibility with standard clinic hardware
4. Availability of third-party API services
5. User access to standard web browsers
6. Basic technical literacy of clinic staff

5.1.2 Dependencies

Key dependencies include:

1. Third-party video conferencing services
2. SMS and email gateway providers
3. Cloud infrastructure providers
4. Authentication service providers
5. Calendar API services

5.2 Acronyms and Abbreviations

1. **API:** Application Programming Interface
2. **EHR:** Electronic Health Record
3. **FHIR:** Fast Healthcare Interoperability Resources
4. **GDPR:** General Data Protection Regulation
5. **HIPAA:** Health Insurance Portability and Accountability Act
6. **HL7:** Health Level Seven
7. **HTTPS:** Hypertext Transfer Protocol Secure
8. **MFA:** Multi-Factor Authentication
9. **PHIPA:** Personal Health Information Protection Act
10. **RBAC:** Role-Based Access Control
11. **REST:** Representational State Transfer
12. **SLA:** Service Level Agreement
13. **SMS:** Short Message Service
14. **TLS:** Transport Layer Security
15. **AI:** Artificial Intelligence
16. **JSON:** JavaScript Object Notation
17. **JWT:** JSON Web Token
18. **SDP:** Session Description Protocol
19. **DTLS:** Datagram Transport Layer Security
20. **SRTP:** Secure Real-Time Transport Protocol
21. **UI:** User Interface

22. **HTML5:** HyperText Markup Language version 5
23. **CSS3:** Cascading Style Sheets version 3
24. **RDBMS:** Relational Database Management System