

# CA Services System Documentation

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## Overview

The CA Services System is a comprehensive solution for managing Chartered Accountant (CA) services including GST registration, company registration, tax filing, and compliance services. It provides a complete workflow from service discovery to application submission, document management, status tracking, and expert support.

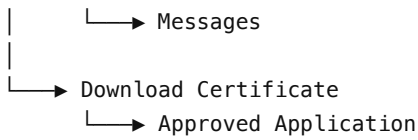
### Key Features

- ✔ **Service Catalog:** Browse categories, subcategories, and services
- ✔ **Application Management:** Submit and track service applications
- ✔ **Document Upload:** Secure document upload and verification
- ✔ **Status Tracking:** Real-time application status with timeline
- ✔ **Chat Support:** Direct communication with CA experts
- ✔ **Certificate Download:** Download approved certificates
- ✔ **Callback Requests:** Request callback from CA experts
- ✔ **Testimonials & Courses:** Educational content and customer reviews

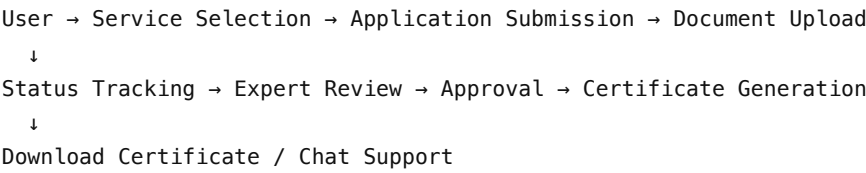
## System Architecture

### Core Components





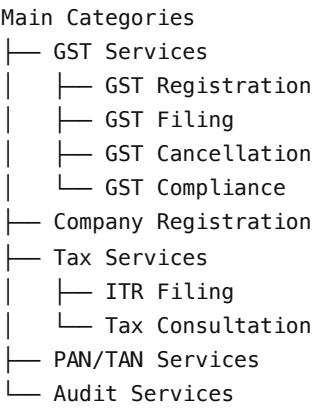
Data Flow



Service Catalog System

Category Structure

The system supports a hierarchical category structure:



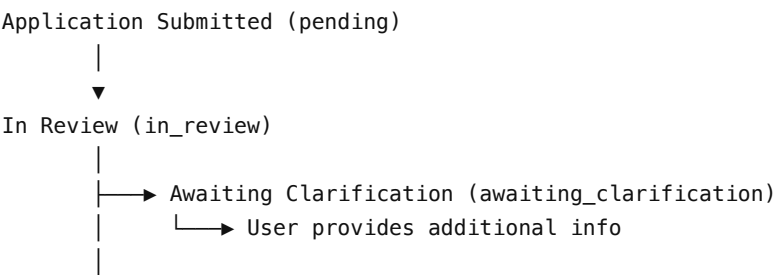
Service Information

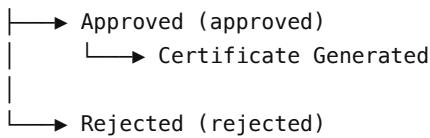
Each service includes:

- **Basic Info:** Title, description, logo
- **Pricing:** Current price and crossed-out price
- **Timeline:** Estimated completion time
- **Features:** List of service features
- **Required Documents:** Document checklist
- **Process Steps:** Step-by-step process

Application Management

Application Lifecycle





Application Fields

Client Details:

- Client Name
- Business Name
- GSTIN (optional, for existing businesses)
- Address Proof

Documents:

- Aadhar Card
- PAN Card
- Address Proof
- Business Proof (if applicable)
- Other documents as required

Additional Info:

- Business Type (for company registration)
- Turnover (for GST services)
- Custom notes

Timeline Tracking

Each application maintains a timeline with:

- **Title:** Status title
- **Time:** Timestamp or "Current"
- **Status:** completed | current | pending
- **Icon:** Visual indicator
- **Description:** Status description

Example Timeline:

```
[
  {
    "title": "Application Submitted",
    "time": "10:30 AM",
    "status": "completed",
    "icon": "check_circle",
    "timestamp": "2024-01-01T10:30:00.000Z",
    "description": "Your application has been received"
  },
  {
    "title": "In Review",
    "time": "Current",
    "status": "current",
    "icon": "hourglass_empty",
    "timestamp": "2024-01-01T11:00:00.000Z",
    "description": "CA expert is reviewing your documents"
  }
]
```

# Document Management

## Document Types

- **aadhar:** Aadhar Card
- **pan:** PAN Card
- **address\_proof:** Address Proof
- **business\_proof:** Business Registration Proof
- **other:** Other documents

## Upload Process

1. **File Selection:** User selects file (PDF, JPG, PNG)
2. **Validation:** File type and size validation (max 10MB)
3. **Upload:** File saved to server/cloud storage
4. **Verification:** CA expert reviews document
5. **Status Update:** Document marked as verified/rejected

## File Requirements

- **Max Size:** 10MB per file
- **Allowed Formats:** PDF, JPG, JPEG, PNG
- **Storage:** Local storage (development) / Cloud storage (production)

---

# Chat & Support System

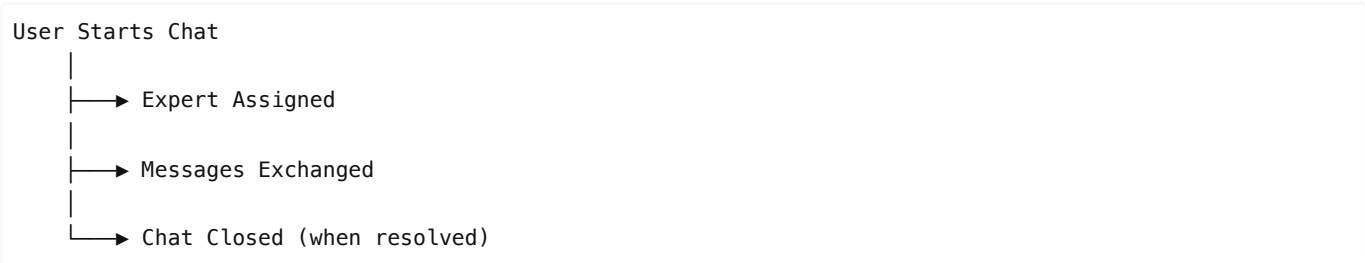
## Chat Features

- **Expert Assignment:** Automatic assignment to available CA expert
- **Real-time Messaging:** Send and receive messages
- **File Attachments:** Attach documents in chat
- **Read Receipts:** Track message read status
- **Chat History:** View complete conversation history

## Support Options

1. **Live Chat:** Instant messaging with CA expert
2. **Callback Request:** Request phone callback
3. **Phone Support:** Direct phone number for urgent queries

## Chat Flow



---

# Data Models

## CAServiceCategory Model

```
{
  id: string;
  cat_name: string;
```

```

cat_img: string;
status: number; // 1 = active, 0 = inactive
parentCategoryId?: ObjectId; // For subcategories
order: number; // Display order
hasCheckmark?: boolean; // For active/completed services
createdAt: Date;
updatedAt: Date;
}

```

## CAService Model

```

{
  id: string;
  title: string;
  description: string;
  logo: string;
  price: number;
  cross_price?: number;
  categoryId: ObjectId;
  subcategoryId?: ObjectId;
  estimatedTime: string; // "7-10 days"
  isActive: boolean;
  features: string[];
  requiredDocuments: Array<{
    name: string;
    type: string;
    isRequired: boolean;
  }>;
  processSteps: string[];
  serviceType: string; // gst_registration, company_registration, etc.
  createdAt: Date;
  updatedAt: Date;
}

```

## CAApplication Model

```

{
  id: string;
  applicationId: string; // Display ID like "APP001"
  userId: ObjectId;
  serviceId: ObjectId;
  serviceType: string;
  status: 'pending' | 'in_review' | 'awaiting_clarification' |
    'approved' | 'rejected' | 'completed';
  clientDetails: {
    clientName: string;
    businessName: string;
    gstin?: string;
    addressProof?: string;
  };
  documents: {
    aadhar?: string;
    pan?: string;
    addressProof?: string;
  };
}

```

```

    [key: string]: string | undefined;
  };
  additionalInfo?: {
    businessType?: string;
    turnover?: number;
    notes?: string;
    [key: string]: any;
  };
  timeline: Array<{
    title: string;
    time: string;
    status: 'completed' | 'current' | 'pending';
    icon: string;
    timestamp?: Date;
    description?: string;
  }>;
  certificateNumber?: string;
  downloadUrl?: string;
  issuedAt?: Date;
  price: number;
  expertId?: ObjectId; // Assigned CA expert
  submittedAt: Date;
  updatedAt: Date;
}

```

## CADocument Model

```

{
  id: string;
  documentId: string; // Display ID
  userId: ObjectId;
  applicationId?: ObjectId;
  documentType: 'aadhar' | 'pan' | 'address_proof' |
    'business_proof' | 'other';
  documentUrl: string;
  fileName: string;
  fileSize: number;
  mimeType: string;
  uploadedAt: Date;
  verifiedAt?: Date;
  verificationStatus: 'pending' | 'verified' | 'rejected';
  rejectionReason?: string;
  createdAt: Date;
  updatedAt: Date;
}

```

## CAChat Model

```

{
  id: string;
  chatId: string; // Display ID
  userId: ObjectId;
  expertId: ObjectId;
  applicationId?: ObjectId;
}

```

```
status: 'active' | 'closed';
startedAt: Date;
lastMessageAt: Date;
closedAt?: Date;
createdAt: Date;
updatedAt: Date;
}
```

## CAChatMessage Model

```
{
  id: string;
  messageId: string;
  chatId: ObjectId;
  senderId: ObjectId;
  senderType: 'user' | 'expert';
  message: string;
  attachments?: string[]; // File URLs
  isRead: boolean;
  timestamp: Date;
  createdAt: Date;
  updatedAt: Date;
}
```

## CACallback Model

```
{
  id: string;
  callbackId: string;
  userId: ObjectId;
  phoneNumber: string;
  preferredTime: string;
  applicationId?: ObjectId;
  reason?: string;
  status: 'pending' | 'scheduled' | 'completed' | 'cancelled';
  requestedAt: Date;
  scheduledAt?: Date;
  completedAt?: Date;
  createdAt: Date;
  updatedAt: Date;
}
```

---

## API Endpoints

### Priority 1: Service Catalog APIs

#### 1. Get Service Categories

**Endpoint:** GET /api/v1/ca/category

**Headers:**

```
Authorization: Bearer {token}
```

**Response:**

```
{
  "success": true,
  "data": [
    {
      "id": "1",
      "cat_name": "GST Services",
      "cat_img": "https://example.com/images/gst.jpg",
      "status": 1,
      "hasCheckmark": true
    }
  ]
}
```

**Frontend Usage:** Service categories display, main navigation

---

## 2. Get Service Subcategories

**Endpoint:** GET /api/v1/ca/category/:categoryId/subcategory

**Response:**

```
{
  "success": true,
  "data": [
    {
      "id": "11",
      "cat_name": "GST Registration",
      "cat_img": "https://example.com/images/gst-reg.jpg",
      "status": 1,
      "parentCategoryId": "1"
    }
  ]
}
```

**Frontend Usage:** Subcategory listing after category selection

---

## 3. Get Services by Category/Subcategory

**Endpoint:** GET /api/v1/ca/services?categoryId=1&subcategoryId=11&page=1&limit=20

**Query Parameters:**

- categoryId : string (optional)
- subcategoryId : string (optional)
- page : number (default: 1)
- limit : number (default: 20)

**Response:**

```
{
  "success": true,
  "data": {
    "services": [
      {
        "id": "101",
```



```
    "title": "GST Registration for New Business",
    "description": "Complete GST registration process...",
    "logo": "https://example.com/images/gst-reg-service.jpg",
    "price": 999,
    "cross_price": 1499,
    "categoryId": "1",
    "subcategoryId": "11",
    "estimatedTime": "7-10 days",
    "isActive": true
  }
],
"pagination": {
  "page": 1,
  "limit": 20,
  "total": 50,
  "totalPages": 3
}
}
```

---

#### 4. Get Service Details

**Endpoint:** GET /api/v1/ca/services/:serviceId

**Response:**

```
{
  "success": true,
  "data": {
    "id": "101",
    "title": "GST Registration for New Business",
    "description": "Complete GST registration process...",
    "logo": "https://example.com/images/gst-reg-service.jpg",
    "price": 999,
    "cross_price": 1499,
    "categoryId": "1",
    "subcategoryId": "11",
    "estimatedTime": "7-10 days",
    "features": [
      "Expert CA guidance",
      "Document verification",
      "Application submission",
      "Status tracking"
    ],
    "requiredDocuments": [
      {
        "name": "Aadhar Card",
        "type": "aadhar",
        "isRequired": true
      }
    ],
    "processSteps": [
      "Fill application form",
      "Upload documents",
      "CA review",
      "Application submission",
    ]
  }
}
```

```
    "Certificate delivery"
  ]
}
}
```

---

## 5. Get GST Service Tabs

**Endpoint:** GET /api/v1/ca/services/gst/tabs

**Response:**

```
{
  "success": true,
  "data": {
    "tabs": [
      {
        "id": "gst_registration",
        "name": "GST Registration",
        "isActive": true
      },
      {
        "id": "gst_filing",
        "name": "GST Filing",
        "isActive": true
      }
    ]
  }
}
```

---

## Priority 2: Application Management APIs

### 6. Submit Service Application

**Endpoint:** POST /api/v1/ca/applications

**Request Body:**

```
{
  "serviceId": "101",
  "serviceType": "gst_registration",
  "clientDetails": {
    "clientName": "John Doe",
    "businessName": "ABC Business Pvt Ltd",
    "gstIn": "29ABCDE1234F1Z5",
    "addressProof": "Address proof text"
  },
  "documents": {
    "aadhar": "https://example.com/uploads/aadhar_12345.pdf",
    "pan": "https://example.com/uploads/pan_12345.pdf"
  },
  "additionalInfo": {
    "businessType": "private_limited",
    "turnover": 5000000,
    "notes": "Additional information"
  }
}
```

```
}  
}
```

**Response:**

```
{  
  "success": true,  
  "message": "Application submitted successfully",  
  "data": {  
    "applicationId": "APP000001",  
    "serviceId": "101",  
    "serviceTitle": "GST Registration for New Business",  
    "status": "pending",  
    "submittedAt": "2024-01-01T10:30:00.000Z",  
    "estimatedCompletionTime": "7-10 days"  
  }  
}
```

---

## 7. Upload Document

**Endpoint:** POST /api/v1/ca/documents/upload

**Request:** Multipart form data

- file : File (required) - PDF, JPG, or PNG
- documentType : "aadhar" | "pan" | "address\_proof" | "business\_proof" | "other" (required)
- applicationId : string (optional)

**Response:**

```
{  
  "success": true,  
  "data": {  
    "documentId": "DOC000001",  
    "documentUrl": "https://example.com/uploads/ca/documents/file-1234567890.pdf",  
    "documentType": "aadhar",  
    "fileName": "aadhar_card.pdf",  
    "fileSize": 245678,  
    "uploadedAt": "2024-01-01T10:35:00.000Z"  
  }  
}
```

**File Requirements:**

- Max size: 10MB
- Allowed types: PDF, JPG, JPEG, PNG

---

## 8. Get Application Status

**Endpoint:** GET /api/v1/ca/applications/:applicationId/status

**Response:**

```
{  
  "success": true,  
  "data": {
```

```

"applicationId": "APP000001",
"serviceTitle": "GST Registration for New Business",
"status": "in_review",
"currentStatus": "In Review",
"timeline": [
  {
    "title": "Application Submitted",
    "time": "10:30 AM",
    "status": "completed",
    "icon": "check_circle",
    "timestamp": "2024-01-01T10:30:00.000Z",
    "description": "Your application has been received"
  },
  {
    "title": "In Review",
    "time": "Current",
    "status": "current",
    "icon": "hourglass_empty",
    "timestamp": "2024-01-01T11:00:00.000Z",
    "description": "CA expert is reviewing your documents"
  }
],
"canDownload": false,
"downloadUrl": null,
"certificateNumber": null,
"issuedAt": null
}
}

```

## 9. Get User Applications

**Endpoint:** GET /api/v1/ca/applications?status=pending&page=1&limit=20

### Query Parameters:

- status : "pending" | "in\_review" | "awaiting\_clarification" | "approved" | "rejected" | "completed" (optional)
- serviceType : string (optional)
- page : number (default: 1)
- limit : number (default: 20)
- startDate : ISO date string (optional)
- endDate : ISO date string (optional)

### Response:

```

{
  "success": true,
  "data": {
    "applications": [
      {
        "id": "507f1f77bcf86cd799439011",
        "applicationId": "APP000001",
        "service": "GST Registration",
        "serviceId": "101",
        "status": "Approved",
        "date": "2024-01-15",

```

```
    "submittedAt": "2024-01-01T10:30:00.000Z",
    "canDownload": true,
    "certificateNumber": "CERT123456789",
    "price": 999
  }
],
"pagination": {
  "page": 1,
  "limit": 20,
  "total": 15,
  "totalPages": 1
},
"summary": {
  "totalApplications": 15,
  "pending": 3,
  "inReview": 2,
  "approved": 8,
  "rejected": 2
}
}
```

---

## 10. Download Certificate/Document

**Endpoint:** GET /api/v1/ca/applications/:applicationId/download?type=certificate

**Query Parameters:**

- type: "certificate" | "application" | "invoice" (default: "certificate")

**Response:**

```
{
  "success": true,
  "data": {
    "downloadUrl": "https://example.com/certificates/APP000001.pdf",
    "fileName": "Certificate_APP000001.pdf",
    "expiresAt": "2024-01-08T10:30:00.000Z"
  }
}
```

---

## 11. Update Application Status (Admin/CA)

**Endpoint:** PATCH /api/v1/ca/applications/:applicationId/status

**Request Body:**

```
{
  "status": "in_review",
  "notes": "Documents verified, proceeding with submission",
  "timelineUpdate": {
    "title": "In Review",
    "description": "CA expert is reviewing your documents",
    "icon": "hourglass_empty"
  }
}
```

**Response:**

```
{
  "success": true,
  "data": {
    "applicationId": "APP000001",
    "status": "in_review",
    "updatedAt": "2024-01-01T16:00:00.000Z"
  }
}
```

**Note:** This is typically an admin/CA endpoint, not for regular users.

---

## 12. Request Clarification

**Endpoint:** POST /api/v1/ca/applications/:applicationId/clarification

**Request Body:**

```
{
  "message": "Please provide additional address proof",
  "requiredDocuments": ["address_proof"],
  "deadline": "2024-01-10T00:00:00.000Z"
}
```

**Response:**

```
{
  "success": true,
  "data": {
    "clarificationId": "CLAR123456",
    "applicationId": "APP000001",
    "status": "pending",
    "requestedAt": "2024-01-01T16:00:00.000Z"
  }
}
```

---

## Priority 3: Support & Communication APIs

### 13. Start Chat with CA Expert

**Endpoint:** POST /api/v1/ca/chat/start

**Request Body:**

```
{
  "applicationId": "APP000001",
  "serviceType": "gst_registration",
  "message": "Hello, I need help with my GST registration"
}
```

**Response:**

```
{
  "success": true,
```

```
"data": {
  "chatId": "CHAT000001",
  "expertId": "EXP001",
  "expertName": "CA Expert",
  "expertImage": "https://example.com/images/ca-expert.jpg",
  "isOnline": true,
  "startedAt": "2024-01-01T15:00:00.000Z"
}
```

---

#### 14. Send Chat Message

**Endpoint:** POST /api/v1/ca/chat/:chatId/messages

**Request Body:**

```
{
  "message": "I need clarification on document requirements",
  "attachments": []
}
```

**Response:**

```
{
  "success": true,
  "data": {
    "messageId": "MSG000001",
    "chatId": "CHAT000001",
    "message": "I need clarification on document requirements",
    "senderId": "USER123",
    "senderType": "user",
    "timestamp": "2024-01-01T15:05:00.000Z",
    "isRead": false
  }
}
```

---

#### 15. Get Chat Messages

**Endpoint:** GET /api/v1/ca/chat/:chatId/messages?page=1&limit=50

**Query Parameters:**

- page : number (default: 1)
- limit : number (default: 50)
- before : ISO date string (optional, for pagination)

**Response:**

```
{
  "success": true,
  "data": {
    "messages": [
      {
        "id": "507f1f77bcf86cd799439011",
        "message": "Hello! How can I help you?",
        "senderId": "EXP001",
```

```
    "senderType": "expert",
    "senderName": "CA Expert",
    "isUser": false,
    "timestamp": "2024-01-01T15:00:00.000Z",
    "isRead": true
  },
  {
    "id": "507f1f77bcf86cd799439012",
    "message": "I need help with GST registration",
    "senderId": "USER123",
    "senderType": "user",
    "isUser": true,
    "timestamp": "2024-01-01T15:05:00.000Z",
    "isRead": true
  }
],
"pagination": {
  "page": 1,
  "limit": 50,
  "hasMore": false
}
}
```

## 16. Get Active Chats

**Endpoint:** GET /api/v1/ca/chat

**Response:**

```
{
  "success": true,
  "data": {
    "chats": [
      {
        "chatId": "CHAT000001",
        "expertId": "EXP001",
        "expertName": "CA Expert",
        "expertImage": "https://example.com/images/ca-expert.jpg",
        "lastMessage": "I need help with GST registration",
        "lastMessageTime": "2024-01-01T15:05:00.000Z",
        "unreadCount": 2,
        "isOnline": true,
        "applicationId": "APP000001"
      }
    ]
  }
}
```

## 17. Request Callback

**Endpoint:** POST /api/v1/ca/support/callback

**Request Body:**



```
{
  "phoneNumber": "+919876543210",
  "preferredTime": "10:00 AM - 12:00 PM",
  "applicationId": "APP000001",
  "reason": "Need clarification on GST registration process"
}
```

**Response:**

```
{
  "success": true,
  "message": "Callback request submitted successfully",
  "data": {
    "callbackId": "CALLBACK000001",
    "requestedAt": "2024-01-01T16:00:00.000Z",
    "estimatedCallbackTime": "Within 2 hours",
    "status": "pending"
  }
}
```

---

## 18. Get Support Phone Number

**Endpoint:** GET /api/v1/ca/support/phone

**Response:**

```
{
  "success": true,
  "data": {
    "phoneNumber": "+911234567890",
    "availableHours": "9:00 AM - 6:00 PM",
    "availableDays": "Monday - Saturday",
    "isAvailable": true
  }
}
```

---

## Priority 4: Additional Features APIs

### 19. Get Testimonials

**Endpoint:** GET /api/v1/ca/testimonials?type=video&limit=10

**Query Parameters:**

- type : "video" | "text" (optional)
- limit : number (default: 10)

**Response:**

```
{
  "success": true,
  "data": {
    "testimonials": [
      {
        "id": "1",

```

```
        "title": "Excellent GST Services",
        "type": "youtube",
        "video": "https://www.youtube.com/watch?v=dQw4w9WgXcQ",
        "thumbnail": "https://example.com/thumbnails/testimonial1.jpg",
        "duration": "2:30",
        "rating": 5,
        "customerName": "John Doe",
        "serviceType": "gst_registration"
    }
  ]
}
```

---

## 20. Get Recent Courses

**Endpoint:** GET /api/v1/ca/courses?limit=10&category=gst

**Query Parameters:**

- limit : number (default: 10)
- category : string (optional)

**Response:**

```
{
  "success": true,
  "data": {
    "courses": [
      {
        "id": "1",
        "title": "Learn and Earn with Demat Account",
        "thumbnail": "https://example.com/thumbnails/course1.jpg",
        "duration": "2:30",
        "category": "investment",
        "views": 1250,
        "rating": 4.5
      }
    ]
  }
}
```

---

## Workflow Examples

### Example 1: Complete Application Flow

#### 1. User Browses Services

```
GET /api/v1/ca/category
→ Selects "GST Services"
→ GET /api/v1/ca/category/1/subcategory
→ Selects "GST Registration"
→ GET /api/v1/ca/services?subcategoryId=11
```

#### 2. User Views Service Details

```
GET /api/v1/ca/services/101
→ Reviews features, documents, process
```

### 3. User Submits Application

```
POST /api/v1/ca/applications
Body: {
  serviceId: "101",
  clientDetails: {...},
  documents: {...}
}
→ Application created with status "pending"
→ Returns applicationId: "APP000001"
```

### 4. User Uploads Documents

```
POST /api/v1/ca/documents/upload
Form Data: {
  file: <file>,
  documentType: "aadhar",
  applicationId: "APP000001"
}
→ Document uploaded and linked to application
```

### 5. User Tracks Status

```
GET /api/v1/ca/applications/APP000001/status
→ View timeline and current status
```

### 6. Application Approved

```
PATCH /api/v1/ca/applications/APP000001/status (Admin)
→ Status changed to "approved"
→ Certificate generated
→ Timeline updated
```

### 7. User Downloads Certificate

```
GET /api/v1/ca/applications/APP000001/download
→ Download certificate PDF
```

---

## Example 2: Chat Support Flow

### 1. User Starts Chat

```
POST /api/v1/ca/chat/start
Body: {
  applicationId: "APP000001",
  message: "I need help with my application"
}
→ Chat created, expert assigned
→ Returns chatId: "CHAT000001"
```

### 2. User Sends Messages

```
POST /api/v1/ca/chat/CHAT000001/messages
Body: {
  message: "When will my application be reviewed?"
}
→ Message sent
```

### 3. User Receives Response

```
GET /api/v1/ca/chat/CHAT000001/messages
→ View all messages including expert responses
```

### 4. User Views Active Chats

```
GET /api/v1/ca/chat
→ List of all active chat sessions
```

---

## Example 3: Request Callback Flow

### 1. User Requests Callback

```
POST /api/v1/ca/support/callback
Body: {
  phoneNumber: "+919876543210",
  preferredTime: "10:00 AM - 12:00 PM",
  applicationId: "APP000001"
}
→ Callback request created
```

### 2. CA Expert Calls Back

- System notifies CA expert
- Expert calls user at preferred time
- Status updated to "completed"

---

## Configuration

### Environment Variables

Add to `.env` file:

```
# Base URL for generating file URLs
BASE_URL=https://yourapp.com

# CA Support Phone Number
CA_SUPPORT_PHONE=+911234567890

# File Upload Configuration
UPLOAD_MAX_SIZE=10485760 # 10MB in bytes
UPLOAD_ALLOWED_TYPES=pdf,jpg,jpeg,png
```

### File Upload Configuration

#### Storage Options:

1. **Development:** Local file system ( `uploads/ca/documents/` )

2. **Production:** Cloud storage (AWS S3, Google Cloud Storage, etc.)

**File Limits:**

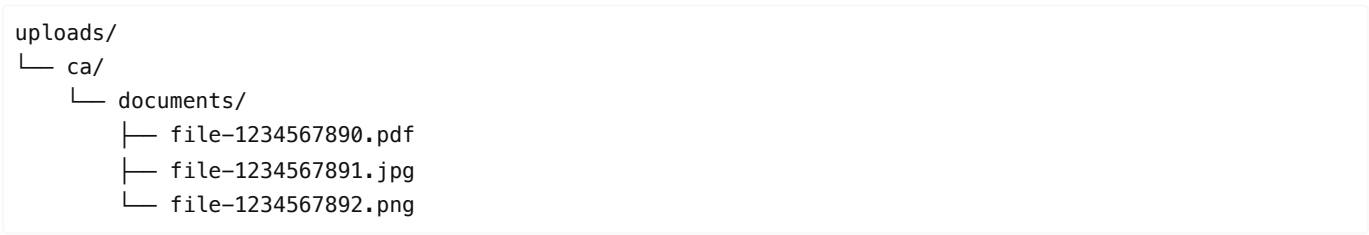
- Maximum file size: 10MB
- Allowed types: PDF, JPG, JPEG, PNG
- Maximum files per application: 10

## File Upload System

### Upload Process

1. **Client Request:** Multipart form data with file
2. **Server Validation:**
  - File type check
  - File size check
  - MIME type validation
3. **File Storage:** Save to configured storage
4. **Database Record:** Create CADocument record
5. **Response:** Return document URL and metadata

### Storage Structure



### Production Considerations

For production, implement:

- Cloud storage integration (S3, GCS, Azure Blob)
- Signed URLs for secure access
- CDN for fast delivery
- Virus scanning
- File compression
- Automatic cleanup of old files

## Status Management

### Application Status Flow



## Status Descriptions

- **pending**: Application submitted, awaiting initial review
- **in\_review**: CA expert is reviewing documents
- **awaiting\_clarification**: Additional information required from user
- **approved**: Application approved, certificate generated
- **rejected**: Application rejected (with reason)
- **completed**: Service completed and delivered

## Timeline Auto-Update

The system automatically updates timeline when:

- Application status changes
  - Expert adds notes
  - Clarification requested
  - Certificate generated
- 

## Error Handling

### Error Response Format

```
{
  "success": false,
  "message": "Error message",
  "error": "ERROR_CODE",
  "details": {} // Optional additional error details
}
```

### Common Error Codes

- `VALIDATION_ERROR` : Invalid input data
  - `NOT_FOUND` : Resource not found
  - `UNAUTHORIZED` : Authentication required
  - `FORBIDDEN` : Insufficient permissions
  - `FILE_TOO_LARGE` : File exceeds size limit
  - `INVALID_FILE_TYPE` : File type not allowed
  - `CERTIFICATE_NOT_READY` : Certificate not available yet
  - `SERVICE_UNAVAILABLE` : CA expert not available
- 

## Security Considerations

### Authentication

- All endpoints require JWT authentication
- Admin endpoints require additional role verification

### File Upload Security

- File type validation
- File size limits
- Virus scanning (recommended)
- Secure file storage
- Access control on downloads

### Data Protection

- Encrypt sensitive client information
  - Secure document storage
  - HTTPS for all communications
  - Regular security audits
- 

## Best Practices

### For Developers

1. **Error Handling:** Always handle errors gracefully
2. **Validation:** Validate all inputs before processing
3. **Logging:** Log important events for debugging
4. **Testing:** Test all endpoints thoroughly
5. **Documentation:** Keep API documentation updated

### For Administrators

1. **Monitor Applications:** Regularly check pending applications
2. **Expert Assignment:** Ensure experts are properly assigned
3. **Response Times:** Maintain quick response times
4. **File Management:** Regularly clean up old files
5. **Backup:** Regular database and file backups

### For CA Experts

1. **Review Promptly:** Review applications within SLA
  2. **Clear Communication:** Provide clear feedback in chat
  3. **Document Verification:** Thoroughly verify all documents
  4. **Status Updates:** Update status promptly
  5. **Customer Service:** Maintain professional communication
- 

## Rate Limiting

### Recommended Limits

- **Application Submission:** 5 per hour per user
  - **Document Upload:** 10 per hour per user
  - **Chat Messages:** 30 per minute per user
  - **API Calls:** 1000 per 15 minutes per user
- 

## Notification Requirements

### Email/SMS Notifications

Send notifications when:

- Application submitted
- Application status changes
- Clarification requested
- Certificate ready for download
- CA expert responds to chat
- Callback scheduled

### Notification Templates

1. **Application Submitted:** Confirmation with application ID
2. **Status Update:** New status with timeline update
3. **Clarification Request:** Details of required information

- 4. **Certificate Ready:** Download link and instructions
  - 5. **Chat Response:** New message notification
  - 6. **Callback Scheduled:** Time and expert details
- 

## Database Indexes

### Optimized Queries

The system includes indexes for:

- User applications lookup
- Status-based filtering
- Service category queries
- Chat message retrieval
- Document verification status

### Index Strategy

```
// Application indexes
{ userId: 1, status: 1 }
{ serviceType: 1, status: 1 }
{ expertId: 1, status: 1 }

// Document indexes
{ userId: 1, applicationId: 1 }
{ verificationStatus: 1 }

// Chat indexes
{ userId: 1, status: 1 }
{ chatId: 1, timestamp: -1 }
```

---

## Testing Checklist

### API Testing

- ☐ Service catalog endpoints
- ☐ Application submission
- ☐ Document upload
- ☐ Status tracking
- ☐ Chat functionality
- ☐ Certificate download
- ☐ Error handling
- ☐ Authentication
- ☐ Validation
- ☐ Pagination

### Integration Testing

- ☐ Complete application flow
- ☐ Chat with expert
- ☐ Document verification
- ☐ Status updates
- ☐ Certificate generation



- ☐ Notification delivery
- 

## Troubleshooting

### Common Issues

#### 1. File Upload Fails

- Check file size (max 10MB)
- Verify file type (PDF, JPG, PNG only)
- Check uploads directory permissions

#### 2. Application Not Found

- Verify applicationId format
- Check user ownership
- Ensure application exists

#### 3. Chat Not Starting

- Check expert availability
- Verify user authentication
- Check chat limits

#### 4. Certificate Not Downloadable

- Verify application status is "approved"
  - Check certificate generation
  - Verify download URL
- 

## Summary

The CA Services System provides a complete solution for:

- ☒ Service catalog browsing
- ☒ Application submission and tracking
- ☒ Document management
- ☒ Real-time status updates
- ☒ Expert chat support
- ☒ Certificate generation and download
- ☒ Callback requests
- ☒ Educational content

All processes are automated, secure, and designed to provide excellent user experience while maintaining efficiency for CA experts and administrators.