

# TitleTesterPro - Technical Specification

## 1. Global Nav & Branding

- **Logo** "TitleTesterPro" positioned top-left
- **Navigation Tabs:**
  - Dashboard - Overview of all tests and key metrics
  - Rotation Manager - Chronological log of all title changes
  - Channel Selector - Dropdown displaying authenticated YouTube channel with profile image

## 2. Authentication & Channel Selection

- **YouTube OAuth Integration** with required scopes:
  - `https://www.googleapis.com/auth/youtube.readonly` - List channels and videos
  - `https://www.googleapis.com/auth/youtube.force-ssl` - Update video titles
  - `https://www.googleapis.com/auth/yt-analytics.readonly` - Access CTR and AVD metrics
- **Channel Picker Implementation:**
  - Fetch all YouTube channels via `channels.list?mine=true&part=snippet,contentDetails,statistics`
  - Display actual channel names with thumbnails (not brand accounts)
  - Store selected channel as "active" in user session
  - All subsequent operations scoped to active channel

## 3. Dashboard

- **Key Metrics Display:**
  - Active Tests - Count of currently running A/B tests
  - Total Views - Aggregate views on all videos with active tests
  - Total Impressions  $\Delta$  - Impressions gained since test start
- **Primary CTA:** "Launch New Test" button (prominent placement)
- **Test Cards:** Grid/list view of active and recent tests with quick stats

## 4. Rotation Manager

- **Chronological Activity Log:**
  - Title change format: "Original Title" → "New Title"
  - Precise timestamp: Full date + exact time (e.g., "Jan 15, 2025 3:45:00 PM")

- Associated video thumbnail and test ID
- **Filtering Options:**
  - By specific test ID
  - By video
  - By date range
- **Export:** Download rotation history as CSV

## 5. Create New A/B Test Flow

### Step 1: Video Selection

- **"Select from Channel" Option:**
  - Load up to 500 most recent videos using pagination
  - API call: `videos.list?forMine=true&maxResults=50&part=snippet,statistics`
  - Display: Thumbnail, title, publish date, current views
  - Search/filter functionality by title keywords or date range
- **"Enter URL Manually" Option:**
  - Validate URL format and ownership
  - Extract video ID and verify against user's channel

### Step 2: Rotation Interval

- **Dropdown Options:**
  - 1 hour
  - 3 hours
  - 4 hours
  - 8 hours
  - 12 hours
  - 24 hours

### Step 3: Test Window

- **Start Date:** Default to current date/time
- **End Date:** Optional field (leave blank for indefinite test)
- **Validation:** Ensure end date is after start date if provided

### Step 4: Title Variants

- **Input Fields:** 2-5 title variants (dynamic add/remove)
- **Character Limit:** Enforce YouTube's 100-character limit
- **Validation:** No duplicate titles, no empty fields

## Step 5: Winner Determination

- **Metric Selection:**
  - CTR (Click-Through Rate) - Default
  - AVD (Average View Duration)
- **Note:** Explain metric implications to user

## Step 6: Test Initiation

- **"Start A/B Test" Action:**
  - Create test record in database
  - Schedule immediate first rotation
  - Log initial title swap in Rotation Manager
  - Redirect to test dashboard

## 6. Rotation Engine

### Core Functionality

- **Scheduler Implementation:**
  - Use BullMQ with Redis for reliable job queuing
  - Create recurring job for each test based on interval
  - Handle graceful shutdown and restart persistence

### Title Rotation Process

1. **Pre-rotation Checks:**
  - Verify test is still active
  - Confirm video still exists and is accessible
  - Validate OAuth token (refresh if needed)
2. **Execute Rotation:**
  - Call `videos.update` with new title
  - Record exact timestamp of change
  - Log rotation in database with before/after titles

### **3. Error Handling:**

- Retry failed rotations with exponential backoff
- Alert user if rotation fails after max retries
- Pause test if critical errors occur

## **Token Management**

- **OAuth Token Refresh:**
  - Check token expiry before each API call
  - Implement automatic refresh using refresh token
  - Store updated tokens securely
  - Handle refresh failures gracefully

## **API Quota Management**

- **YouTube API Limits:**
  - Track daily quota usage (10,000 units/day)
  - Implement caching for video metadata
  - Queue rotations if approaching limits
  - Display quota warnings to users

## **Technical Implementation Notes**

### **Database Schema Essentials**

sql

-- Tests table

```
CREATE TABLE tests (  
  id UUID PRIMARY KEY,  
  user_id UUID NOT NULL,  
  channel_id VARCHAR(255) NOT NULL,  
  video_id VARCHAR(255) NOT NULL,  
  status VARCHAR(50) DEFAULT 'active',  
  rotation_interval INTEGER NOT NULL,  
  start_date TIMESTAMP NOT NULL,  
  end_date TIMESTAMP,  
  winner_metric VARCHAR(20) DEFAULT 'ctr',  
  created_at TIMESTAMP DEFAULT NOW()  
);
```

-- Title variants

```
CREATE TABLE title_variants (  
  id UUID PRIMARY KEY,  
  test_id UUID REFERENCES tests(id),  
  title TEXT NOT NULL,  
  order_index INTEGER NOT NULL,  
  is_original BOOLEAN DEFAULT false,  
  total_impressions INTEGER DEFAULT 0,  
  total_clicks INTEGER DEFAULT 0,  
  total_views INTEGER DEFAULT 0  
);
```

-- Rotation log

```
CREATE TABLE rotation_log (  
  id UUID PRIMARY KEY,  
  test_id UUID REFERENCES tests(id),  
  from_title TEXT NOT NULL,  
  to_title TEXT NOT NULL,  
  rotated_at TIMESTAMP NOT NULL,  
  success BOOLEAN DEFAULT true,  
  error_message TEXT  
);
```

## API Endpoints

- `POST /auth/youtube` - OAuth callback handler
- `GET /channels` - List user's YouTube channels

- `POST /channels/select` - Set active channel
- `GET /videos` - List channel videos with pagination
- `POST /tests` - Create new A/B test
- `GET /tests` - List all tests
- `GET /tests/:id` - Get test details
- `PUT /tests/:id/stop` - Stop active test
- `GET /rotations` - Get rotation history
- `GET /metrics/test/:id` - Get test performance metrics