# **YouTube Downloader - Technical Documentation**

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## **1. Overview**

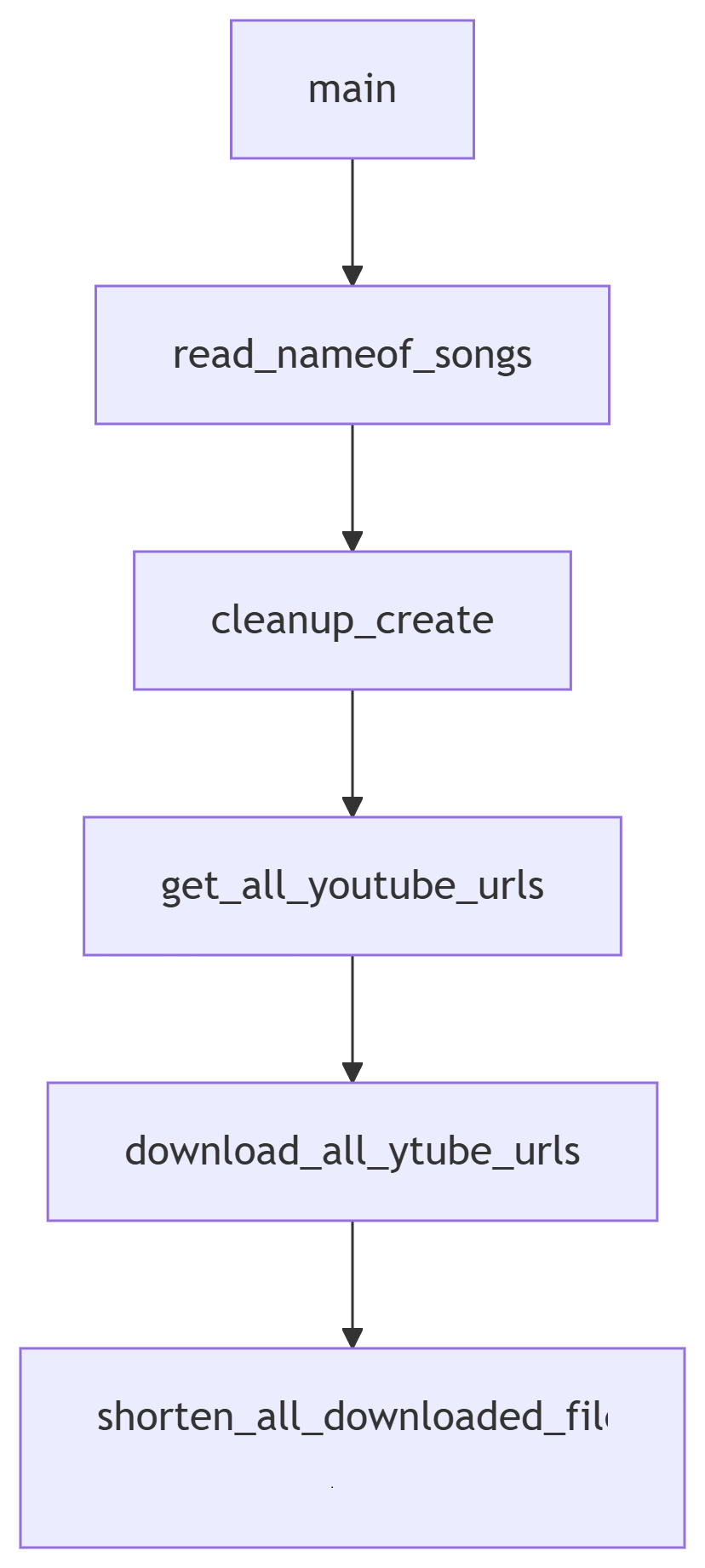
A Python-based tool to download YouTube videos/audio concurrently with:

* Threaded downloads for performance
* Automatic filename shortening
* Robust error handling

## **2. Package Dependencies**

| **Package** | **Purpose** | **Installation** |
| --- | --- | --- |
| yt-dlp | YouTube content download | pip install yt-dlp |
| youtubesearchpython | URL resolution | pip install youtubesearchpython |
| aria2 | Accelerated downloads | scoop install aria2 (Windows) / brew install aria2 (Mac) |
| FFmpeg | Audio conversion | Download from [ffmpeg.org](https://ffmpeg.org/) |

## **3. Core Function Flow**



## **4. Key Functions**

### **4.1 File Processing**

| **Function** | **Description** |
| --- | --- |
| read\_nameof\_songs() | Parses input file with v/a prefixes |
| cleanup\_create() | Ensures fresh download directory |

### **4.2 URL Resolution**

| **Function** | **Concurrency** | **Description** |
| --- | --- | --- |
| search\_youtube() | Threaded | Gets YouTube URL for a query |
| get\_all\_youtube\_urls() | ThreadPoolExecutor | Batch-resolves URLs |

### **4.3 Download Handlers**

| **Function** | **Type** | **Features** |
| --- | --- | --- |
| download\_youtube\_audio\_as\_mp3() | Audio | MP3 conversion via FFmpeg |
| download\_youtube\_video() | Video | Adaptive format fallback |

### **4.4 Post-Processing**

| **Function** | **Threaded** | **Description** |
| --- | --- | --- |
| shorten\_downloaded\_file\_name() | Yes | Safe filename shortening |
| return\_short\_string() | No | Truncates strings to N words |

## **5. Concurrency Architecture**

with ThreadPoolExecutor() as executor:

futures = {

executor.submit(downloader, url): query

for url in url\_list

}

*# Process completed futures*

**Threading Used In**:

1. URL resolution (get\_all\_youtube\_urls)
2. Batch downloads (download\_all\_ytube\_urls)
3. Filename shortening (shorten\_all\_downloaded\_file\_names)

## **6. Error Handling**

| **Error Type** | **Mitigation Strategy** |
| --- | --- |
| Format Unavailable | Multi-stage fallback in download\_youtube\_video() |
| Network Timeouts | aria2c with 10 retries and exponential backoff |
| File Collisions | Sequential numbering in shorten\_downloaded\_file\_name() |