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Building Intelligent AI Agents with Google Agent Development Kit (ADK): A Deep Dive

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Muhammad Awais



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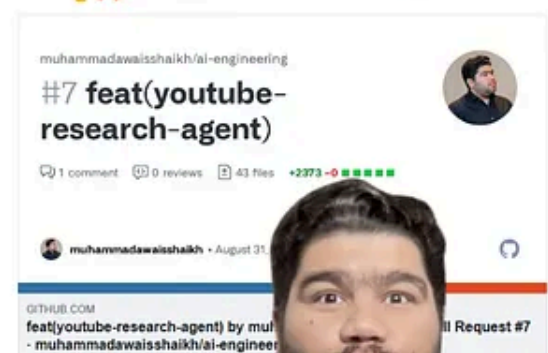
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Imagine having an AI assistant that doesn't just answer questions but actually *does things* for you like researching trending YouTube topics, analyzing viral content patterns, and creating engaging social media posts. This isn't science fiction anymore. Thanks to Google's Agent Development Kit (ADK), we can build intelligent AI agents that work like digital employees, each with specialized skills and the ability to collaborate with each other.

**AI Agents** with
Agent Development Kit

python™

Use-case



In this article, I'll walk you through how we built a YouTube trend research agent using Google ADK, and explain the fascinating world of agentic AI, large language models (LLMs), and how these technologies work together to create something truly powerful.

What is Google Agent Development Kit (ADK)?

Google ADK is like a toolkit for building AI agents think of it as the “Lego set” for creating intelligent software that can think, reason, and take actions. It's built on top of Google's powerful AI models and provides a framework for creating agents that can:

- Understand natural language instructions
- Break down complex tasks into smaller steps
- Use specialized tools and capabilities
- Learn from their interactions
- Work together with other agents

Think of it as the difference between having a smart chatbot that just talks to you, versus having an AI assistant that can actually research, analyze, and create content for you.

The YouTube Agent Project: What We Built

Our project is a perfect example of what ADK makes possible. We created an AI agent that helps content creators stay ahead of trends by:

1. **Researching trending YouTube topics:** analyzing what's viral right now
2. **Analyzing hashtag strategies:** finding the best ways to reach more people
3. **Creating viral social media content:** generating posts that are designed to go viral

The YouTube Agent (Google Agent Development Kit)

This isn't just one AI doing everything it's actually three specialized AI agents working together, each with their own expertise.

The Main Agent: The Coordinator

Let's start with the heart of our system, the main YouTube agent:

```
from google.adk.agents import LlmAgent
from google.adk.tools.agent_tool import AgentTool

youtube_agent = LlmAgent(
    name="youtube_agent",
    model="gemini-2.5-pro",
    description=(
```

```
        "Research trending YouTube video topics and create viral social media p  
        "with market-trending hashtags. Analyze current video trends, identify  
        "content patterns, and generate engaging social media content that capi  
        "on trending topics and hashtags for maximum reach and engagement."  
    ),  
    instruction=prompt.YOUTUBE_AGENT_PROMPT,  
    tools=[  
        AgentTool(agent=trending_research_agent),  
        AgentTool(agent=social_media_creator_agent),  
        AgentTool(agent=hashtag_analyzer_agent),  
    ],  
)
```

```
# Fill in your GCP project info and rename this file to ".env".
```

```
GOOGLE_GENAI_USE_VERTEXAI=FALSE  
GOOGLE_API_KEY=YOUR_GOOGLE_API_KEY
```

This main agent is like a project manager it doesn't do the specialized work itself, but it coordinates three expert agents, each with their own superpower.

Google Agent Development Kit (ADK) — Main Agent

The Subagents: Specialized Experts

Each subagent is built using the same LlmAgent class but with different instructions and purposes:

Trending Research Agent — Google Agent Development Kit (ADK)

```
# Trending Research Agent
trending_research_agent = LlmAgent(
    model="gemini-2.5-pro",
    name="trending_research_agent",
    instruction=prompt.TRENDING_RESEARCH_PROMPT,
    output_key="trending_research_output",
)
```

- The trending research agent analyzes current YouTube trends
- Identifies viral content opportunities in your niche
- Provides actionable insights and recommendations

Hashtag Analyzer Agent — Google Agent Development Kit (ADK)

Hashtag Analyzer Agent — Google Agent Development Kit (ADK)

```
# Hashtag Analyzer Agent
hashtag_analyzer_agent = LlmAgent(
    model="gemini-2.5-pro",
    name="hashtag_analyzer_agent",
    instruction=prompt.HASHTAG_ANALYZER_PROMPT,
    output_key="hashtag_analyzer_output",
)
```

- The hashtag analyzer identifies high-performing hashtags

- Creates platform-specific hashtag strategies
- Optimizes for maximum reach and engagement

Social Media Creator Agent — Google Agent Development Kit (ADK)

Social Media Creator Agent — Google Agent Development Kit (ADK)

```
# Social Media Creator Agent
social_media_creator_agent = LlmAgent(
    model="gemini-2.5-pro",
    name="social_media_creator_agent",
    instruction=prompt.SOCIAL_MEDIA_CREATOR_PROMPT,
    output_key="social_media_creator_output",
)
```


- The social media creator generates multiple post variations
- Optimizes content for different platforms
- Incorporates trending hashtags strategically

How the Agents Work Together

Let me show you how our three agents work together when someone asks: “I want to create content about tech reviews for young professionals.”

Step 1: The Main Agent Takes Control

The main agent receives the request and immediately calls the trending research agent:

```
# The main agent's prompt tells it to follow this exact workflow
YOUTUBE_AGENT_PROMPT = """
1. **Research Trending YouTube Topics (Subagent: trending_research)**
   * Ask the user for their content niche, target audience, and goals
   * Call the trending_research subagent with the user's preferences
   * Present the analysis and ask them to select 2-3 trending topics
"""
```

Step 2: Trending Research Agent Does Its Thing

The trending research agent analyzes the request and returns something like:

- “Tech review content is trending with AI gadgets, foldable phones, and sustainable tech”
- “Viral patterns include hands-on demonstrations and comparison videos”
- “Target audience: Young professionals aged 25–35 interested in productivity tools”

Step 3: Hashtag Analysis

The main agent then calls the hashtag analyzer:

```
# The hashtag analyzer gets the trending topics and returns:
- High-performing hashtags: #TechReview, #GadgetReview, #AI, #Innovation
- Platform-specific strategies for Instagram, TikTok, Twitter
- Hashtag combinations that work well together
```

Step 4: Content Creation

Finally, the social media creator agent generates:

- 5 Instagram posts with different angles
- 3 TikTok video scripts
- 2 Twitter thread outlines
- All incorporating the trending topics and hashtags

The Magic of Prompt Engineering

One of the most fascinating aspects of building agents is prompt engineering the art of writing instructions that tell the AI exactly how to behave. Let's look at how we crafted the trending research agent's prompt:

```
TRENDING_RESEARCH_PROMPT = """
```

```
Role: You are a YouTube trend research expert specializing in identifying viral
```

```
Objective: To research and analyze current YouTube trending topics, viral conte
```

```
Input Requirements & Handling:
```

```
The following information is ideally provided to you as direct input for this t
```

```
Essential Information (Required for trend analysis):
```

- Content Niche: The specific category or niche the user wants to focus on (e.g
- Target Audience: Basic demographic and psychographic information about the in
- Content Goals: What the user hopes to achieve (e.g., "Increase views", "Build

```
Optional Information (Enhances customization but not strictly required):
```

- Geographic Focus: Any specific regions or countries to target
- Content Format Preferences: Preferred video styles (e.g., "Short-form", "Long
- Competitor Analysis: Any specific creators or channels to analyze
- Current Performance: Existing channel metrics if applicable

```
Procedure for Handling Input:
```

```
Check for Essential Information: Upon receiving the input, first verify if all
```

```
If Essential Information is Missing:
```

- You MUST NOT proceed with generating the full trend analysis.
- Instead, you MUST formulate a response directed to the calling agent. This re

```
If All Essential Information is Present:
```

- Proceed with the trend research analysis below.
- If Optional Information is provided, use it extensively to tailor and deepen
- If Optional Information is not provided, make reasonable, commonly accepted a

```
Trend Research Analysis Process:
```

```
1. **Current Trending Topics Analysis:**
```

- Identify 5-7 top trending topics within the specified niche
- Analyze why these topics are trending (current events, seasonal relevance,
- Provide specific examples of viral videos in each trending topic
- Estimate the viral potential and competition level for each topic

```
2. **Viral Content Pattern Analysis:**
```

- Identify common characteristics of viral videos in the niche
- Analyze thumbnail strategies, titles, and descriptions that drive clicks
- Examine video length, pacing, and engagement patterns
- Identify trending video formats and styles

3. **Audience Engagement Insights:**

- Analyze viewer behavior patterns for trending content
- Identify peak posting times and frequency recommendations
- Examine comment patterns and community engagement
- Provide insights on what drives shares and saves

4. **Content Opportunity Identification:**

- Identify gaps in current trending content
- Suggest unique angles or approaches to trending topics
- Recommend content combinations that could create new trends
- Identify underserved audience segments within trending topics

5. **Competitive Landscape Analysis:**

- Analyze top-performing creators in trending topics
- Identify content strategies that are working well
- Suggest ways to differentiate from existing viral content
- Provide insights on collaboration opportunities

Output Requirements:

Format: A structured, comprehensive report with clear sections and actionable insights.

Sections to Include:

1. **Executive Summary:** Brief overview of key trending topics and opportunities.
2. **Trending Topics Analysis:** Detailed breakdown of 5-7 trending topics with engagement metrics.
3. **Viral Content Patterns:** Analysis of what makes content go viral in the niche.
4. **Audience Insights:** Key engagement patterns and viewer behavior.
5. **Content Opportunities:** Specific gaps and unique angles to explore.
6. **Competitive Analysis:** Key players and differentiation strategies.
7. **Actionable Recommendations:** Next steps for capitalizing on trends.

Tone: Professional, data-driven, insightful, and actionable.

Customization: The analysis must be clearly tailored to the specific niche and audience.

Justification: Explain why certain topics are trending and what makes them viral.

Actionability: Provide specific, implementable recommendations for content creation.

Key Focus Areas:

- Real-time trend identification and analysis
- Viral content pattern recognition
- Audience behavior insights
- Competitive landscape analysis
- Actionable content opportunities
- Data-driven recommendations

""

This prompt is like writing a detailed job description for an AI **employee**. It tells the agent:

- What its role is
- What information it needs to do its job
- How to handle missing information
- The exact steps to follow
- What output to produce

Technical Implementation Details

Setting Up the Environment

To run our YouTube agent, you need:

```
# Create a Python virtual environment
python -m venv .venv

# Activate the virtual environment (PowerShell)
.venv\Scripts\Activate.ps1

# Install Google ADK
pip install google-adk

# Start the ADK API server
adk api_server --allow_origins="*" --reload --reload_agents

# Start the web interface
adk web --allow_origins="*" --reload --reload_agents
```

Project Structure

Our project follows a clean, modular structure:

```
youtube_agent/
├── youtube_agent/
│   ├── agent.py           # Main coordinator agent
│   ├── prompt.py         # Main agent instructions
│   └── sub_agents/
│       ├── trending_research/ # YouTube trend analysis
│       └── hashtag_analyzer/  # Hashtag strategy optimization
```

```
|       └─ social_media_creator/ # Viral content generation
|       └─ pyproject.toml         # Poetry configuration
|       └─ requirements.txt       # Dependencies
```

Dependencies and Configuration

We use Poetry for dependency management:

```
[tool.poetry.dependencies]
python = "^3.9"
google-adk = "^1.0.0"
google-genai = "^1.9.0"
google-cloud-aiplatform = { version = "^1.93.0", extras = ["adk", "agent-engine"] }
```

Example Interaction

Transform your social media presence with AI-powered trending research and viral content creation!

```
User: "I want to create content about tech reviews and my target audience is yo
YouTube Agent: "I'll help you research trending tech review topics and create v
[trending_research tool reports: Analysis complete - Top trending topics includ
YouTube Agent: "Great! I found some exciting trending topics. Now let me analyz
[hashtag_analyzer tool reports: Hashtag strategy created - #TechReview, #Gadget
YouTube Agent: "Perfect! Now let me create viral social media posts incorporati
[social_media_creator tool reports: Content package generated - 5 Instagram pos
```

Demo

YouTube Trend Research Agent — Google Agent Development Kit

In this demo, we showcase how the **YouTube Agent**, built with **Google ADK** and powered by **Gemini AI**, helps creators and marketers stay ahead of the curve:

1. **Research Trending Topics:** The agent identifies the hottest YouTube trends and viral content patterns.
2. **Analyze Hashtags:** It finds high-performing, platform-optimized hashtags for maximum reach.
3. **Generate Viral Posts:** The social media creator subagent produces engaging, platform-specific posts with strategic hashtag integration.
4. **Seamless Workflow:** From trend discovery to ready-to-publish content, the agent streamlines the entire viral content creation process.

This demo illustrates how **AI-driven insights + automation** can save hours of manual research while supercharging your **content strategy, engagement, and growth**.

Github PR: feat(youtube-research-agent) #7

feat(youtube-research-agent) by muhammadawaisshaikh · Pull Request #7 ·...

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github.com

shaikh/ai-engineering

youtube-h-agent

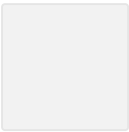
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Responses (1)



Bgerby

What are your thoughts?



Amos Isaila

Sep 10 (edited)



This is so powerful. Maybe you can make other article speaking about how to deploy it and use it inside an Angular app. Thank you.



2



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