

LLM-based Learning Companion & Co-Pilot

A Video to Text Approach

CCDS24-0653

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01

Introduction

Background & Aim of the Project

Background & Motivation

Distributed File Systems

- Network File System
 - Architecture, stateless servers
 - Block-based file serving and caching
 - Timeout-based cache consistency maintenance
 - Approximate one-copy update semantics
- Andrew File System
 - Architecture, stateful servers
 - Whole file serving and caching
 - Callback-based cache consistency maintenance
 - Session update semantics
- Coda File System
 - Hoarding



24S2-SC4051-CE4013-CZ4013-C-LEC-week13_lect_thurs

1x 🔍 ⏪ ⏴

1x

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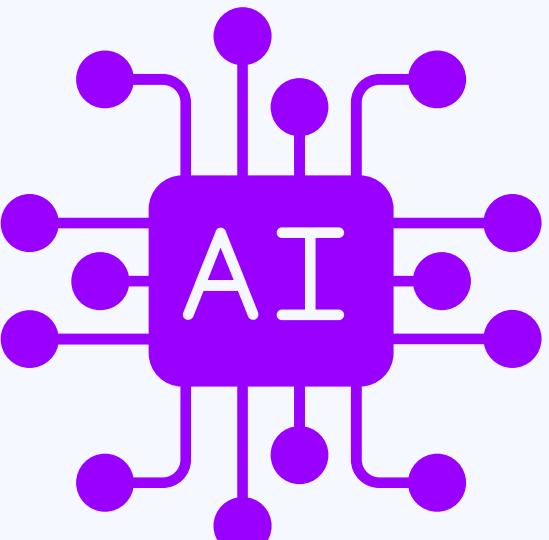
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Background & Motivation



ChatGPT

- AI Chatbot built on top of OpenAI's LLMs
- Released on November 30, 2022
- Popularise Generative AI Chatbots



Human-AI Collaboration

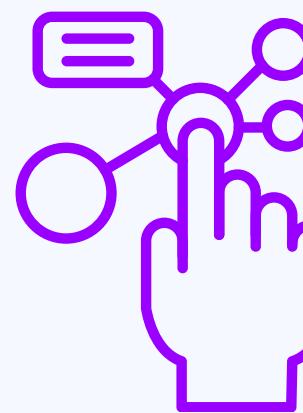
- Humans and AI systems work together to achieve a common goal
- AI Chatbot as a learning companion

Background & Motivation



On-Demand Help

- Receive instant, context-aware responses to questions
- Reinforce understanding beyond class hours
- Tailored guidance based on individual learning need



Interactive Learning

- Engage in dialogue about specific lecture segments
- Learn through conversation
- Stimulate curiosity and improve information retention



Learning Autonomy

- Learn at your own pace without waiting for lecturer input
- Build confidence in independent study

Provide a **Learning Companion Chatbot** for learners via a **Video-to-Text** approach.

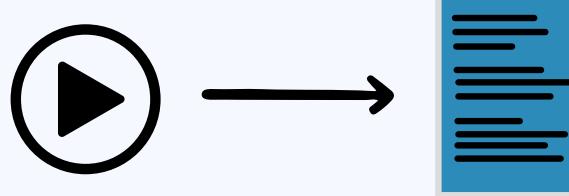
Project's Statement

Project's Objective



Learning Companion Chatbot

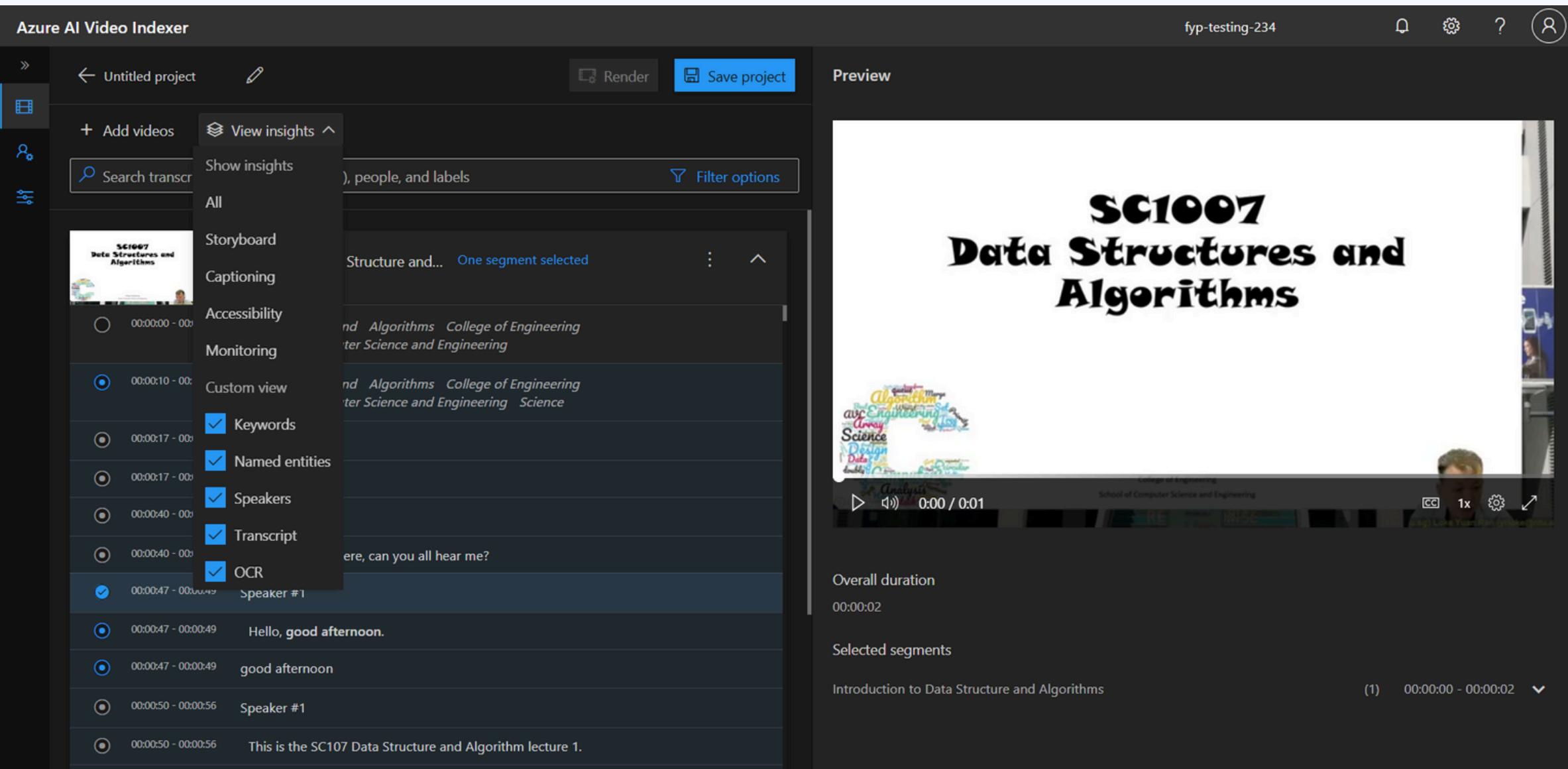
- Create application where users are able to interact with the chatbot
- Provide Course and Lecture Management System for lecturers



Video-to-Text

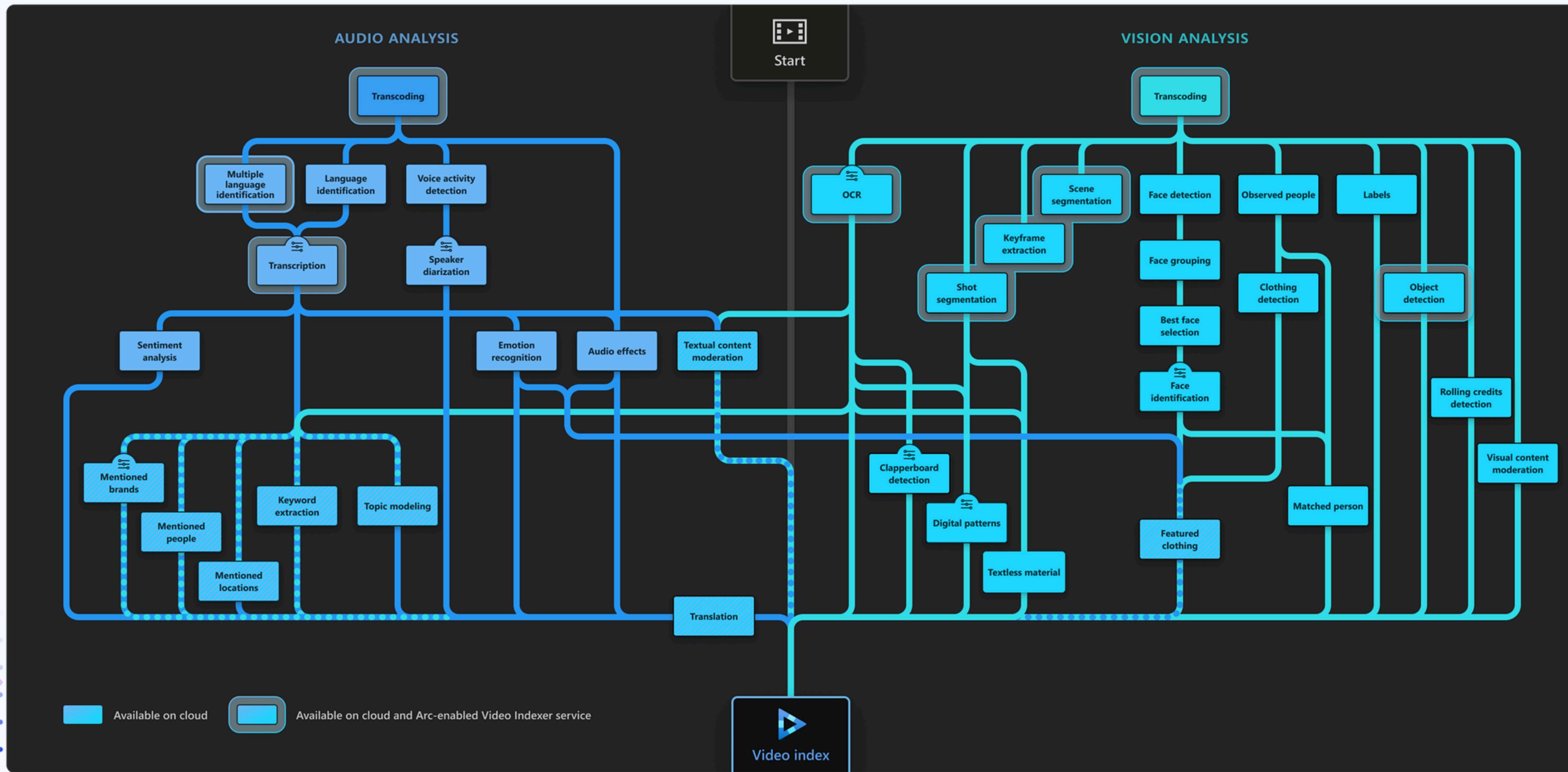
- Explore existing video-to-text technologies
- Experiment ways to enhance contextual building of lecture videos

Azure's video-to-text approach



**Azure AI
Video Indexer**
Uses Azure Audio
and Visual Services
to generate
insights.

Azure's video-to-text approach



Azure's video-to-text approach

Get Prompt Content API

For the output to be prompt-ready, the video is split into coherent sections that fit both the essence of the video and the prompt size. The sections are divided based on Azure AI Video Indexer Scene Segmentation and other insights. The results of the prompt content are consolidated and generated per segment separately.

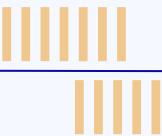
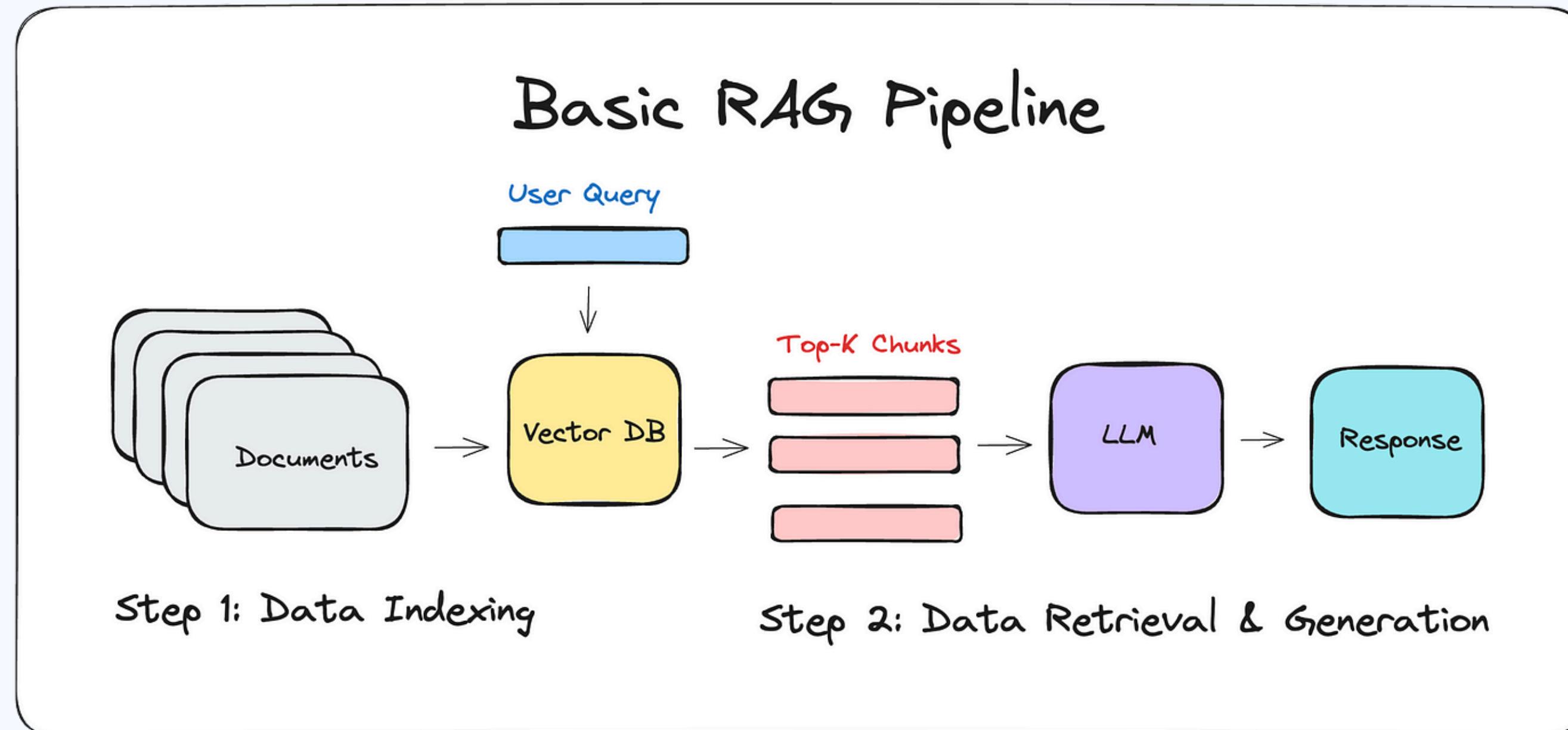
```
{  
    "id": 2,  
    "start": "0:04:19.32",  
    "end": "0:12:38.76",  
    "content": "[Video title] Introduction to Data Structures and Algorithms\n[Tags]  
Beginning\n[OCR] Data Structures and, Algorithms, College of Engineering, School of Computer Science  
and Engineering, Science, Dr. Loke Yuan Ren, RE, Yuan Ren, N4-02B-69A, Dr. Luu Anh Tuan,  
Introduction, Loke Yuan, oke Yuan, oke Yuan Re, uan Ren, Loke Yua, ke Yuan, fuan Ren, Loke Yuar, Loke  
Y, ke Yuan R, uan, Yuan R, Loke, Jan Ren, an Ren, anhtuan.luu@ntu.edu\n[Transcript] OK, good  
afternoon.\nJust wait for a while.\nWe yeah, I will start the lecture at 12:30.\nNow we have 131  
student maybe yeah, 136.\nNow this same.\nWe have a very big class.\nWe have nearly I think we have 700  
plus student taking this module.\nSo the lecture will be conducted online tutorial mainly.\nAlso  
online only the lab will be conducted in the physically in the lab.\nof this module you going to use  
the the programming language we use is the C programming which you should you have learned it in  
1003.\nSo any software you in the lab, we in the lab in the test we provide you the cop block.\nYou can  
consider to use it, but you also can use other ID to write your program.\nBut during the test we  
only provide one ID which is called block.\nSo just take notes.\nYeah, it's good that you familiar  
the interface so you may not have any difficulty during the test, but you still can use other IDE  
like some people use.\nThe VS Code or any C compiler is fine.\nWill this thing be used for the next  
lecture and this channel?\nI will, I will, I will, I will, I will.\nTrying to put all the live  
streaming in this channel.\nSo the link I give you, you can click the the channel and then yeah, all  
the all the video, all the live streaming lecture will be upload in that Channel.\nMy estimation  
there are about 7:00 to 8:00 second delay.\nYes.\nOnly C programming will we use.\nNo, we will not  
use the.\nWe will use another platform.\nWe will let you know.\nYeah, Later, Yeah.\nBut yeah, the  
platform will be similar to R Paas, but not R Paas.\nBy code block, you mean the code blocks?"  
},
```

02

Implementation

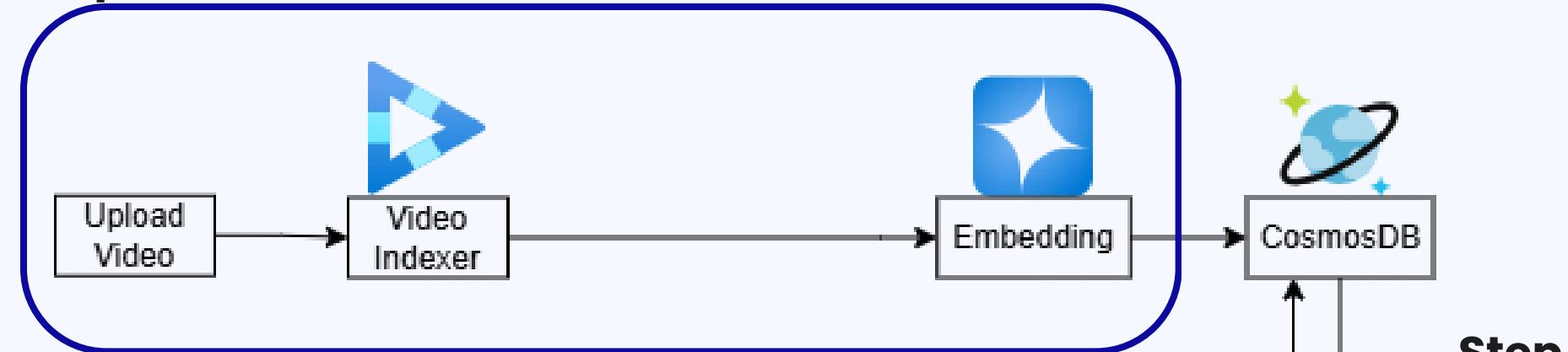
Consideration & Design

RAG



RAG-Azure Services

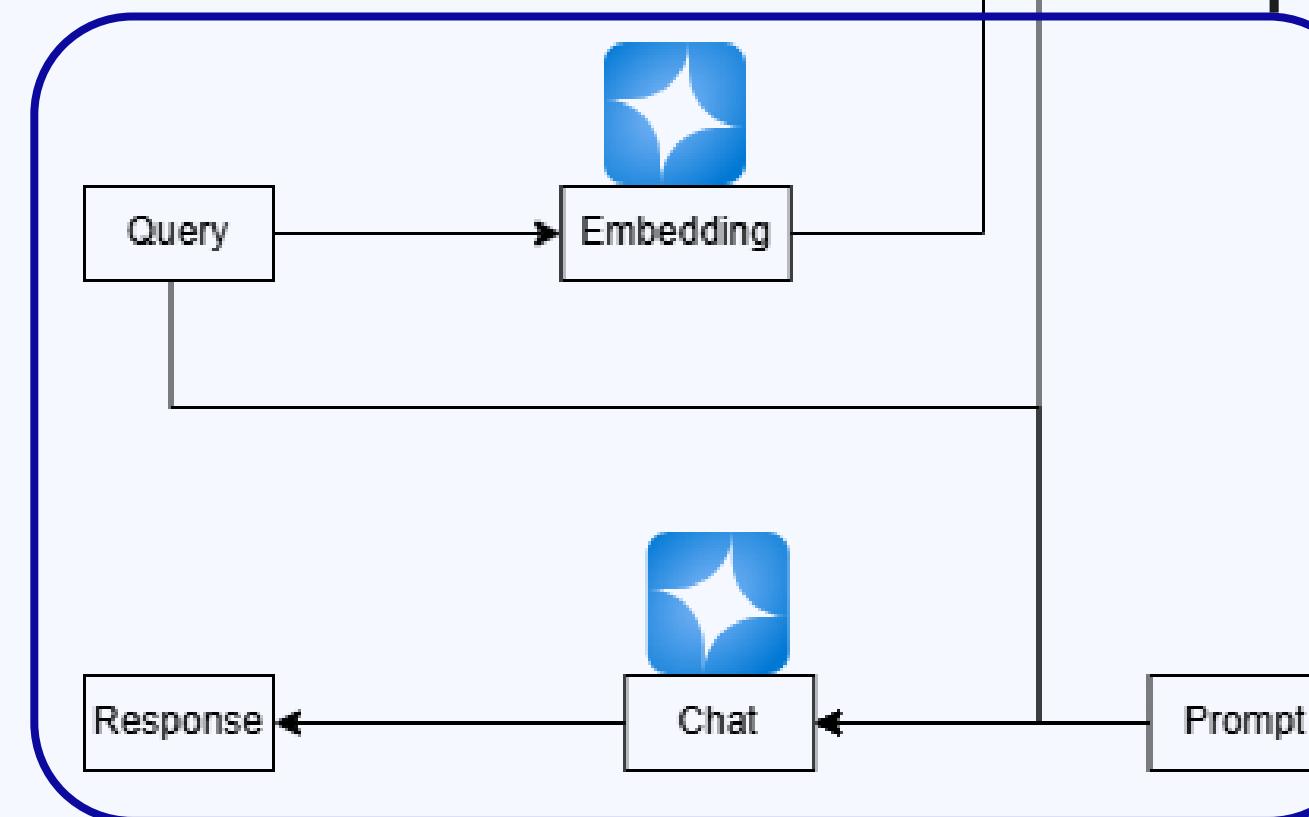
Step 1



Azure AI Video Indexer
Transcription & Frames Analysis



Step 2



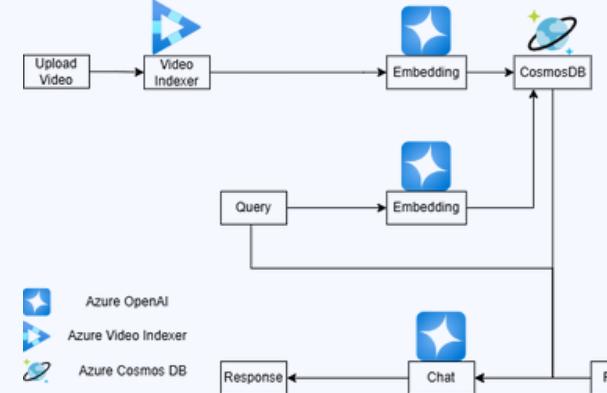
Azure OpenAI
Response Generation & Embedding



- Azure OpenAI
- Azure Video Indexer
- Azure Cosmos DB

Azure CosmosDB
Vector Store





Lecture Characteristics

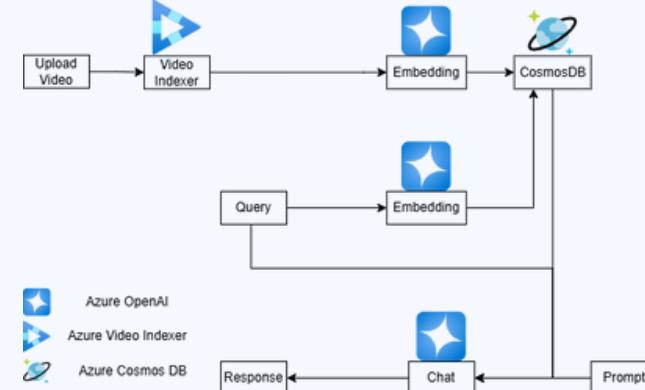


VS

Computational Geometric Problem

- Convex hull problem: Given a set of points, find the smallest convex polyhedron/polygon containing all the points
- Delaunay triangulation: for a given set P of discrete points in a plane is a triangulation such that no point in P is inside the circumcircle of any triangle

The diagram shows three geometric concepts: 'Convex Hull' (a red polygonal chain around a set of blue points), 'circumcircle' (a red circle passing through four blue points), and 'Delaunay Triangulation' (a blue mesh connecting the same four points such that no point is inside the circumcircle of any triangle). To the right, a video feed shows a man speaking.



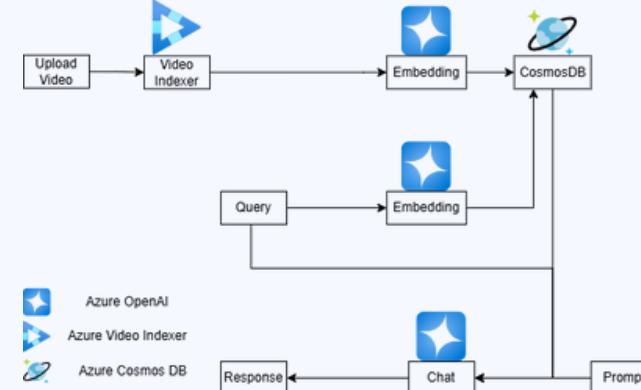
Lecture Characteristics



Computational Geometric Problem

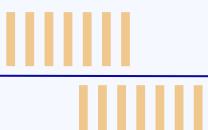
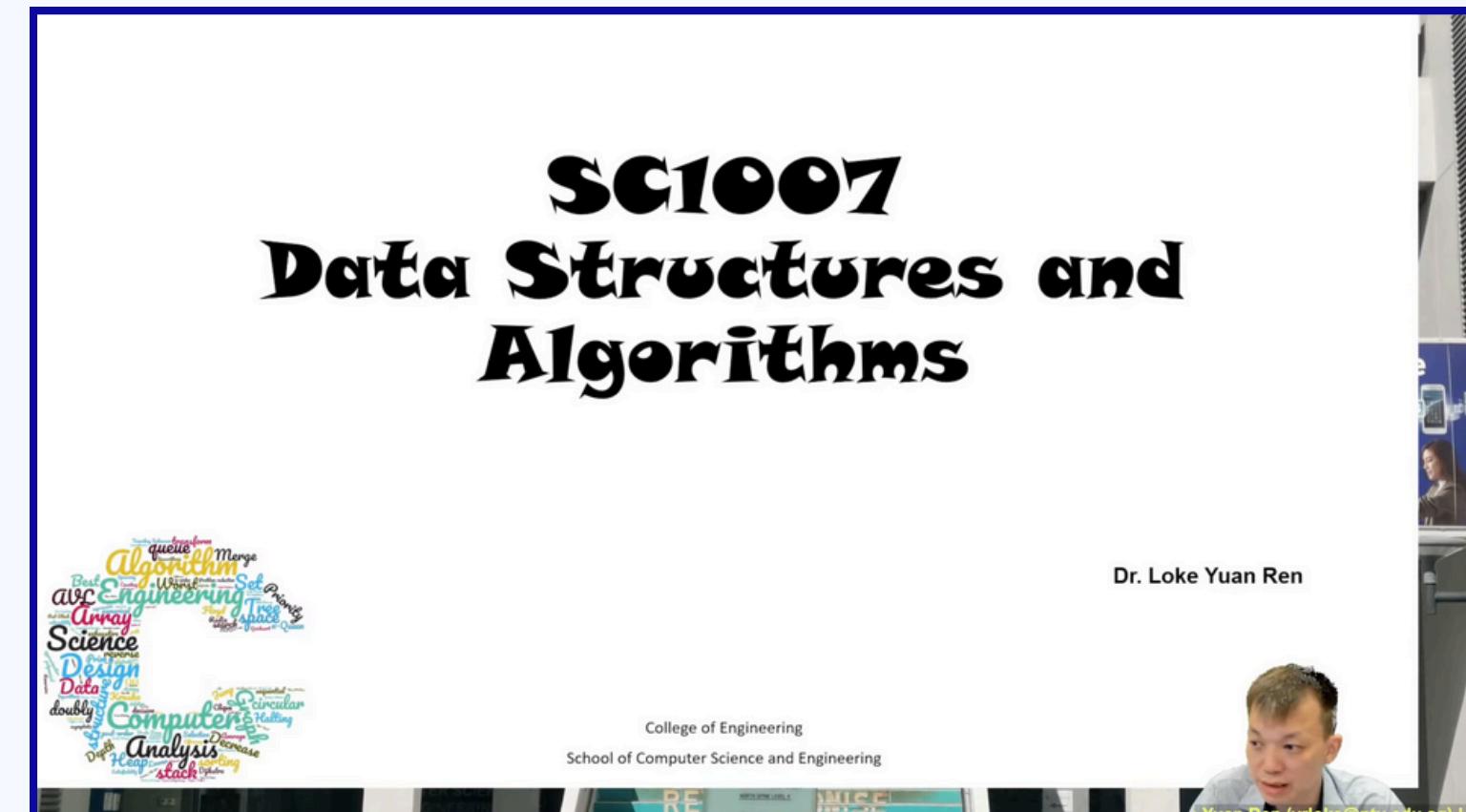
- Convex hull problem: Given a set of points, find the smallest convex polyhedron/polygon containing all the points
- Delaunay triangulation: for a given set P of discrete points in a plane is a triangulation such that no point in P is inside the circumcircle of any triangle

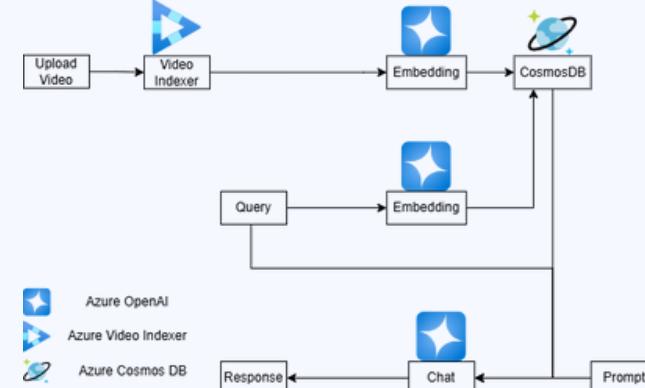
Characteristic	Conventional Video	Lecture Video
Visual Aids	Story-driven	Slides, bullet points, diagrams
Structure	Free-flowing scenes; dialogues often not aligned with visuals	Slide-based, logically segmented, dialogues aligned with visuals
Pronunciation & Enunciation	Professionally recorded with clear and intentional speech	Often unclear due to accents, background noises, or low-quality recording
Transcript Quality	Usually clean	Contains filler words, pauses, incomplete sentences, technical terms



Lecture Video Example

- Sample of a lecture video conducted virtually will be used
- Conducted by Dr. Loke Yuan Ren on January 11, 2022
- 83-minutes
- For SC1007 Introduction to Data Structures and Algorithms (2022) for SCSE (now CCDS) students in NTU
- Available on YouTube: https://www.youtube.com/watch?v=grNf_6wTJug





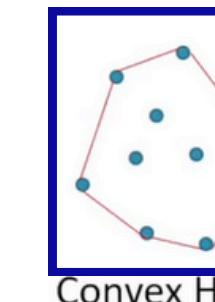
Lecture Characteristics

Visual Aids

Computational Geometric Problem

- Convex hull problem: Given a set of points, find the smallest convex polyhedron/polygon containing all the points
- Delaunay triangulation: for a given set P of discrete points in a plane is a triangulation such that no point in P is inside the circumcircle of

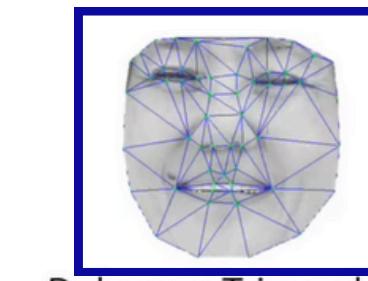
A diagram of a hexagon with blue dot



Convex Hull



circumcircle



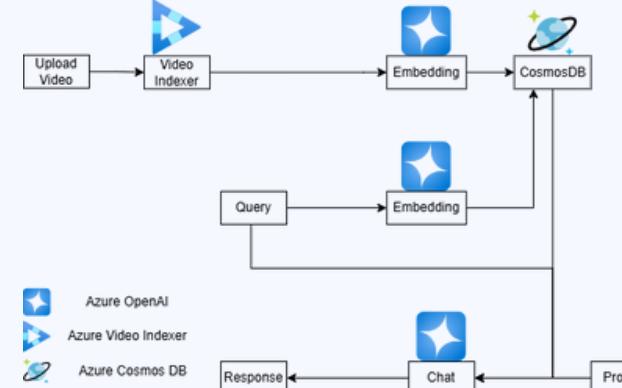
Delaunay Triangulation



Yuan Ren (vrluke@ntu.edu.sg)

Certain features in Visual Services (*Detect Common Objects in Images*, etc)
are **irrelevant**





Lecture Characteristics

Visual Aids

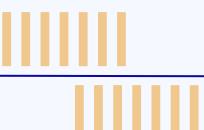
Computational Geometric Problem

- Convex hull problem: Given a set of points, find the smallest convex polyhedron/polygon containing all the points
- Delaunay triangulation: for a given set P of discrete points in a plane is a triangulation such that no point in P is inside the circumcircle of any triangle

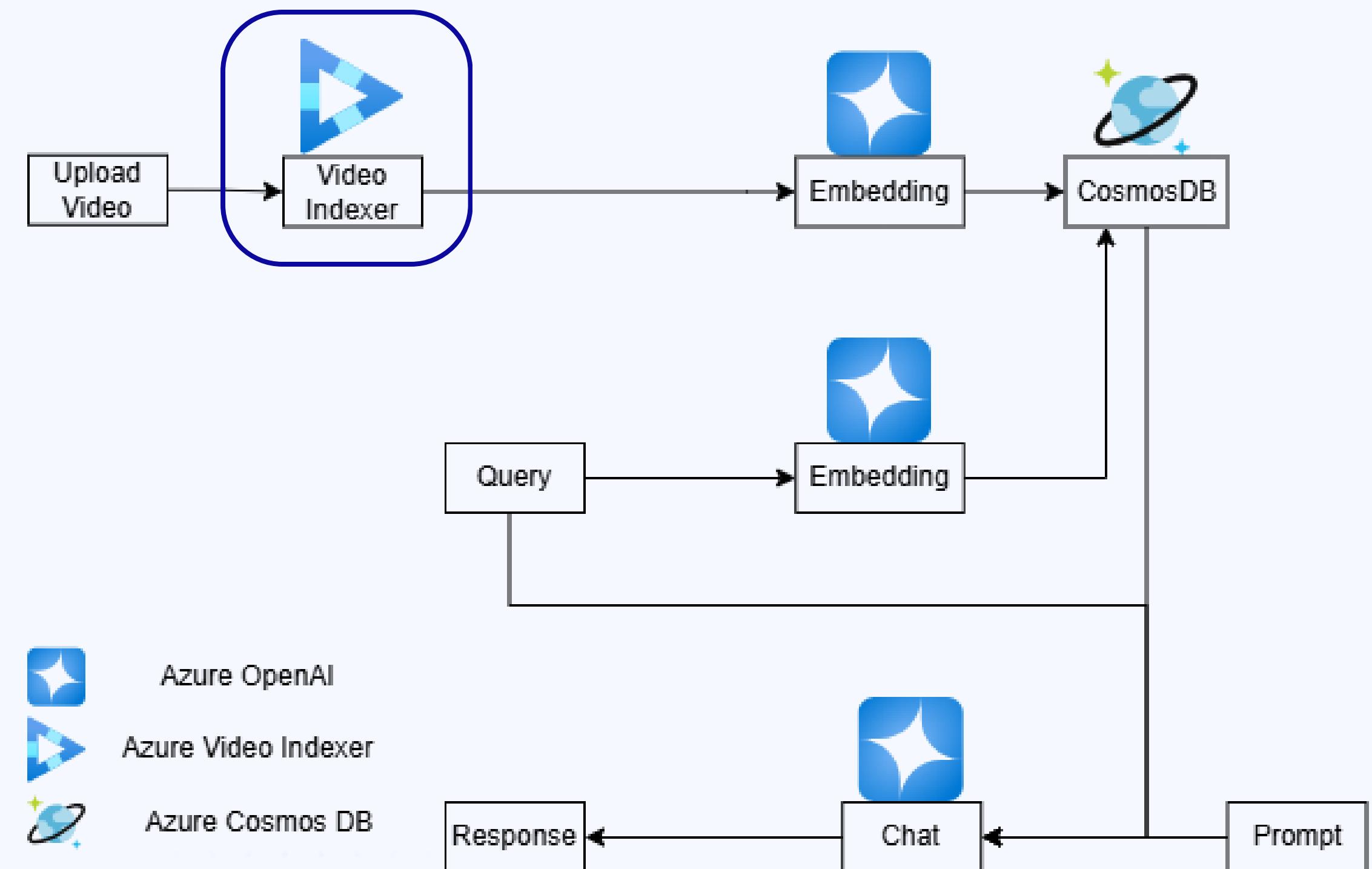
Convex Hull Circumcircle Delaunay Triangulation

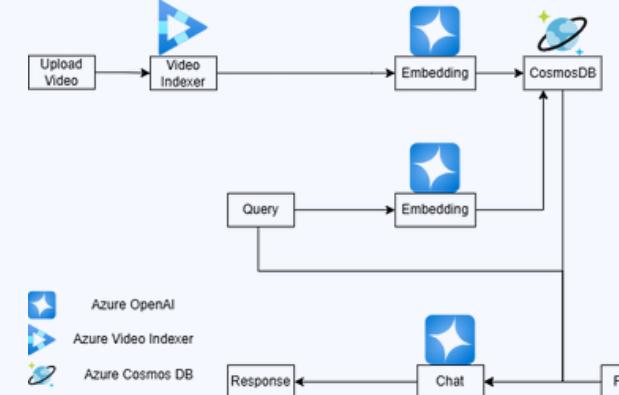
Other topic like computational geometric that maybe involve more mathematics, we will not discuss in this module. And the next level, yeah, if you're interested, you maybe can take like like our metric geometric in the SPMS. Yeah. So that I'm not going to too details about this, but just let you know that is another topic. We also apply this thing in a lot of in computer graphic. In computer graphic, yeah, people will use this, yeah. They involve a lot of this kind of computational geometric problem. So here, yeah. Like for example, you want to find like the boundary of this viewpoint. Yeah, that is a convex hub problem. Even a set of point, you want to find the smallest convex Polygon containing all the point. That is a computational geometric problem. One of the computer computational geometric problem, another one. Yeah, you give me a few point then I I need to find to have all the to triangulate all these point and such that there's no Y in, in P is inside the circumcircle of any triangle. Yeah, that is the well known Delaunay triangulation. Yeah. And and that is involved a lot of, again, you'll find that in computer science actually involve a lot of problem, actually involve a Yeah, a lot in mathematics first, before you can really implement the program. You want to appreciate this one, you want to solve this problem. Yeah, your Max must be good, especially in geometric before you can implement it. Yeah. This we will not cover in this module, just let you know just for your information, another one is a very typical problem in engineering.

Strong relationship between diagrams shown in slides and speech/bullet points → supplement missing information



Approach-Azure AI Video Indexer



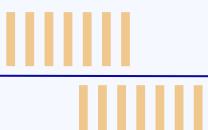


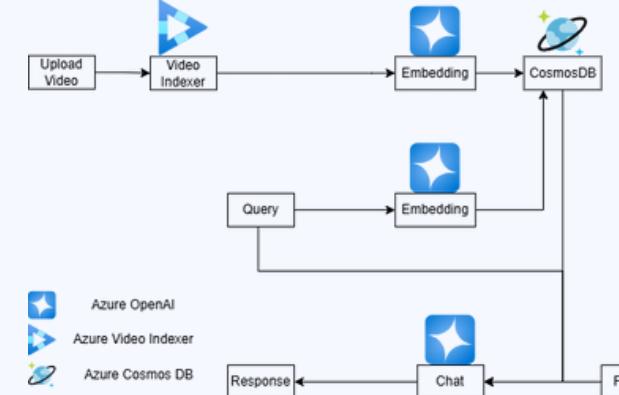
Approach-Configurations

- Video Indexer APIs:
 - **POST** Upload Video
 - Configured *exclude_ai* parameters to reduce irrelevant context
 - Only focus on required visual services (OCR)
 - **GET** Prompt Content
 - Pull video chunks with the relevant context (“*Video title*”, “*Tags*”, “*OCR*”, *Transcript*”)



[Video title] Introduction to Data Structure and Algorithm
[Tags] Beginning
[OCR] Data Structures and, Algorithms, College of Engineering, School of Computer Science and Engineering, Science, Dr, Dr. L, Dr. Loke Yuan Ren, RE, Yuan Ren, N4, N4-02B-69A, Dr. Luu Anh, Dr. Luu Anh Tuan, anh, N4-02B-66, Introduction, N4-02
[Transcript] Seth. Hi, and you all here, can you all hear me? Hello, good afternoon. This is the SC107 Data Structure and Algorithm lecture 1. Good. I hope it is working. So the first part of this module II because the class size is quite large....

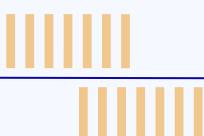




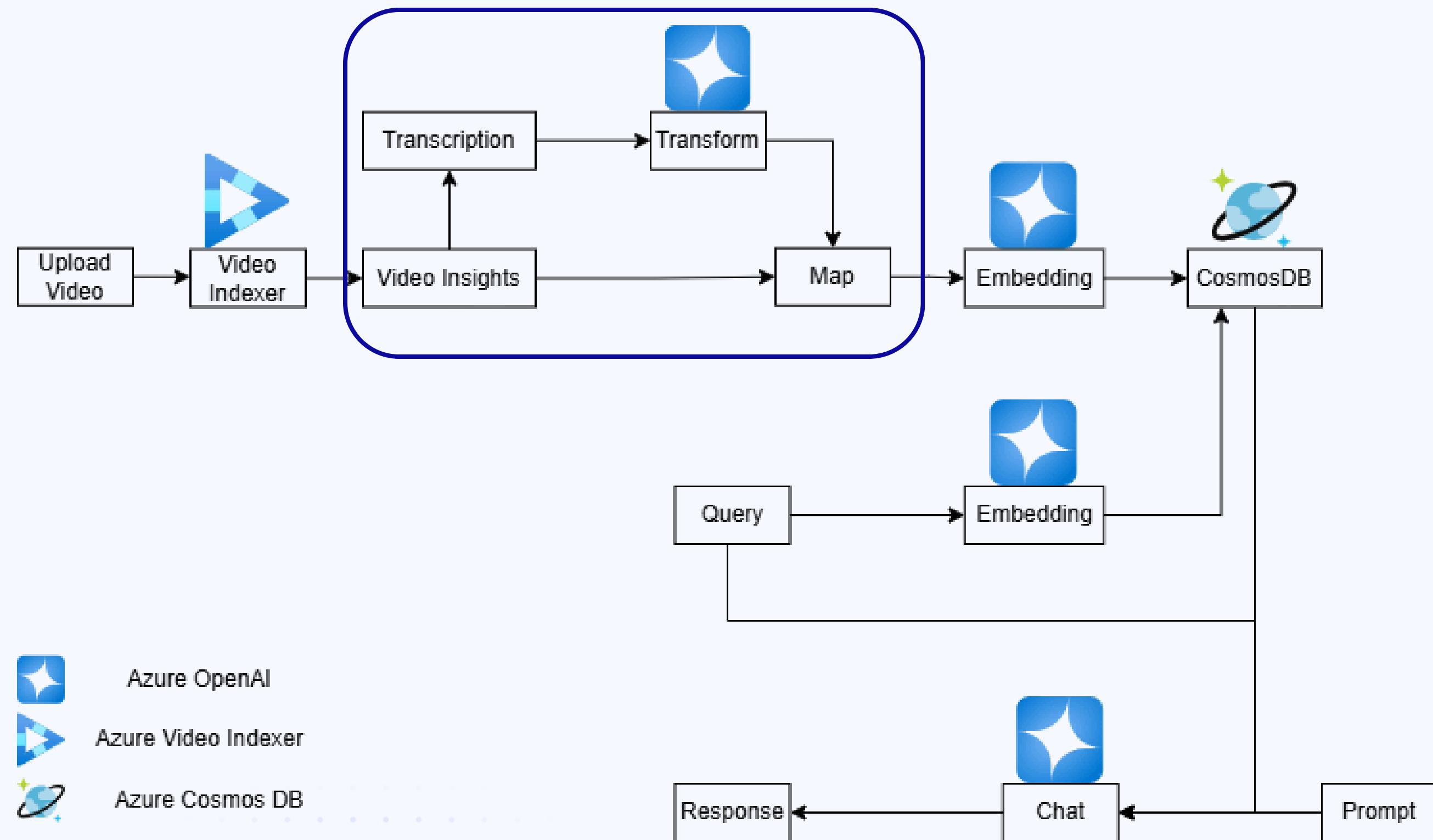
Lecture Characteristics

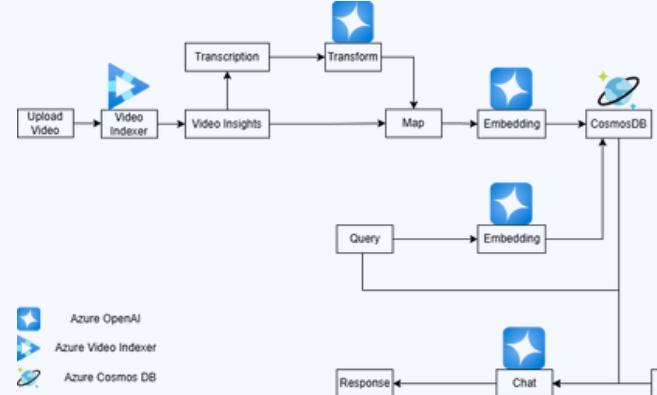
Poor Pronunciation & Enunciation / Transcript Quality

Other topic like computational geometric that maybe involve more mathematics, we will not discuss in this module. And the next level, *yeah*, if you're interested, you maybe can take *like like* our metric geometric in the SPMS. Yeah. So that I'm not going to too details about this, but just let you know that is another topic. We also apply this thing in a lot of in computer graphic. In computer graphic, *yeah*, people will use this, *yeah*. They involve a lot of this kind of computational geometric problem. So here, *yeah. Like* for example, you want to find *like* the boundary of this viewpoint. Yeah, that is a **convex hub** problem. Even a set of point, you want to find the smallest convex Polygon containing all the point. That is a computational geometric problem. One of the computer computational geometric problem, another one. *Yeah*, you give me a few point then *I* need to find to have all the to triangulate all these point and such that there's no Y in, in P is inside the circumcircle of any triangle. *Yeah*, that is the well known Delaunay triangulation. *Yeah. And and that is involved a lot of, again, you'll find that in computer science actually involve a lot of problem, actually involve a Yeah, a lot in mathematics first, before you can really implement the program.* You want to appreciate this one, you want to solve this problem. Yeah, your **Max** must be good, especially in geometric before you can implement it. *Yeah*. This we will not cover in this module, just let you know just for your information, another one is a very typical problem in engineering.



Approach - Transformation





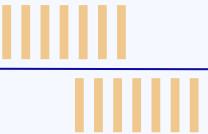
Approach - Transformation

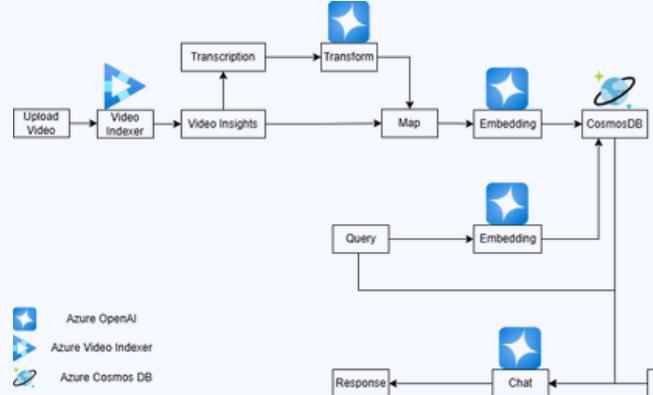
- GPT-4o + Prompt Engineering
- **Cleaning** of transcripts to remove filler words, truncate sentences and correct spelling errors
- Use *Course Description* and *Video Description* to **provide context** for LLM to correct technical terms

```
def generate_clean_transcript(self, transcript: str, course_description: str, video_description: str):
    try:
        prompt = PromptTemplate(
            template=self.prompt_template,
            input_variables=["course description", "video description", "context"]
        )

        combine_docs_chain = create_stuff_documents_chain(self.chat_model, prompt)

        return combine_docs_chain.invoke({
            "course description": course_description,
            "video description": video_description,
            "context": [Document(page_content=transcript)]
        })
    except Exception as ex:
        print(ex)
        return ex
```





Lecture Characteristics

Slide-based, logically segmented

SC1007 Data Structures and Algorithms

Algorithm VS Program

- A computer program is an instance, or concrete representation of an algorithm in some programming languages.
- Implementation is the task of turning an algorithm into a computer program.

```

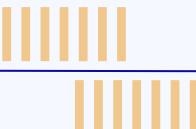
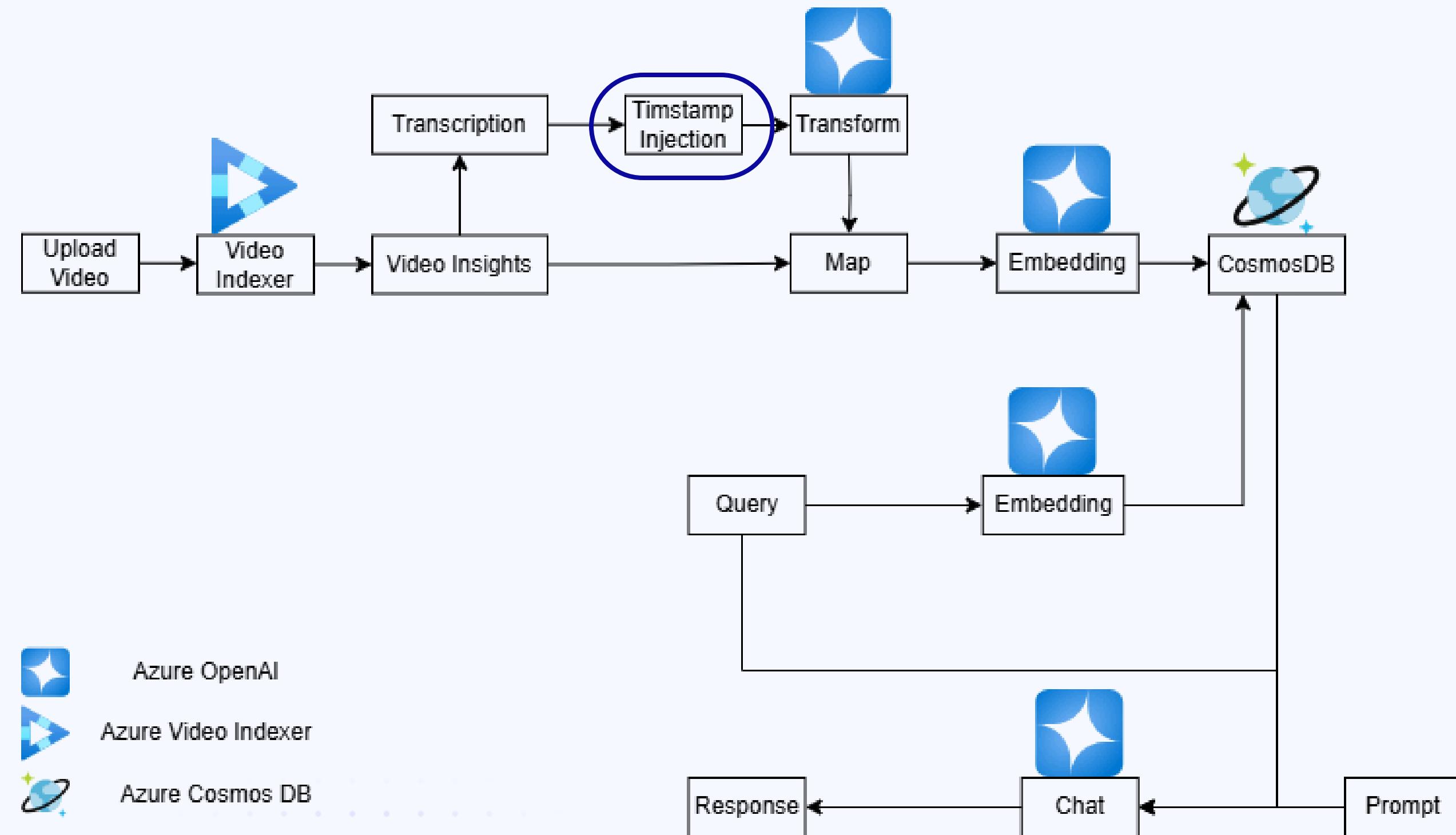
graph TD
    Problem[Problem] --> Algorithm[Algorithm]
    Algorithm --> Program[Program]
    Program --> Problem
    Program --> Algorithm
  
```

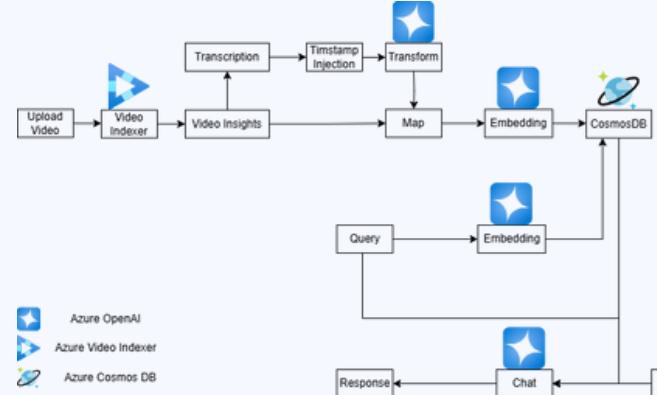
Input → Program → Output

36:36 / 1:23:17

- Each slide often maps to a clear timestamp
- Students often want to revisit exact moments where complex concepts were explained
- *Can we allow chatbots to reference the timestamp of the content?*

Approach - Timestamp Injection





Approach-Timestamp Injection

- Injecting Timestamps within the transcripts (using '[' and ']' as boundaries) to provide time context during prompt generation

```

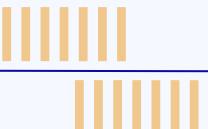
    ▼ transcript: Array (636)
      ▼ 0: Object
        id : 1
        text : "Seth, "
        confidence : 0.1258
        speakerId : 1
        language : "en-US"
      ▼ instances : Array (1)
        ▼ 0: Object
          adjustedStart : "0:00:17.33"
          adjustedEnd : "0:00:17.61"
          start : "0:00:17.33"
          end : "0:00:17.61"
      ▪ 1: Object
        id : 2
        text : "Hi, and you all here, can you all hear me? "
        confidence : 0.7862
        speakerId : 1
        language : "en-US"
      ▼ instances : Array (1)
        ▼ 0: Object
          adjustedStart : "0:00:39.88"
          adjustedEnd : "0:00:45.88"
          start : "0:00:39.88"
          end : "0:00:45.88"
    
```

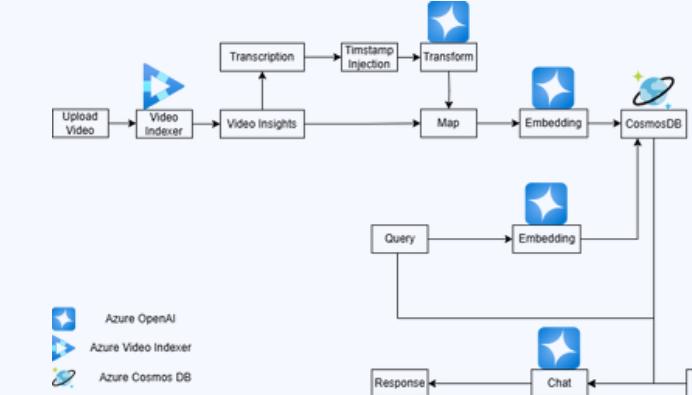
```

def map_insights_to_transcript(self, insight, video_id):
    transcript_list = insight["videos"][0]["insights"]["transcript"]
    document = {
        "phrases": [
            {
                "start": phrase["instances"][0]["adjustedStart"],
                "end": phrase["instances"][0]["adjustedEnd"],
                "phrase": phrase["text"]
            } for phrase in transcript_list
        ]
    }

    transcript_timestamp = ""
    transcript_raw = ""
    for phrase in transcript_list:
        transcript_timestamp += "[" + phrase["instances"][0]["adjustedStart"] + "] "
        transcript_timestamp += phrase["text"] + " "
        transcript_raw += phrase["text"] + " "
    document["transcript_timestamp"] = transcript_timestamp.strip()
    document["transcript"] = transcript_raw.strip()
    document["video_reference_id"] = video_id

    self.transcript_db.save_transcript(document)
    return document
  
```





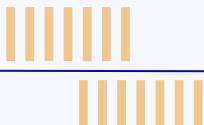
Transcript-Changes

Other topic like computational geometric that maybe involve more mathematics, we will not discuss in this module. And the next level, yeah, if you're interested, you maybe can take like like our metric geometric in the SPMS. Yeah. So that I'm not going to too details about this, but just let you know that is another topic. We also apply this thing in a lot of in computer graphic. In computer graphic, yeah, people will use this, yeah. They involve a lot of this kind of computational geometric problem. So here, yeah. Like for example, you want to find like the boundary of this viewpoint. Yeah, that is a **convex hull** problem. Even a set of point, you want to find the smallest convex Polygon containing all the point. That is a computational geometric problem. One of the computer computational geometric problem, another one. Yeah, you give me a few point then I need to find to have all the to triangulate all these point and such that there's no Y in, in P is inside the circumcircle of any triangle. Yeah, that is the well known Delaunay triangulation. Yeah. And and that is involved a lot of, again, you'll find that in computer science actually involve a lot of problem, actually involve a Yeah, a lot in mathematics first, before you can really implement the program. **You want to appreciate this one, you want to solve this problem. Yeah, your Max must be good, especially in geometric before you can implement it.** Yeah. This we will not cover in this module, just let you know just for your information, another one is a very typical problem in engineering.

Original Transcript

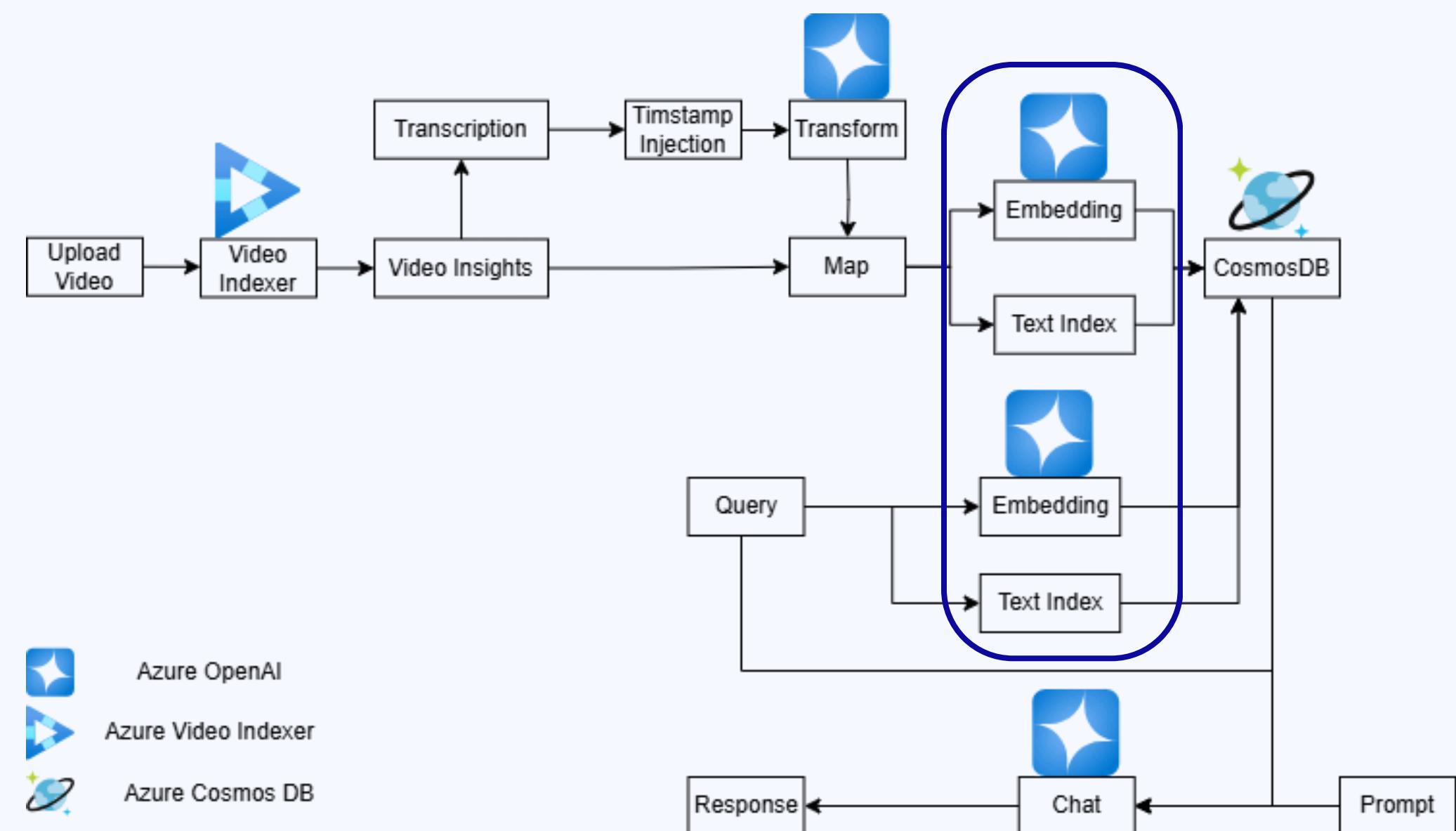
[1:07:38.8] Other topics, like computational geometry, may involve more mathematics, and we will not discuss them in this module. [1:07:47.44] If you're interested, you may take computational geometry in the SPMS. [1:07:49.12] I'm not going into too much detail about this, but just to let you know, it is another topic. [1:07:56.16] We also apply this in computer graphics. [1:08:01.88] In computer graphics, people use this. [1:08:05.72] They involve a lot of computational geometry problems. [1:08:10.88] For example, you want to find the boundary of a viewpoint. [1:08:20.72] That is a **convex hull** problem. [1:08:23.04] Given a set of points, you want to find the smallest convex polygon containing all the points. [1:08:30.76] That is a computational geometry problem. [1:08:34.16] Another problem is, if you give me a few points, I need to triangulate all these points such that no point in P is inside the circumcircle of any triangle. [1:09:02.24] That is the well-known Delaunay triangulation. [1:09:07.84] This involves a lot of problems in computer science, which also involve a lot of mathematics before you can really implement the program. [1:09:25.76] **To appreciate this, you need to have a good understanding of mathematics, especially in geometry, before you can implement it.** [1:09:37.64] We will not cover this in this module, just for your information. Another typical problem in engineering is numerical problems and optimization problems.

Transformed Transcript



Hybrid Search

- Test Hybrid Search Approach in Video Retrieval Context
 - Text Search
 - Semantic Search
 - Reciprocal Rank Fusion (RRF)



03

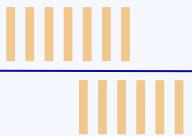
Experiment

Methodology & Results



RAG Versions

RAG	Description
RAG v0	Naive RAG, Semantic Search
RAG v1	Hybrid Search
RAG v2	Semantic Search, LLM Transcript Transformation (Cleaning + Timestamp Injection)
RAG v3	Hybrid Search, LLM Transcript Transformation





RAG Versions

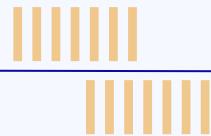
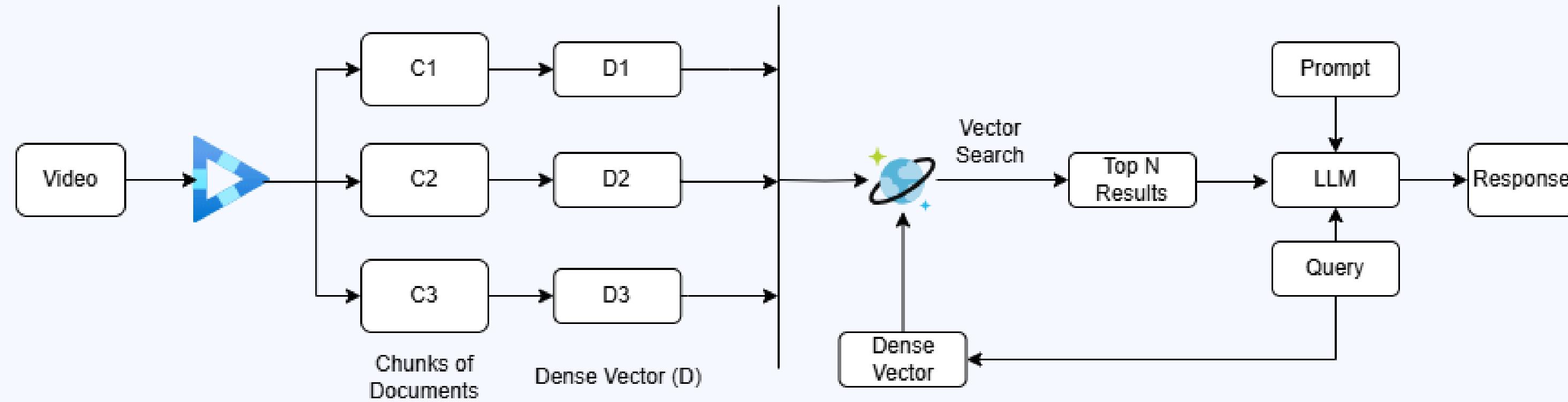
Naive RAG - RAG v0



Azure CosmosDB for MongoDB



Azure Video Indexer





RAG Versions

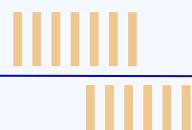
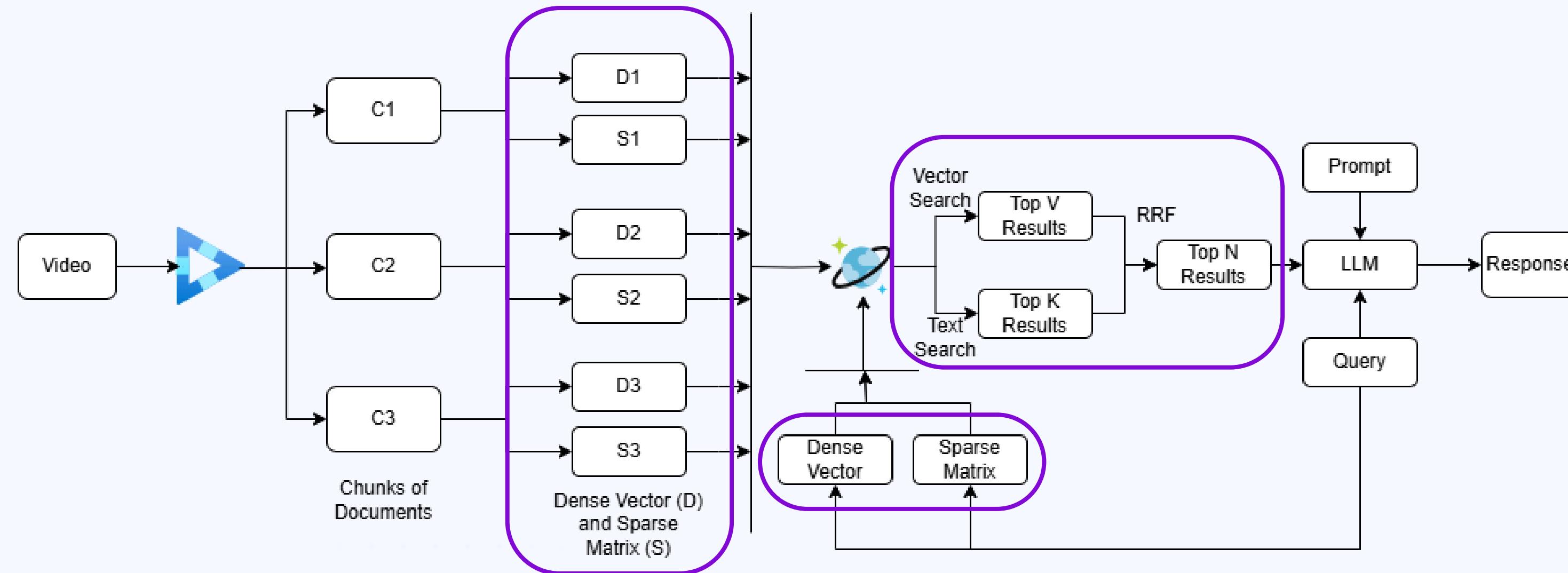
Hybrid Search - Introduced in RAG v1 & v3

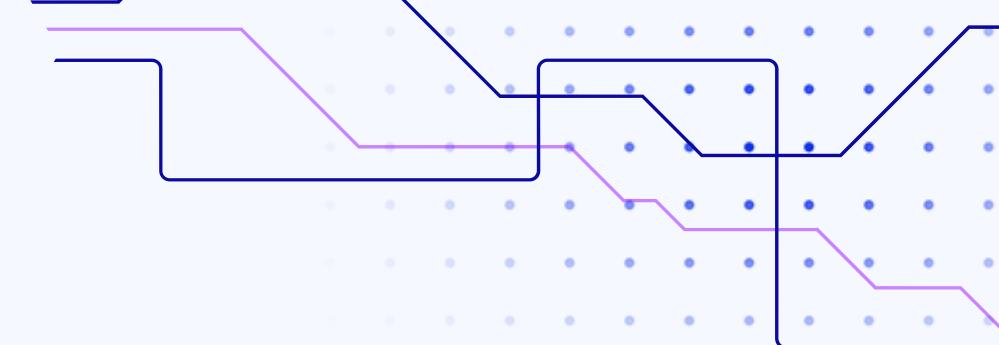


Azure CosmosDB for MongoDB



Azure Video Indexer





RAG Versions

LLM Transcript Transformation - Introduced in RAG v2 & v3



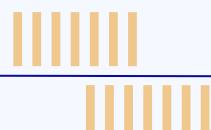
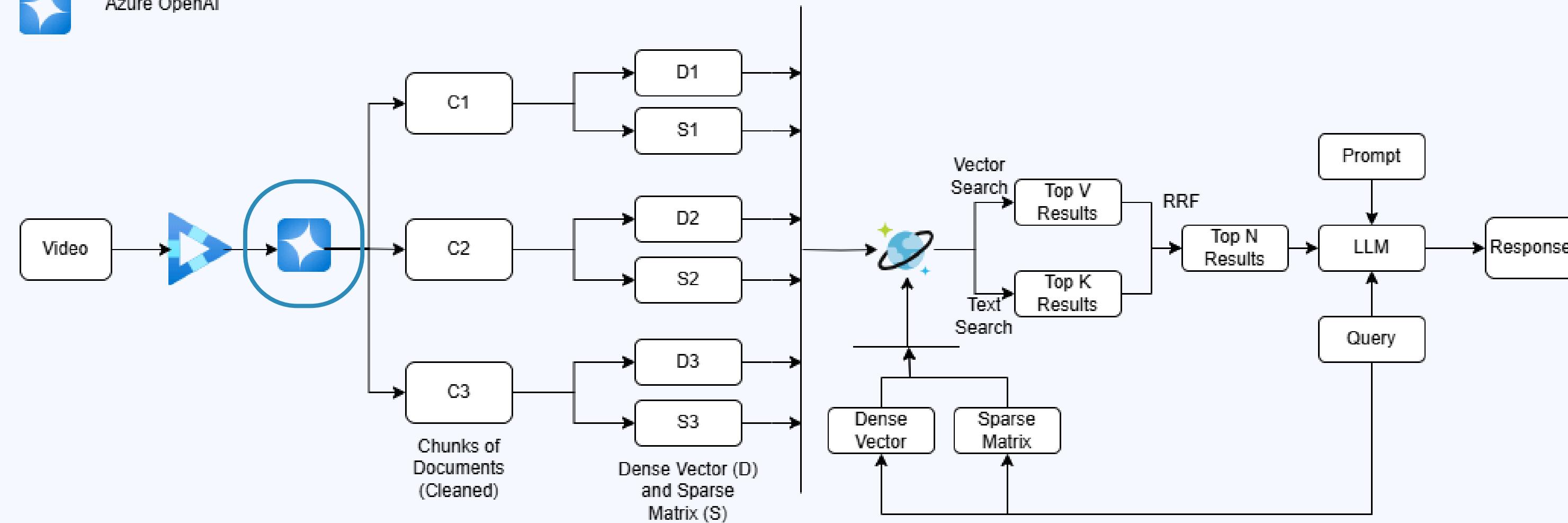
Azure CosmosDB for MongoDB



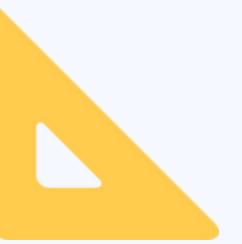
Azure Video Indexer



Azure OpenAI



Experiment (RAGAS)



SingleTurnSample

- Single-turn interaction between a user, LLM, and expected results for evaluation
- Evaluations that involve a single question and answer pair

Evaluator

- GPT-4o
- Output scores for the different metrics used

Dataset

- Generic and Temporal Question Dataset
- Human-annotated

Metrics (RAGAS)

1

Context Precision

Measures the proportion of relevant chunks in the retrieved context

2

Context Recall

Measures how many of the relevant documents were successfully retrieved

3

Faithfulness

Measures how factually consistent a response is with the retrieved context

4

Response Relevancy

Measures how relevant a response is to the user input

Dataset

Crafted with respect to *SC1007 Introduction to Data Structures and Algorithms*

Generic Question Dataset

- Question-answer pairs covering a broad range of topics discussed in the lecture video
- Example: (“When is the first lab test?”, “3rd March”)

Temporal Question Dataset

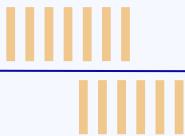
- Question-answer pairs requiring time-sensitive reasoning
- Example: (“When did the lecturer talked about how SC1007 relates to other courses?”, “The lecturer talked about it when mentioning CS Curriculum Structure. This is mentioned from 23:40 to 25:00.”)





Results (Generic)

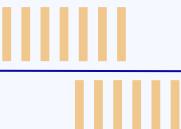
Metric	Context Precision	Context Recall	Faithfulness	Response Relevancy
RAG v0	0.723	0.764	0.867	0.949
RAG v1	0.730	0.76	0.804	0.944
RAG v2	0.729	0.808	0.779	0.955
RAG v3	0.764	0.79	0.774	0.952

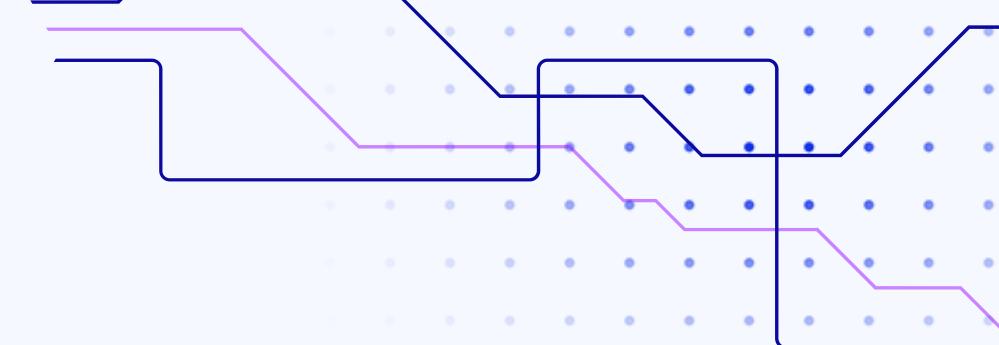


Results (Generic)

Metric	Context Precision	Context Recall	Faithfulness	Response Relevancy
RAG v0	0.723	0.764	0.867	0.949
RAG v1	0.730	0.76	0.804	0.944
RAG v2	0.729	0.808	0.779	0.955
RAG v3	0.764	0.79	0.774	0.952

Removal of Irrelevant Content





Results (Generic)

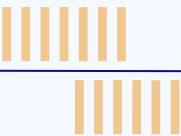
Metric	Context Precision	Context Recall	Faithfulness	Response Relevancy
RAG v0	0.723	0.764	0.867	0.949
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RAG v3	0.764	0.79	0.774	0.952

May have Omitted Necessary Context



Results (Temporal)

Metric	Context Precision	Context Recall	Faithfulness	Response Relevancy
RAG v0	0.456	0.75	0.629	0.938
RAG v1	0.423	0.7	0.615	0.929
RAG v2	0.423	0.5	0.660	0.957
RAG v3	0.523	0.8	0.86	0.943



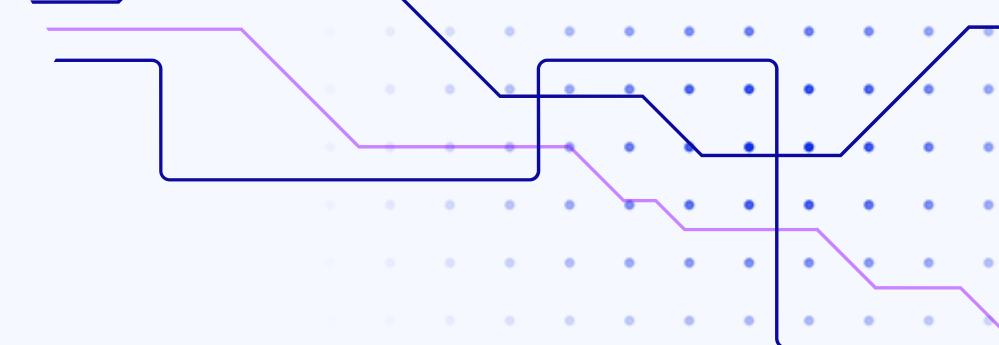


Results (Temporal)

Metric	Context Precision	Co	Generic	Response Relevancy
RAG v0	0.456		0.723	0.938
RAG v1	0.423		0.730	0.929
RAG v2	0.423		0.729	0.957
RAG v3	0.523		0.764	0.943

Poor retrieval of context that requires alignment between the question's temporal reference and the transcript's timestamp





Results (Temporal)

Metric	Context Precision	Context Recall	Faithfulness	Response Relevancy
RAG v0	0.456	0.75	0.629	0.938
RAG v1	0.423	0.7	0.615	0.929
RAG v2	0.423	0.5	0.660	0.957
RAG v3	0.523	0.8	0.86	0.943

May imply a hybrid search + transformation strategy is more beneficial in scenarios requiring temporal reasoning

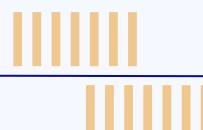




Results (Temporal)

Question
When did the lecturer talked about how SC1007 relates to other courses?
Ground Truth
The lecturer talked about it when mentioning CS Curriculum Structure. This is mentioned from 23:40 to 25:00.
RAG v0 and RAG v1 Answer
The lecturer discussed how SC1007 relates to other courses at the timestamp **(04:00)**. They mentioned that SC1007 is a prerequisite for several other modules, including 2101 Algorithm Design and Analysis, as well as database and AI courses. Additionally, it is also a prerequisite for computer engineering courses like Operating Systems. This highlights the importance of SC1007 in the overall curriculum structure. Covered at **04:00** .
RAG v2 and RAG v3 Answer
The lecturer discussed how SC1007 relates to other courses at several points. Specifically, they mentioned that SC1007 is a prerequisite for several modules, including algorithm design and analysis (2101), database, and AI, which all require SC1007 as a prerequisite. This information was covered at "23:44.04" and "24:27.72" . Additionally, for computer engineering courses like operating systems (OS), SC1007 is also a prerequisite, as noted at "24:36.64" .

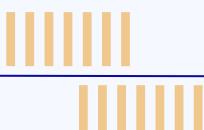
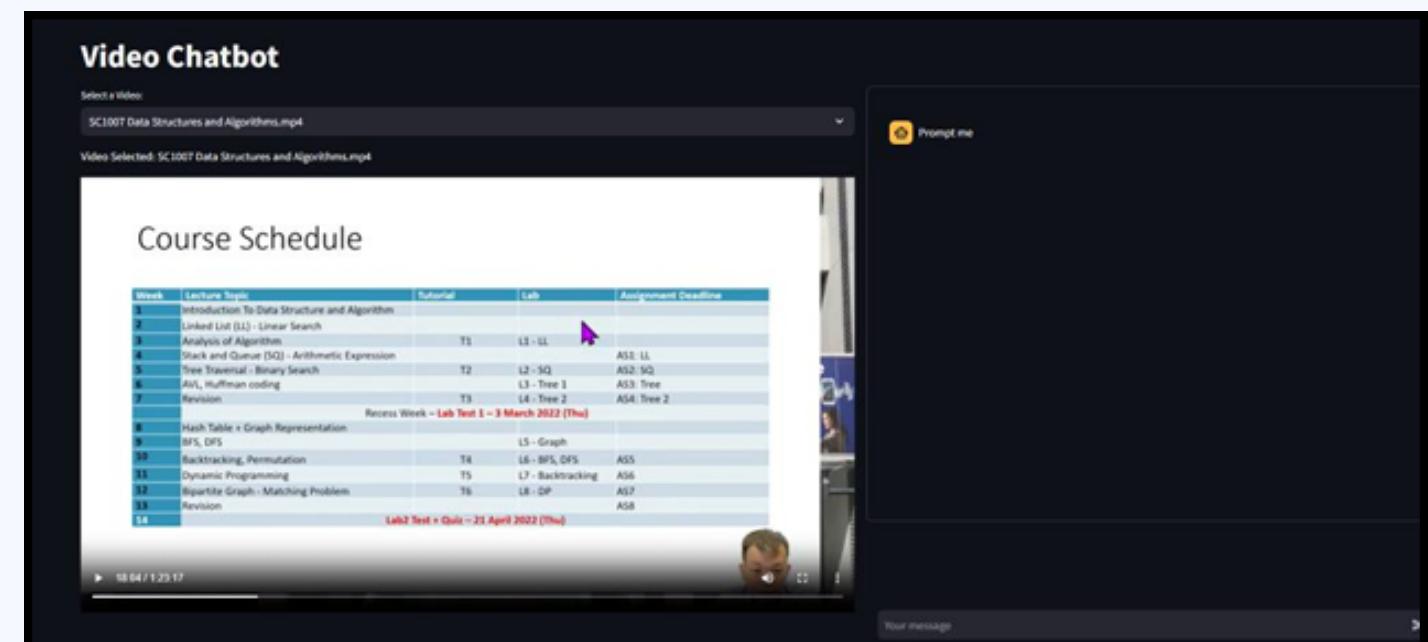
RAG v0 and RAG v1 are **more prone to hallucination** compared to RAG v2 and RAG v3 due to the structure of the prompt, which includes a requirement to provide timestamp information alongside the answer.





User Testing

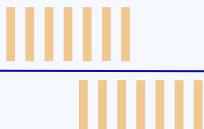
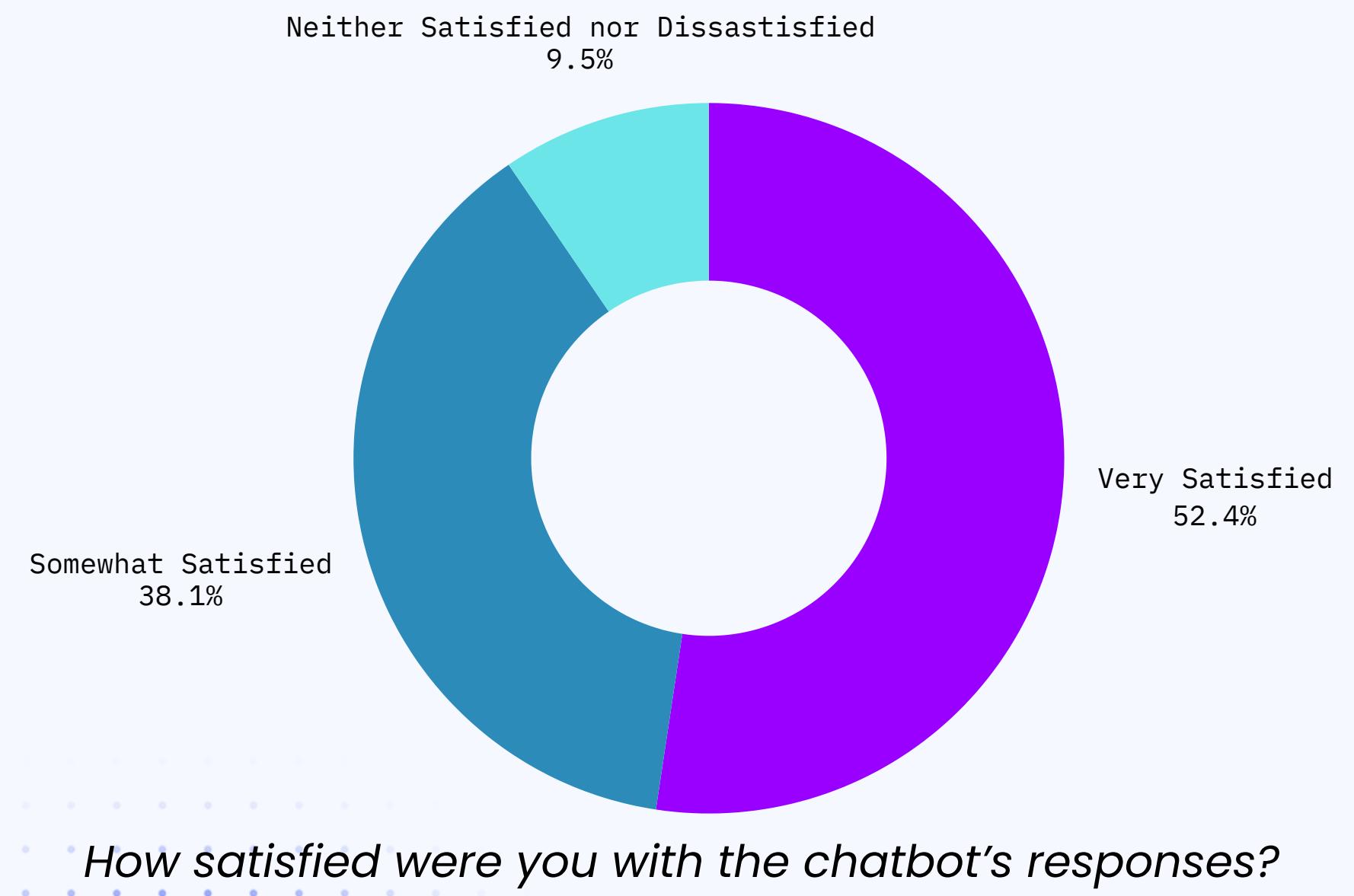
- Aims to gather user feedback on the chatbot's response quality
- Assess the chatbot's performance in a real-world setting
- **RAG v3**
- Participants were given a brief description of *SC1007 Data Structures and Algorithms* lecture video and were tasked to interact with the chatbot
- **21 Responses**
- Mainly Year 1 and 2 students from the College of Computing and Data Science (CCDS), who are familiar with the SC1007 course





User Testing

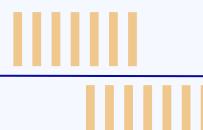
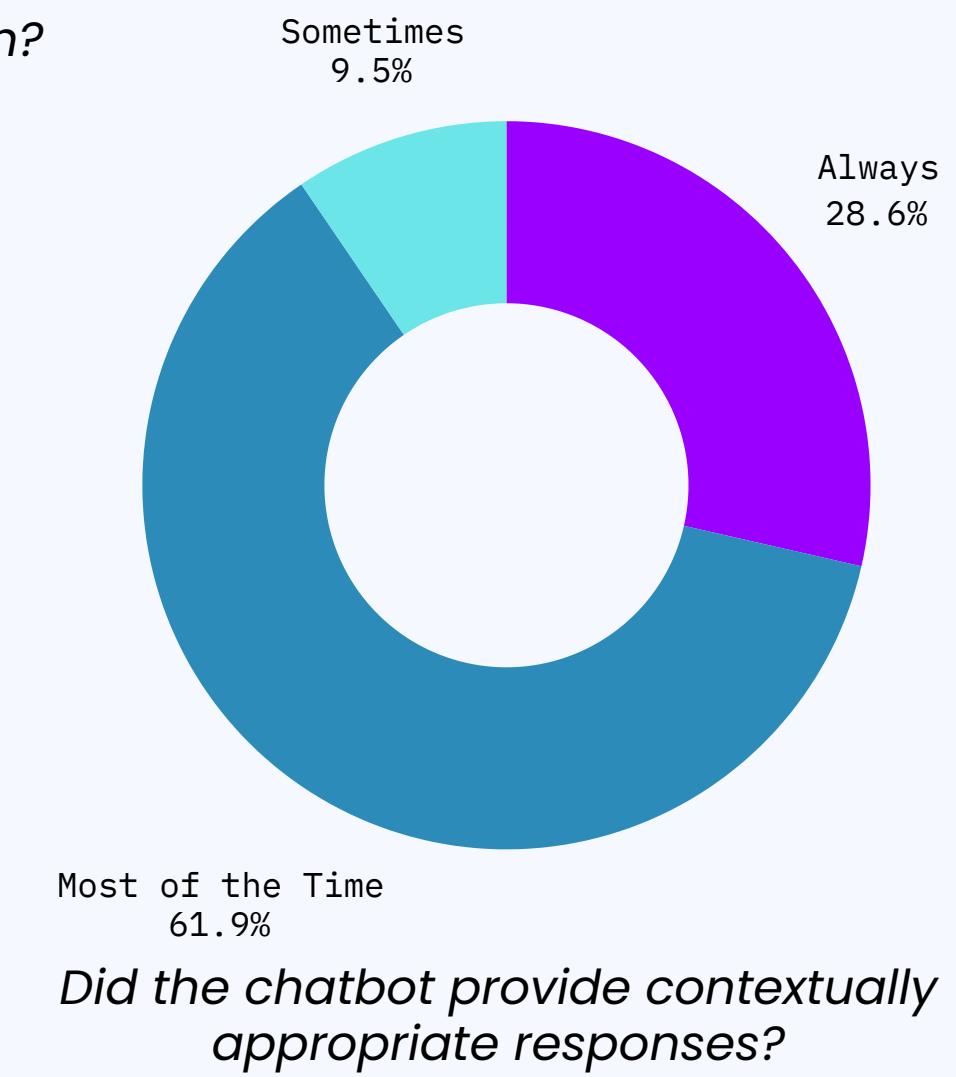
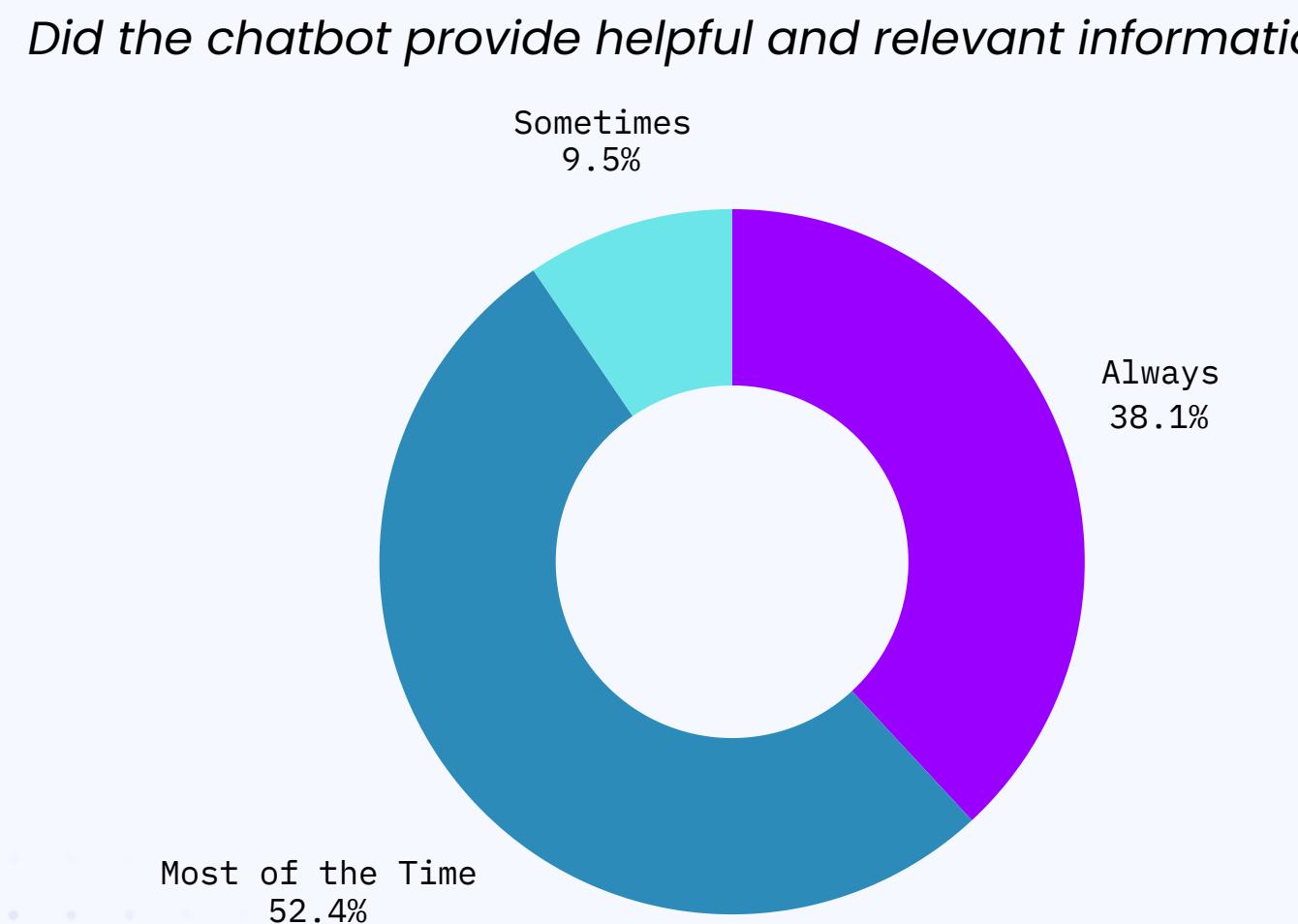
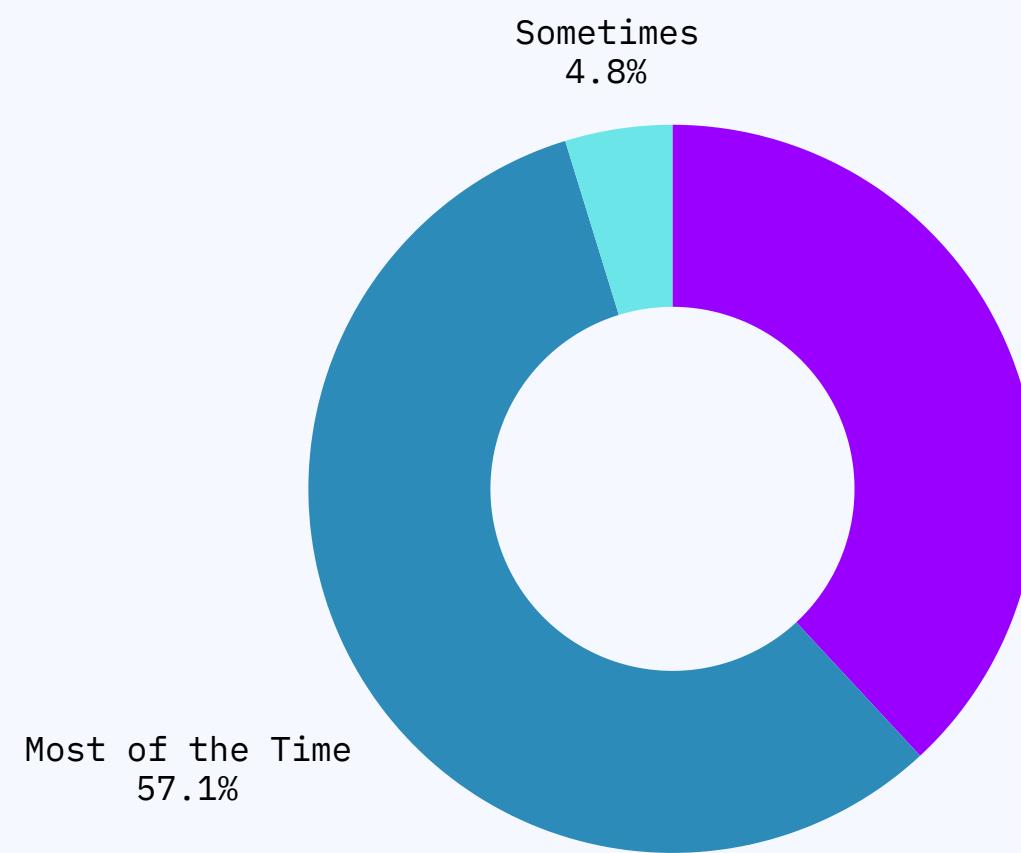
- **90%** of respondents were either *Very Satisfied* or *Somewhat Satisfied* with the chatbot's responses
- No respondents expressed dissatisfaction





User Testing

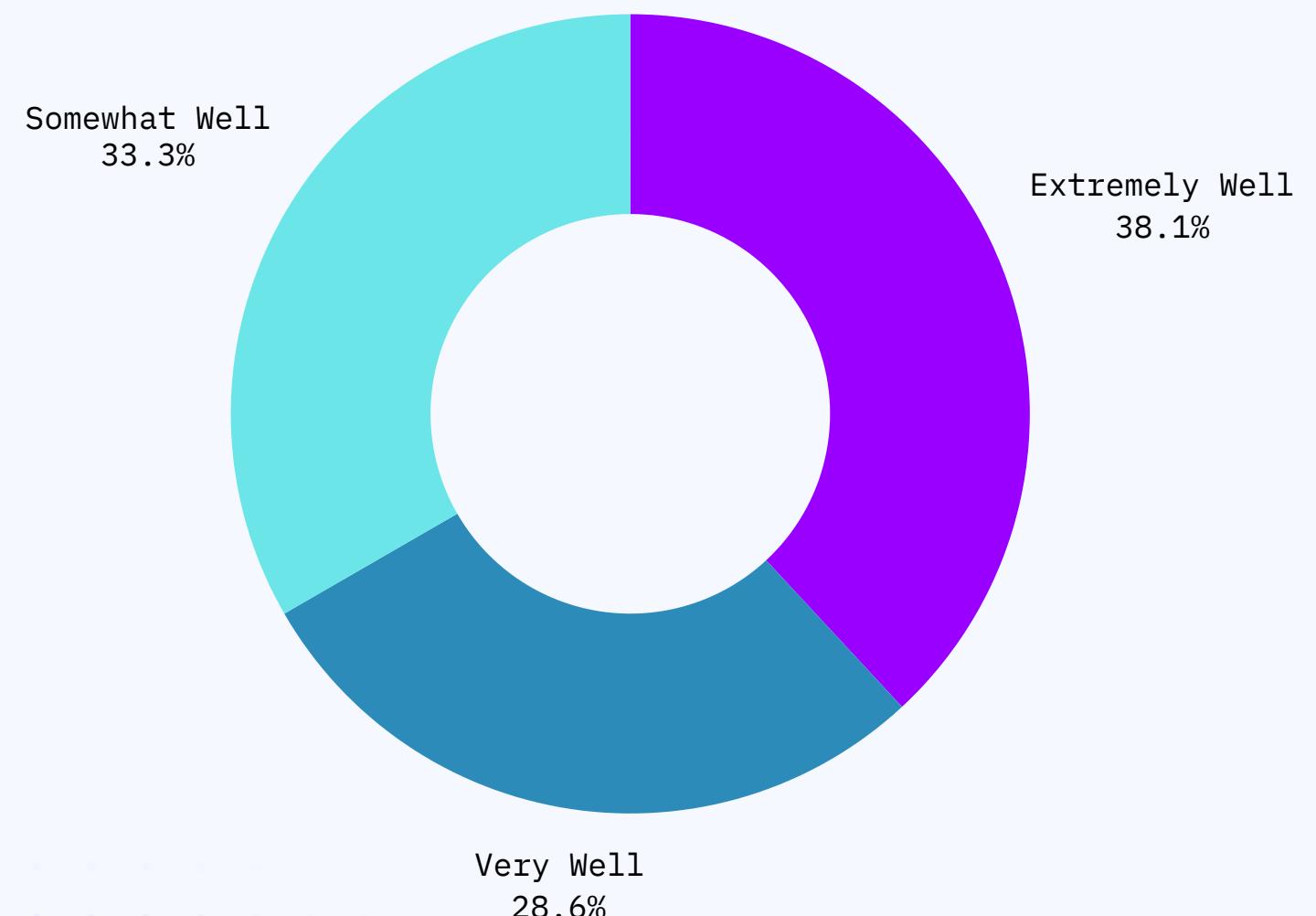
- 90% of respondents indicated that the chatbot understood their queries accurately and provided helpful, relevant, yet contextually appropriate responses
- RAG v3 can effectively produce **high response quality and contextual alignment**





User Testing

- 33% of respondents felt that the chatbot only performed *Somewhat Well* with complex queries
- Room for improvement in **handling complex or ambiguous queries**



How well did the chatbot handle complex queries?



04

Application

Use Cases & Demo



Use Cases



Interact

- Students must be able to query using the chatbot
- Chatbot must be able to answer with relevant context



Manage Course

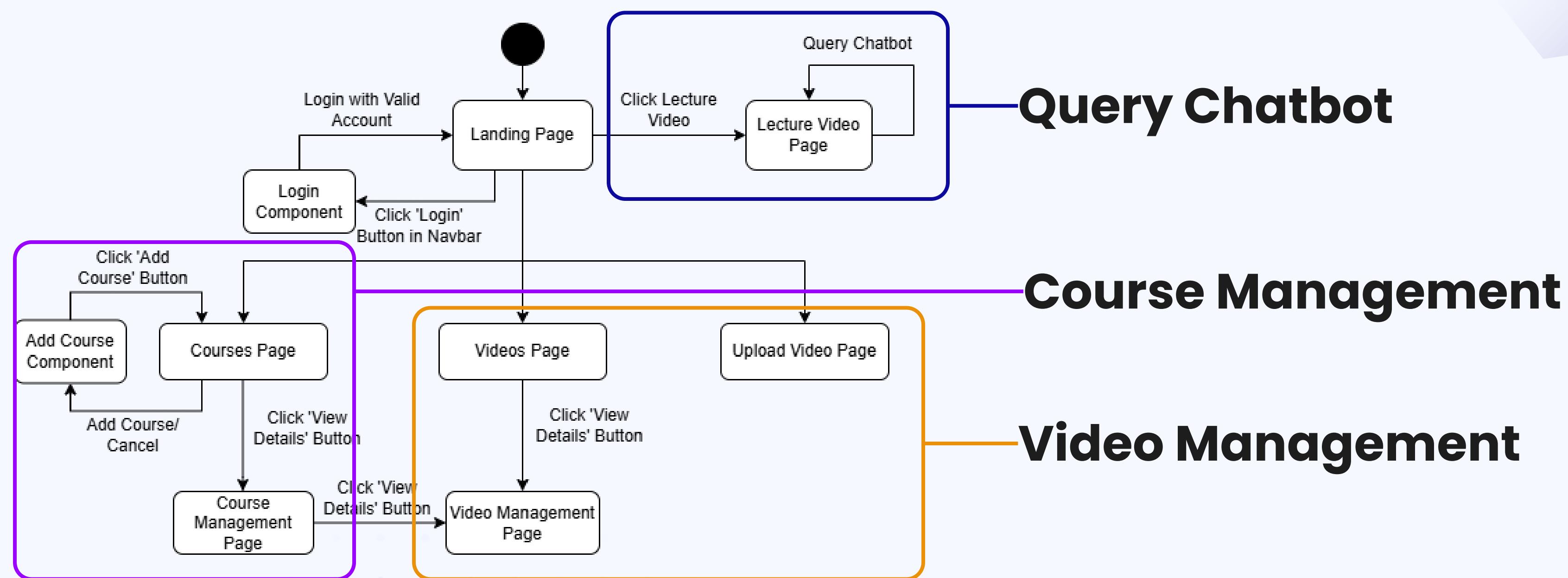
- Lecturers must be able to manage their courses
- Viewing, updating and deleting course information



Manage Lecture

- Lecturers must be able to manage lecture videos
- Viewing, updating, uploading and deleting lecture information

Flow





Application

Demo

05

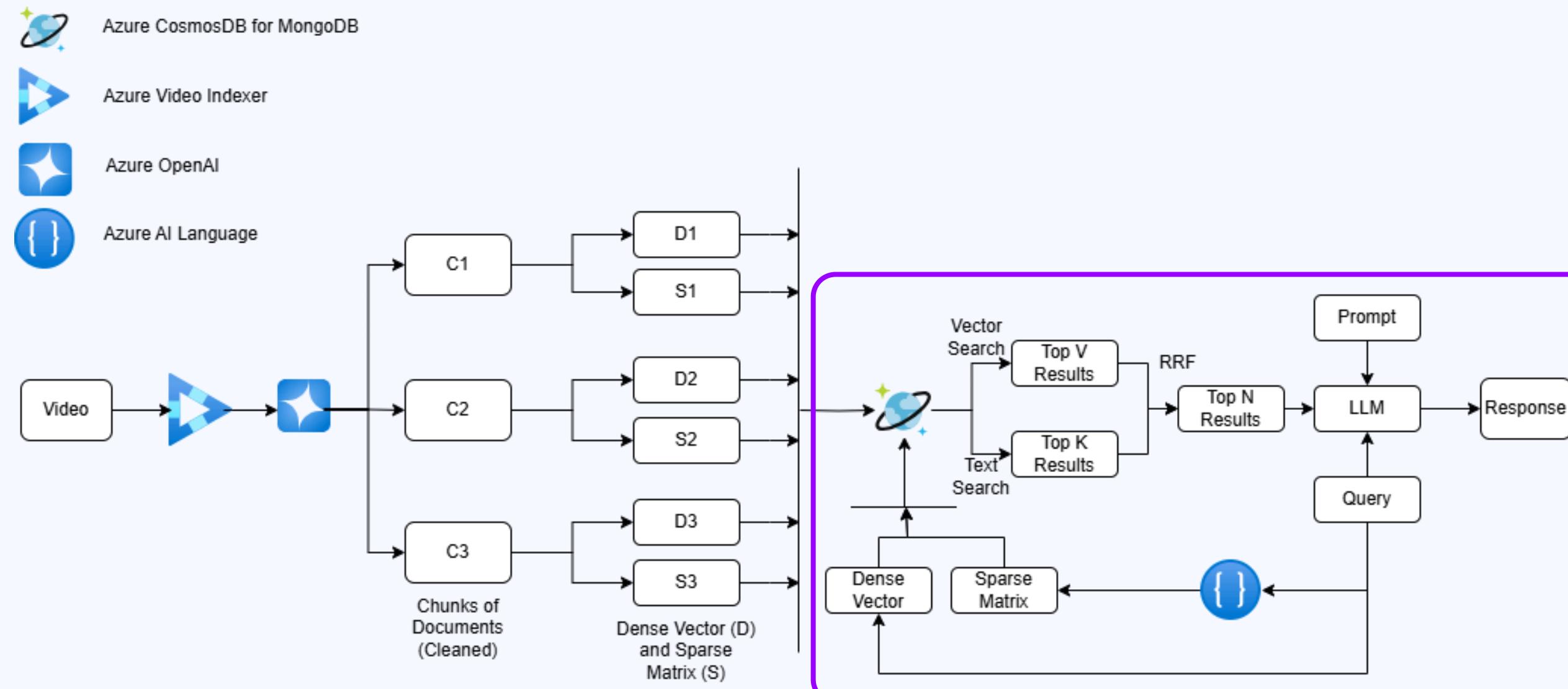
Conclusion

Future Developments

Limitations & Future Developments

Complex Queries

- Extracting keywords using Azure AI Language
- Query Reformulation, whereby the query preprocessed via summarization to reflect its intent



Limitations & Future Developments

Temporal Understanding

- Drop in Context Precision on the Temporal Question Dataset compared to the Generic Question Dataset
- Indexing on the timestamp to retrieve more temporally aligned contexts:
 - Implemented by associating each chunk with its corresponding timestamp
 - Filtering based on temporal proximity
 - Simple timestamp filtering method

Usability

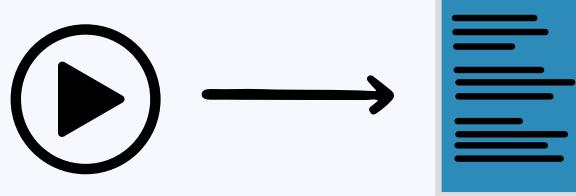
- Application can enhance **engagement/usability** with quiz generations, etc
- **Integration** with existing platforms (e.g. askNarelle)

Project's Outcome



Learning Companion Chatbot

- Create application where users are able to interact with the chatbot
- Provide Course and Lecture Management System for lecturers



Video-to-Text

- Explore existing video-to-text technologies
- Experiment ways to enhance contextual building of lecture videos

Thanks!

Do you have any questions?

CREDITS: This presentation template was created by [Slidesgo](#), and includes icons by [Flaticon](#), and infographics & images by [Freepik](#)

References

- https://www.youtube.com/watch?v=grNf_6wTJug
- <https://learn.microsoft.com/en-us/azure/azure-video-indexer/video-indexer-overview>
- https://www.youtube.com/watch?v=wJO_vIDZn-l
- <https://medium.com/@mayssamayel4/building-a-rag-system-with-gpt-4-a-step-by-step-guide-291711342f0d>

QnA Comments

Temporal Understanding

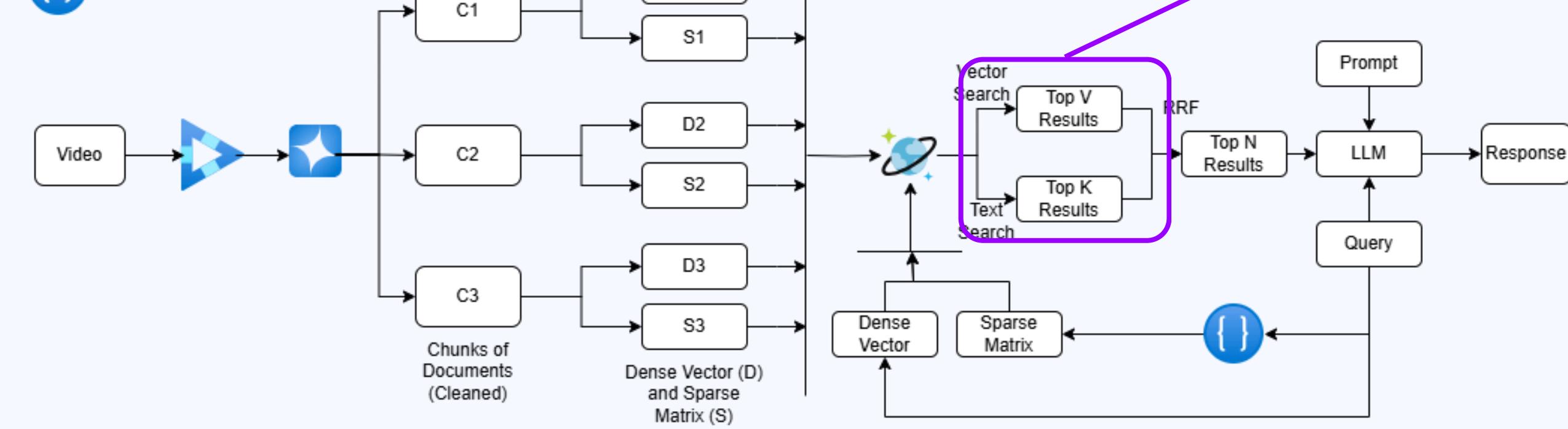
- Lack of Temporal Understanding is a common problem in LLMs
- How can we resolve such an issue?

 Azure CosmosDB for MongoDB

 Azure Video Indexer

 Azure OpenAI

 Azure AI Language

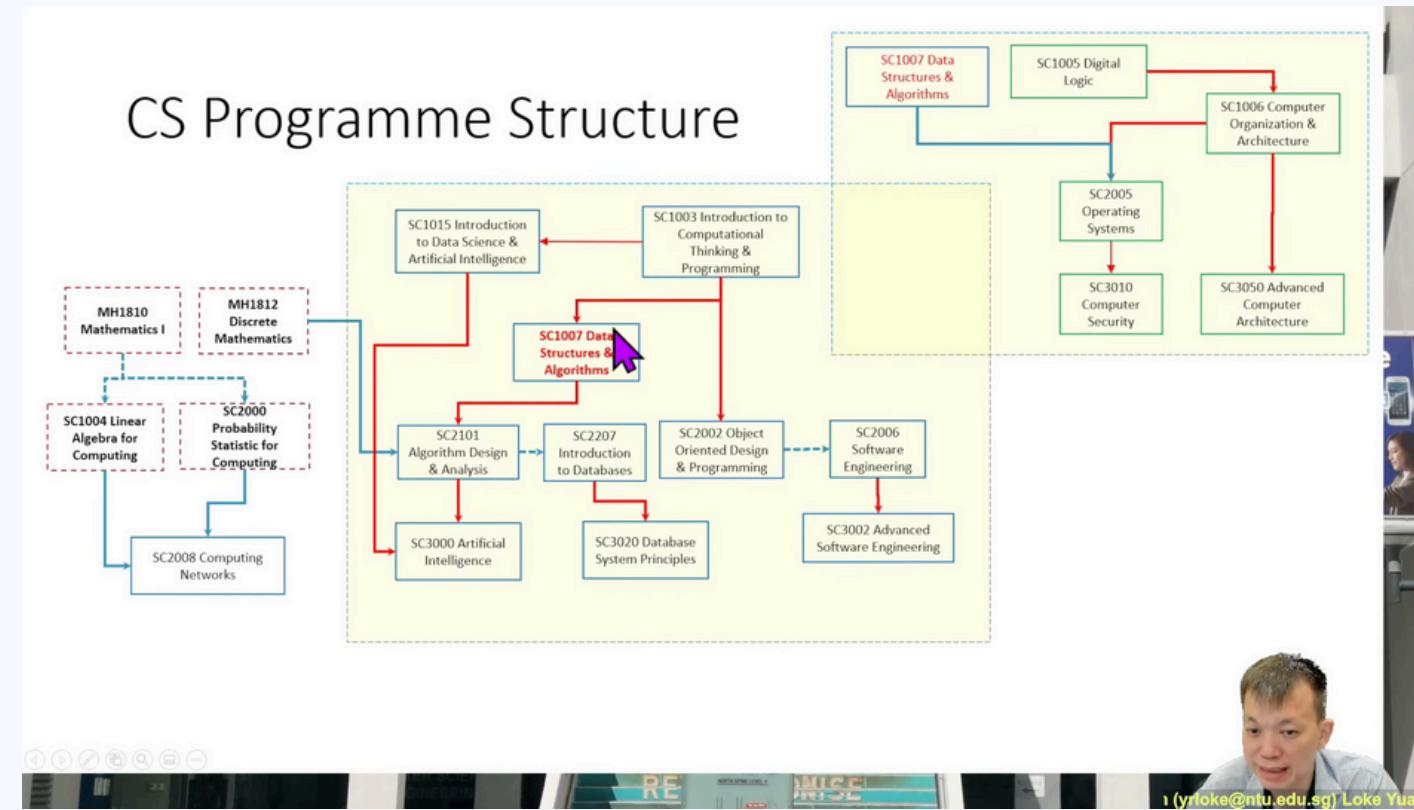


Additional retrieval method based on timestamp (spatial indexing) - this improves context precision as it narrows search space

QnA Comments

Error Analysis

- Acknowledged that test results are not representative of all lectures
 - Some lectures can be diagram heavy and speech may refer to diagrams
 - How can we build such a relationship?
 - Other Vision Services must be used (Might even require own model to identify the diagrams) → how can it identify relationship in diagram?



“In this diagram, ...”

QnA Comments

Error Analysis

- Experimental Results
 - Might need to create tests data for different types of lecture videos
 - How does it perform against other types of lecture videos?