YOUTUBE LINK

- https://youtu.be/KF8UAyMPDv8

A3: ARCHITECTURAL ENHANCEMENT

GROUP 20:

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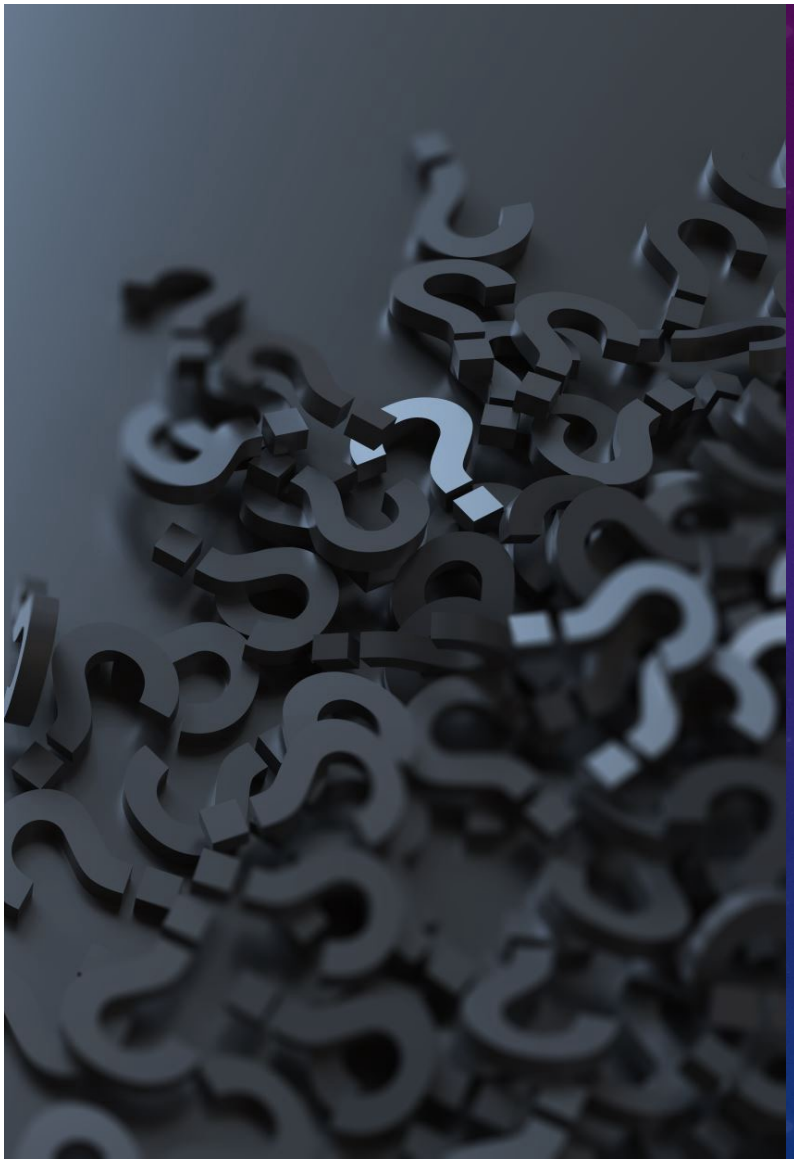


INTRODUCTION

- Previously covered conceptual and concrete architecture of FlightGear
- Used Scitools Understand, found divergences between conceptual and concrete
- Proposing an Air Traffic Control speech-to-text module
- Incorporate LLM functionality into FlightGear

OVERVIEW

- Proposed Enhancement
- SAAM Analysis
- Impact on Subsystems/Architecture
- Potential Risks
- Testing
- Sequence Diagram

PROPOSED ENHANCMENT

Existing add-ons for voice commands with ATC

Utilize numen for speech-to-text

Developing feature based on Red Griffin ATC add-on

Allow optional LLM functionality

SAAM ANALYSIS

Stakeholders include users and developers

Developers responsible for implementation	• Proposed feature adds computational requirements and complexity
Users focused on usability, security, reliability	• Expect accurate and fast execution, concerned with added performance requirements

SAAM ANALYSIS

- Chosen architecture for this improvement is a Client-Server model
- ATC acts as client and LLM acts as server
- Consider maintainability, evolvability, testing, performance
- Use unit testing, performance profiling, scalability testing

IMPACT ON SUBSYSTEMS

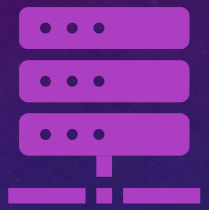
ATC	Must properly understand input and output appropriate response
Add-ons	Red Griffin ATC add-on must access speech input and output established ATC requests
Input	Must add microphone input

IMPACT ON CONCEPTUAL & CONCRETE ARCHITECTURE

Conceptual Architecture

Data flow and networking must support STT and LLM data

Red Griffin ATC used instead of base ATC



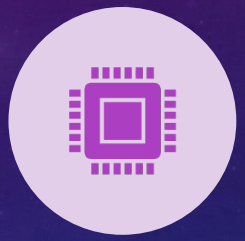
Concrete Architecture

ATC subsystem must change to Red Griffin

New subsystems added: Lumen STT, LLM, and data interface

POTENTIAL RISKS AND LIMITATIONS

LLMs are computationally expensive



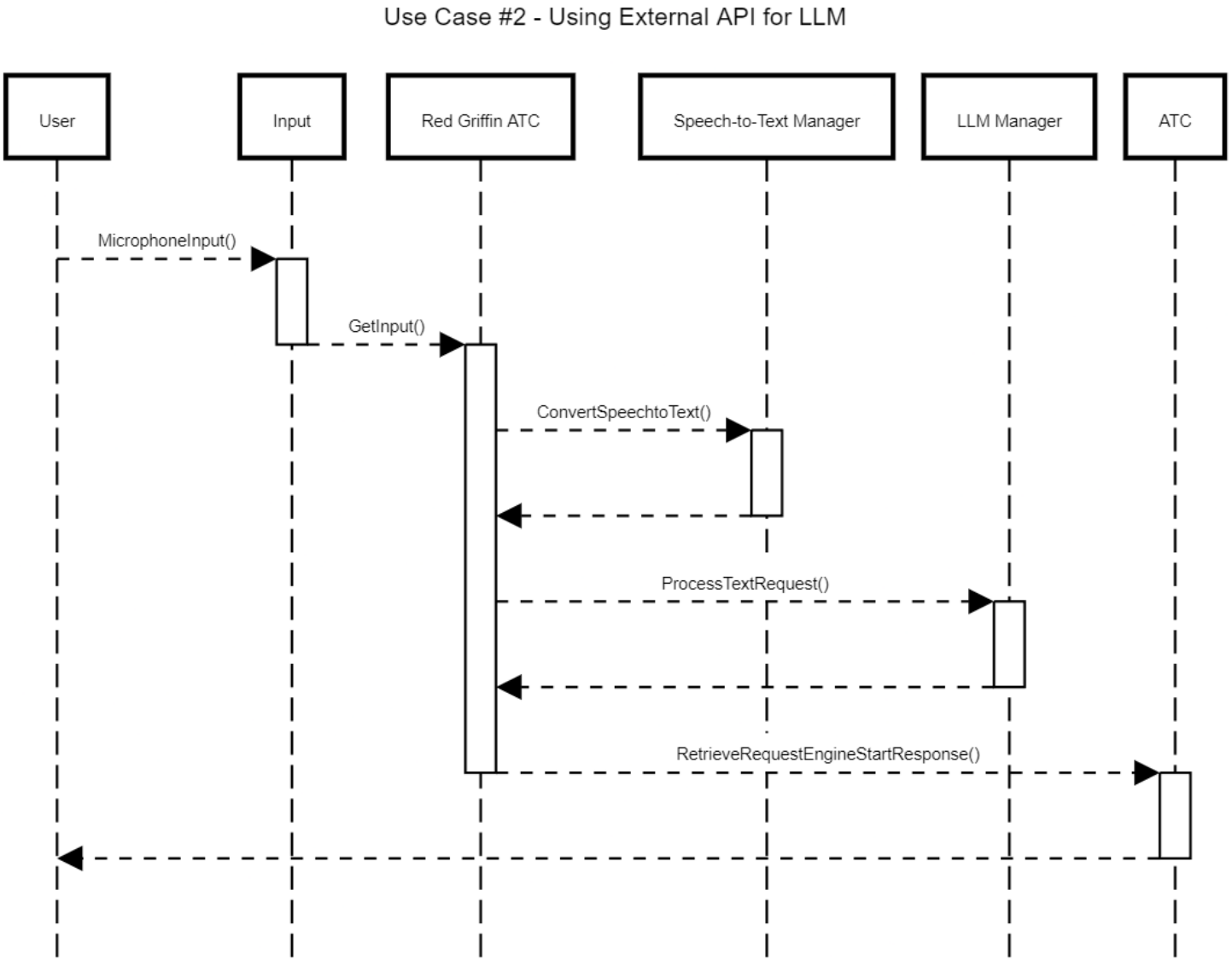
External LLM reduces computations, but increases network load and wait time

Data privacy concerns around OpenAI, Meta

LLM usage can sacrifice accuracy in interpretation

TESTING

- Unit testing of Lumen STT and LLM functionality
- Integration testing between the two
- STT testing involves recognition accuracy and interface compatibility
- LLM tested via text input testing
- Integration tested by feeding STT output into LLM



SEQUENCE DIAGRAM

- *Sequence diagram of using LLM with Red Griffin ATC in order to process the request of starting engine.*

LESSONS LEARNED

- Initially proposed STT add-on
- Considered use of LLMs and impact on system
- Consider more modularity to give players options for performance, accuracy, and privacy

CONCLUSION

- By extending current architecture through add-ons, made FlightGear more immersive
- Can utilize existing open-source add-ons
- Give more choice to the user with optional LLM features