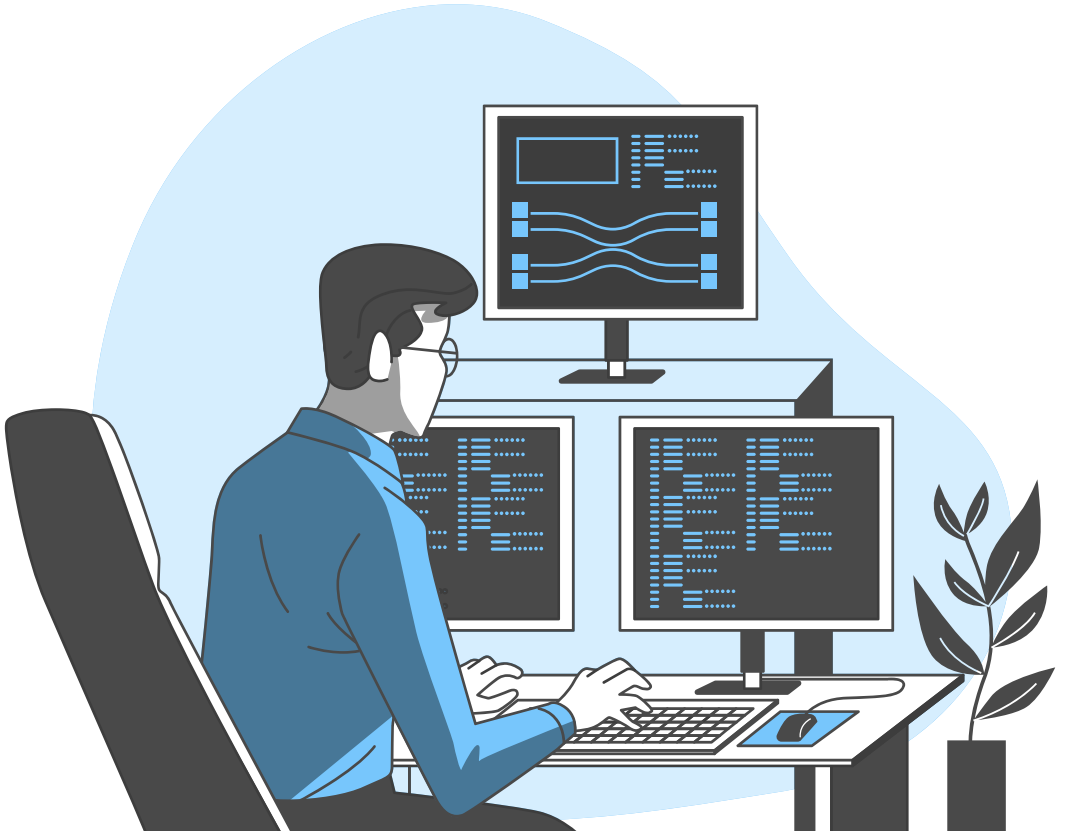
Golden Thread for Safety Management (i-GBSM)

Understanding & Overview



Context

- Simply Video won grant funding in a combined bid to develop a digital solution in response to the announcement of the Golden Thread from the Building Safety Act
- A legislation looking to transform safety practices and deliver safer buildings within the construction industry
- There is a large Data and AI component to this digital solution that Simply Video are looking for assistance with

Understanding

- i-GBSM is a solution designed to be the continual source of truth to enable the Golden Thread initiative put forward by the BSA
- Multiple components of the solution aimed towards supporting construction through the design, build and review stages of building a residential property
- It will be essential that the solution can ingest, compare and report on multiple documents and data sources through upload and automatic ingestion
- There are multiple parties involved in the project, responsible for individual pieces of work, each sitting in their area of expertise

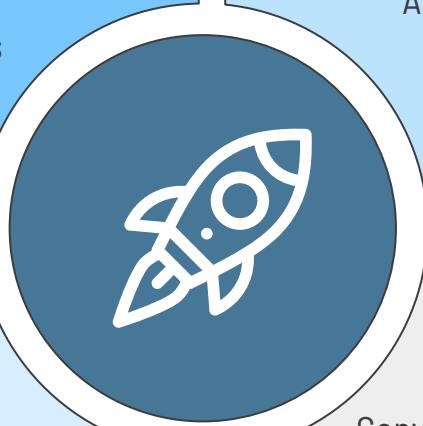
i-GBSM Components

RACI (iGT-RACI)

Highlight project-specific compliance plans for stakeholders based on their specific roles

Design Safety Analytics (iGT-DeSA)

Assesses designs and archives data to diagnose and demonstrate compliance with fire safety standards



Compliance Record Analytics (iGT-CoRA)

Enable contractors to record and manage building information employing an AI algorithm to verify compliance

Building Users (iGT-BUS)

Conversational AI interface for building users and managers to query information recorded on golden thread

Involved Parties

	Simply Video	GMI	Leeds Beckett	AngleStack
Description	IT company that specialises in the development of software and devices	UK Contractor providing specialist design and build capabilities	World-class research consultancy in construction automation	Software development, Machine learning, and advanced visualisation
Work Items	**WP 6 – Development of Intelligent Golden Thread for Building Users(iGT-BUS):** entails conversational-AI embedded in a user-friendly interface to allow building users and managers to inquire about **WP7 - Full System Integration:** The WP involves the integration and full development, testing and optimisation	**WP8 - Project Management:** This WP is for the overall project coordination and management, covering task management, project steering, reviewing and reporting	**WP1 - Development of Project Implementation Frameworks:** Approach to project-implementation based on state-of-the-art methodological review **WP2 - Development of UI/UX:** This work package involves, definition of User Personas, User Stories, and Use Case Diagrams, Design of UI/UX Platform, review and Testing of UI/UX Platform	**WP3-Development of Intelligent Golden Thread for RACI (iGT-RACI):** development of module to highlight project-specific compliance plans for users based on their specific roles and efficiently allocate responsibilities RACI. **WP4 – Development of Intelligent Golden Thread for Design Safety Analytics(iGT-DeSA):** user-friendly platform that focuses on Golden Thread Gateway-1 **WP5 – Development Intelligent Golden Thread for Compliance Record Analytics(iGT-CoRA):** a platform to facilitate adherence to Gateway 2 & 3 by enabling contractors to record and manage

Question: How do the members work together on different pieces of work? Expectation to support across all or just designated WPs?

Solution Dataflow

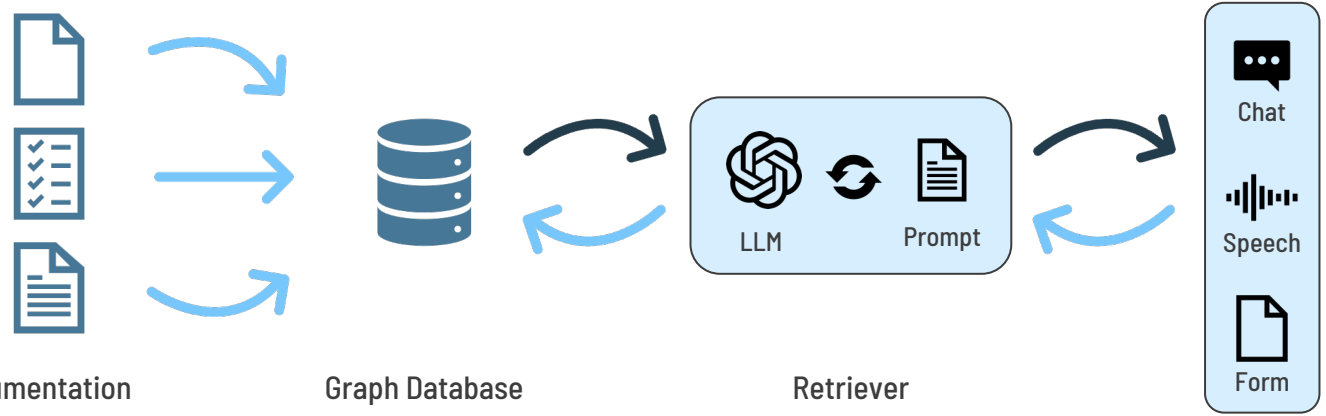
If designed and implemented correctly all components can be delivered using the same architecture, streamlining development and improving efficiency

RACI

Design Safety Analytics

Compliance Record Analytics

Building Users



Documentation

Building Standards
Contracts
Design Documentation

Graph Database

Decompose documents into nodes and edges for modelling relationships and information retrieve

Retriever

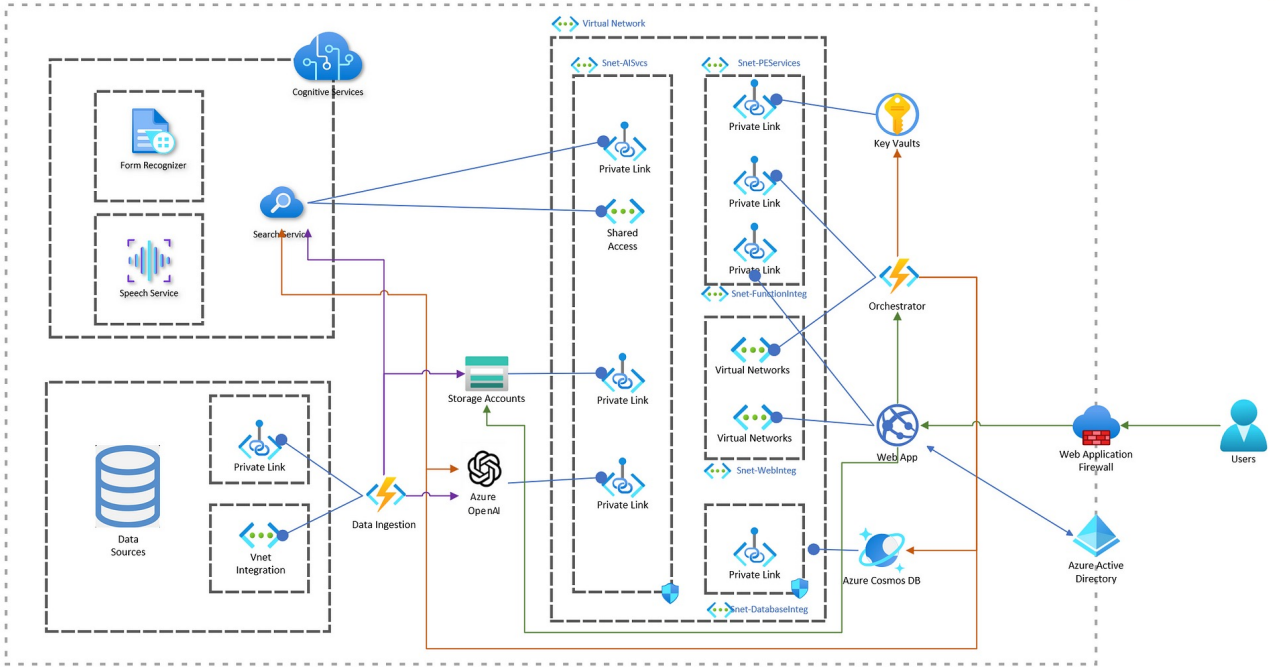
Prompts are submitted to the LLM to create a database query

User Query

Building manager or user able multi-medium prompt

Example RAG Architecture

A full enterprise solution could be completely cloud native and utilise many out of the box components



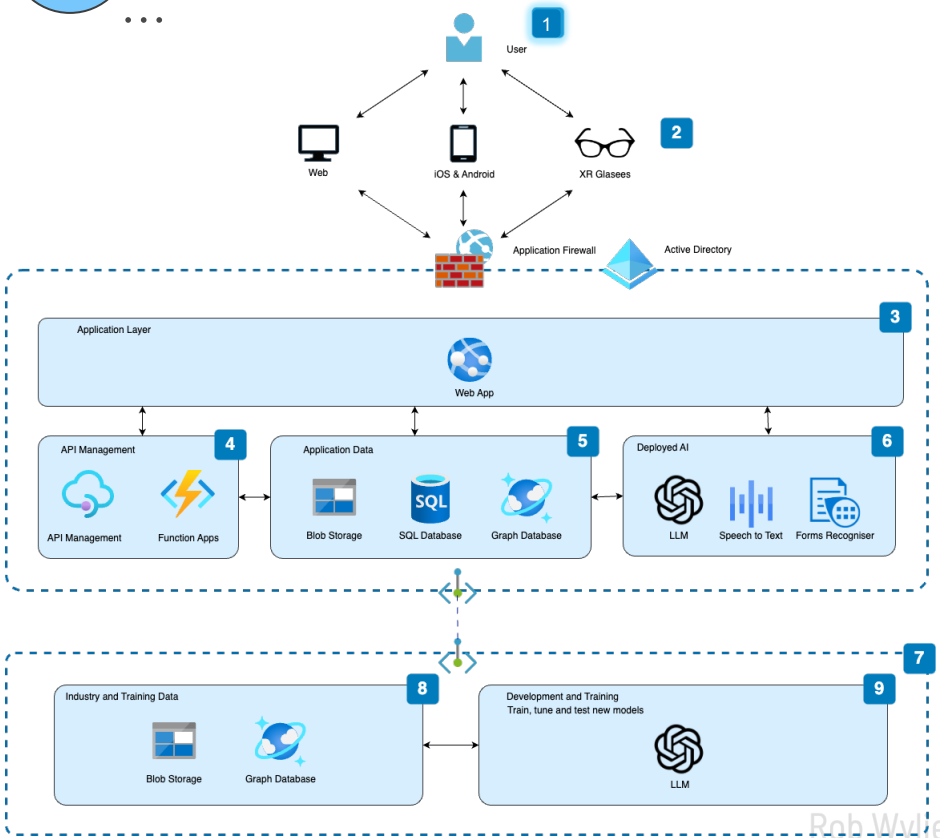
Rob Wylie

Solution Architecture

How the technical solution may look

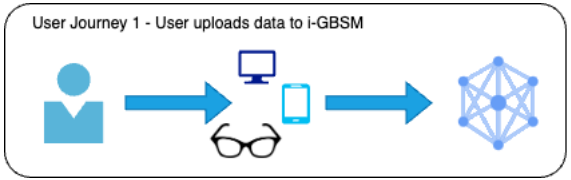
Rob Wylie

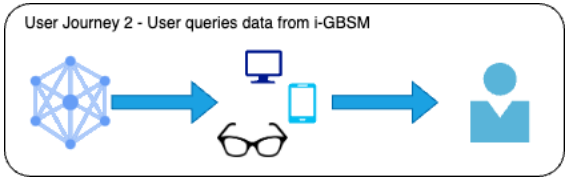
i-GBSM Solution v1



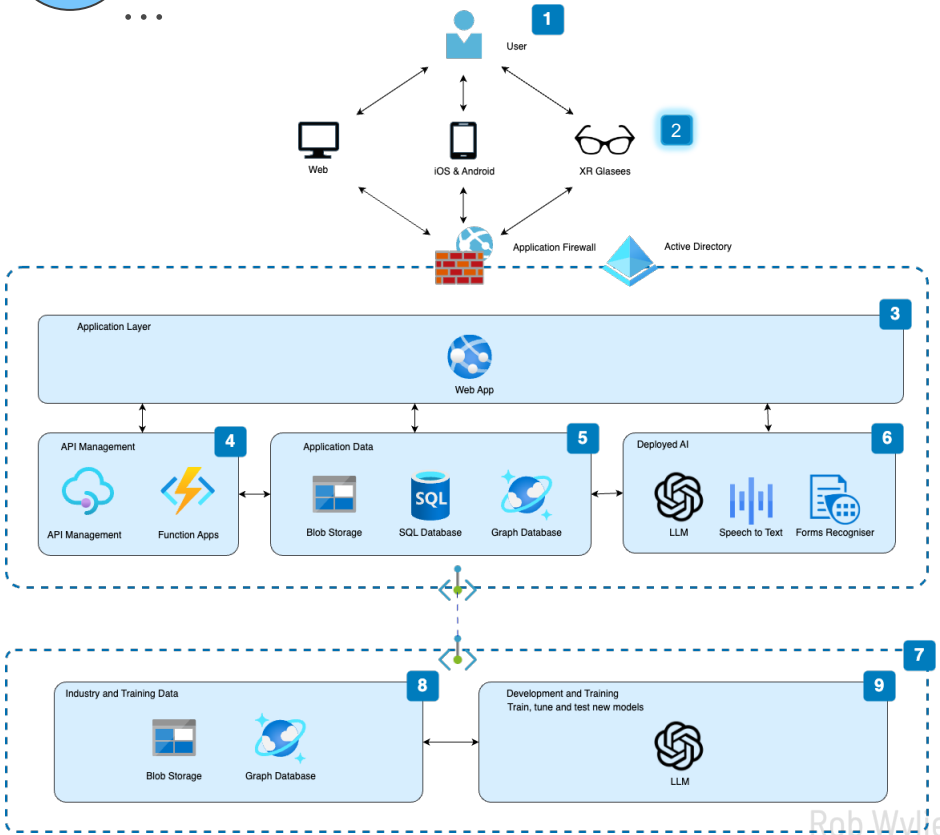
1

Users can log on to the platform with Active Directory, ensuring single sign on is available.





i-GBSM Solution v1

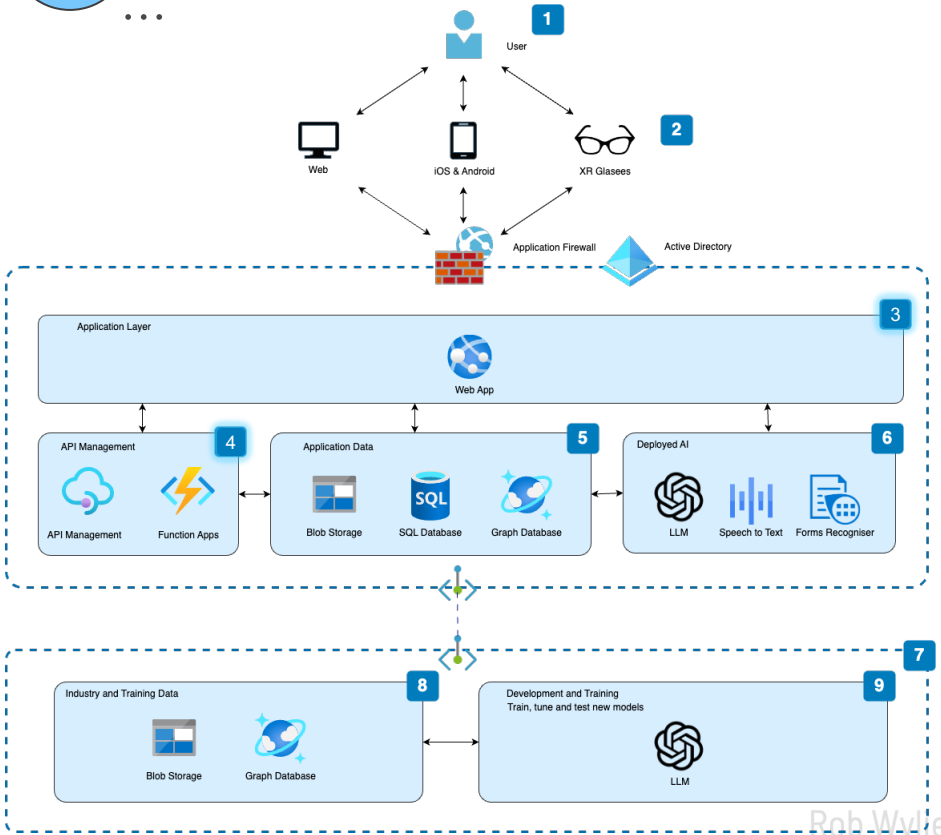


2

Users can access the platform through a number of devices, each tailored to specific use cases. Web access would be focussed on information upload and retrieval. Mobile device / XR glasses enabling on-site documenting and validation.

Devices	Type	Device Assets	Speech	Visuals	Power	Cost
XR Light	Glasses	Camera	AI		Phone	£
XR Medium	Glasses	Camera	AI	Waveguide	Phone	££
XR Power	Glasses	Camera	AI	Waveguide	In Device	£££
XR 3D	HMD	Camera	AI	Waveguide	In Device	££££
XR VR	VR Headset Inc. Passthrough	Camera (Access?)	AI	Passthrough	In Device	£
Mobile	App					
Tablet	App					
Computer	Web					

i-GBSM Solution v1



3

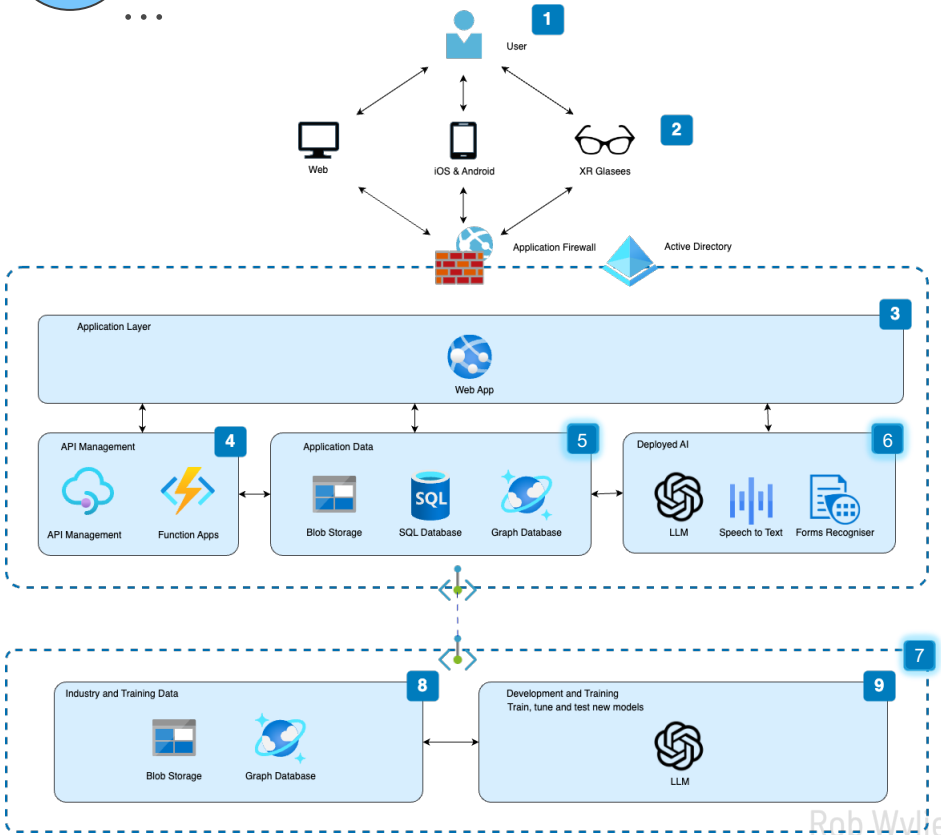
Application Layer provides a modern UI/UX for users with access to i-GBSM through their chosen device through a web app. Here users can perform a number of tasks such as:

- Create new projects
- Upload documents & data
- Query database through voice or chat
- Add / Remove / Edit people to projects
- Create and manage roles (designer / contractor)
- Project overview and dashboard
- Project compliance reports
- Manage involved projects
- Manage logs of ownership and hand overs

4

API management will enable the solution to interact and integrate with industry APIs. Ingesting information into data storage as required.

i-GBSM Solution v1



5

Blob storage, SQL Databases and Graph Databases will be used by the solution for storing and processing project specific data (BIM Models, Contracts, Applications & Approvals, Building Designs) in various ways:

- Blob Storage - Document storage to ensure all project information is in a central repository.
- SQL Database - Application logging and event records i.e. project ownership changes, report generation.
- Graph Database - Allow for document comparisons and user queries.

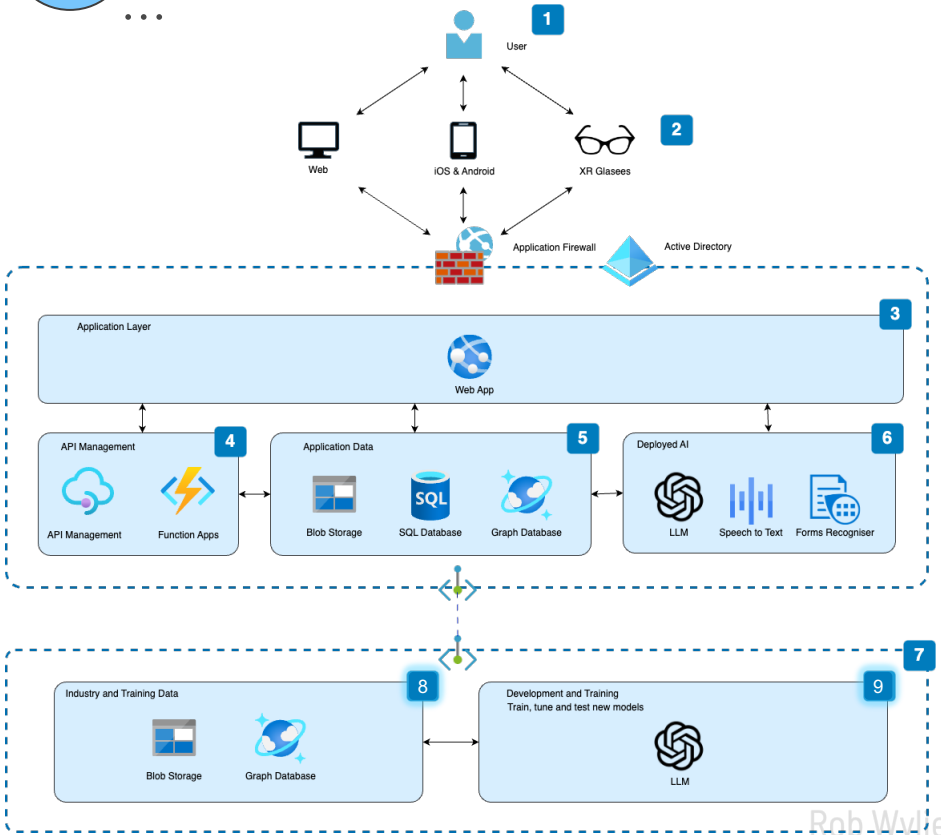
6

Deployed AI models and tooling will have gone through appropriate training and testing to ensure high performance and accuracy. The LLM will facilitate the retrieval of information from documents stored within the Graph Database. Speech-to-text and form recogniser to convert unstructured to structured data.

7

Secure development and storage environment separate to deployed solution. Separate environments will improve safety and security.

i-GBSM Solution v1



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Storage of industry and proprietary information, separate from the main application. Information will be used for the development of AI models and loaded into application when required.

Building Control Information BSA:

- HSE
- Materials
- Electrical
- Plumbing
- Heating Standards
- Legislation
- Ground Works
- Water
- Gas

9

AI Model development and testing conducted outside the deployed solution. Allowing for continuous development and testing in secure environment.

Models should be tested for:

- Detect & Prevent Hallucinations
- Prompt Injection Verification
- Toxicity
- Data Leakage

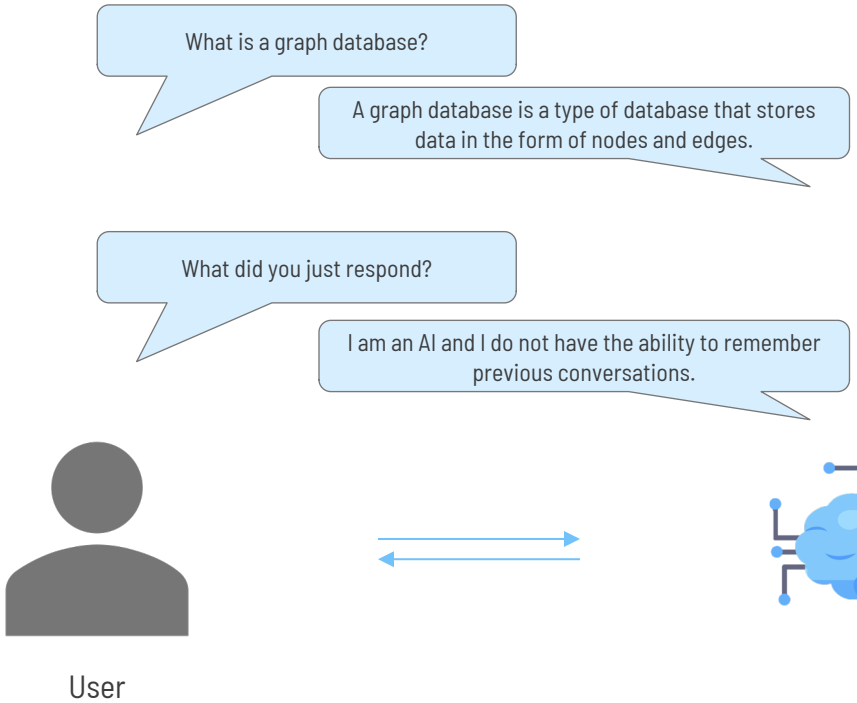
Working with LLMs

How exactly do we use LLMs

Rob Wylie

Basic LLMs

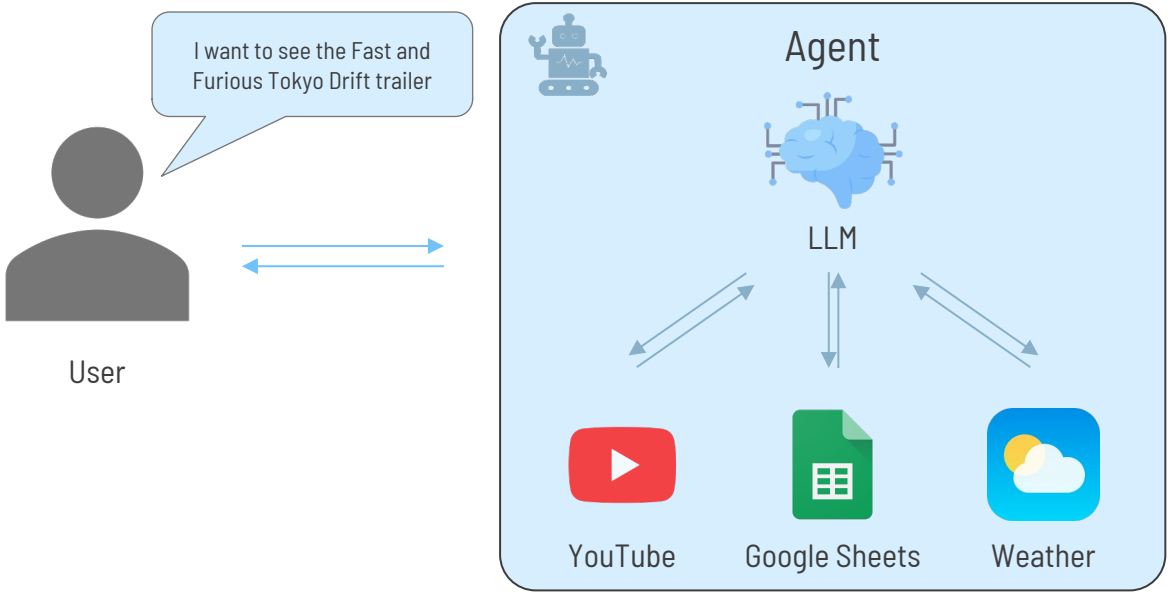
- An LLM provides the ability to ingest and respond to user queries
- It is limited to the data it is trained on, which gives rise to hallucinations and inaccurate responses
- They do not contain any memory and do not remember their previous responses



- To overcome these limitations there have been a number of packages developed that work with the LLM to produce the amazing and helpful features we see in the market today
- With these features, in conjunction with the chosen LLM, we will be able to provide the functionality we are needing for i-GBSM

Utilising Agents

Through agents and tooling LLMs can be given access to a host of additional functionality from accessing YouTube to finding out the weather




```
> Entering new AgentExecutor chain...
Thought: Do I need to use a tool? Yes
Action: Movie Trailer Search
Action Input: fast and furious tokyo drift
```

```
> Finished chain.
['https://www.youtube.com/watch?v=pbYMReX2ci4&pp=ygUcZmFzdCBhbmQgZnVyaW91cyB0b2t5byBkcmlmdA%3D%3D',
```

Accessing Graph Tooling

A specific Graph querying tool is available that is able to translate English into Cypher, to pass into the database

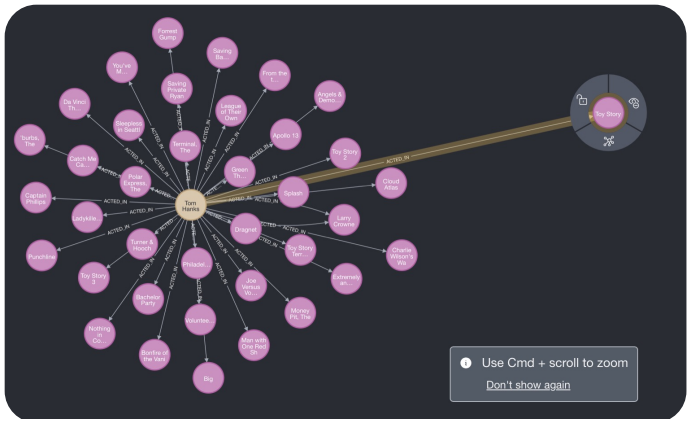
User

What role did Tom Hanks play in Toy Story?

1. LLM translates the query into Cypher

```
Entering new GraphCypherQAChain chain... Generated Cypher:
MATCH (a:Actor)-[r:ACTED_IN]->(m:Movie)
WHERE a.name = "Tom Hanks" AND m.title = "Toy Story"
RETURN r.role
```

2. Pass the query to the database



3. Obtain the result


```
'result': 'Woody (voice)'
```

4. Feed result back

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Importing Documents to Graph

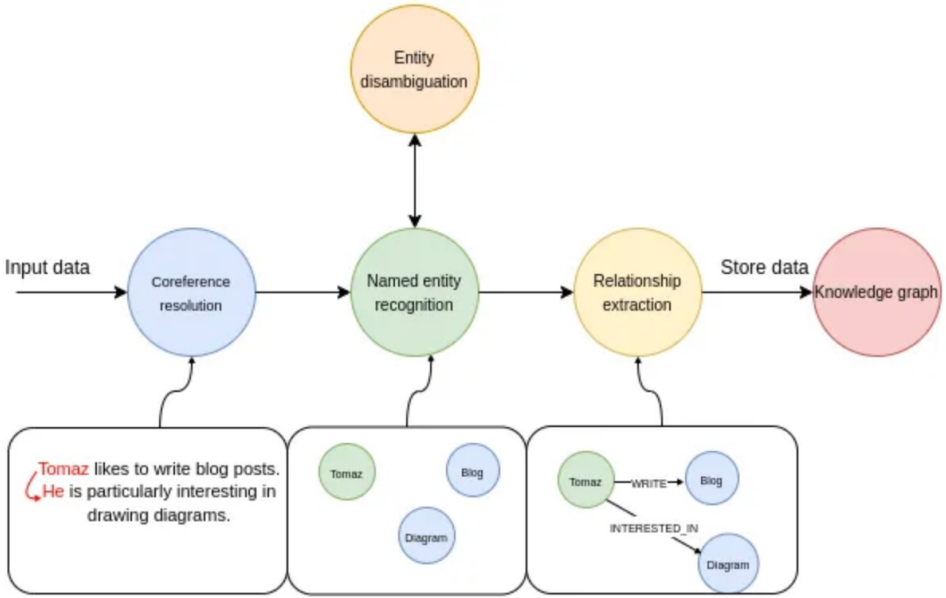
Building graphs from documentation

Rob Wylie

Text to Graph

The solution will use a pipeline that ingests documents and identifies relationships between entities to create graphs

This simple example demonstrates the necessary steps the pipeline will take



BSA Example

Within the BSA, this could look like the following; where the Principle Contractor has a number of responsibilities

Principal contractors' duties

As the principal contractor you must carry out contractors' duties and the duties for principal contractors. You must have the necessary competence requirements to work as a principal contractor.

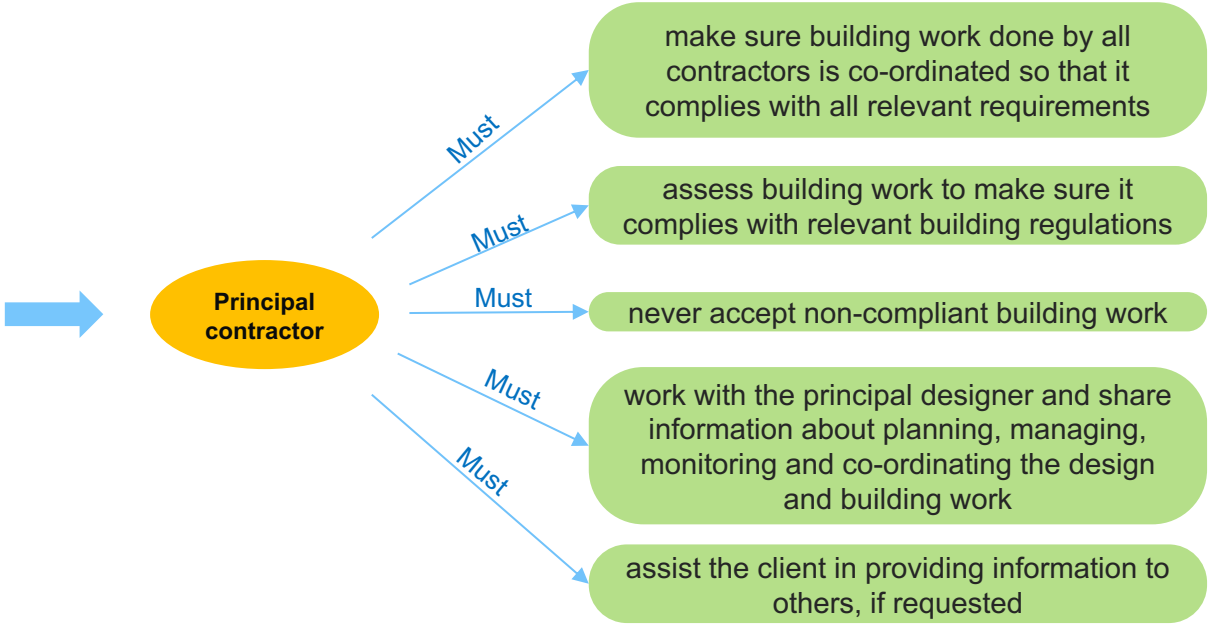
You must plan, manage, monitor and co-ordinate matters related to the building work. This means you must:

- make sure building work done by all contractors is co-ordinated so that it complies with all relevant requirements
- assess building work to make sure it complies with relevant building regulations
- never accept non-compliant building work
- work with the principal designer and share information about planning, managing, monitoring and co-ordinating the design and building work
- assist the client in providing information to others, if requested

You must take reasonable steps to make sure anyone working on the building work co-operates, communicates and co-ordinates their work with:

- the client
- the principal designer
- other contractors and designers

If there is a principal designer working on the project, you must consider any comments they make in relation to compliance with building regulations.



User Journey's

Mapping out how Users will interact with the i-GBSM

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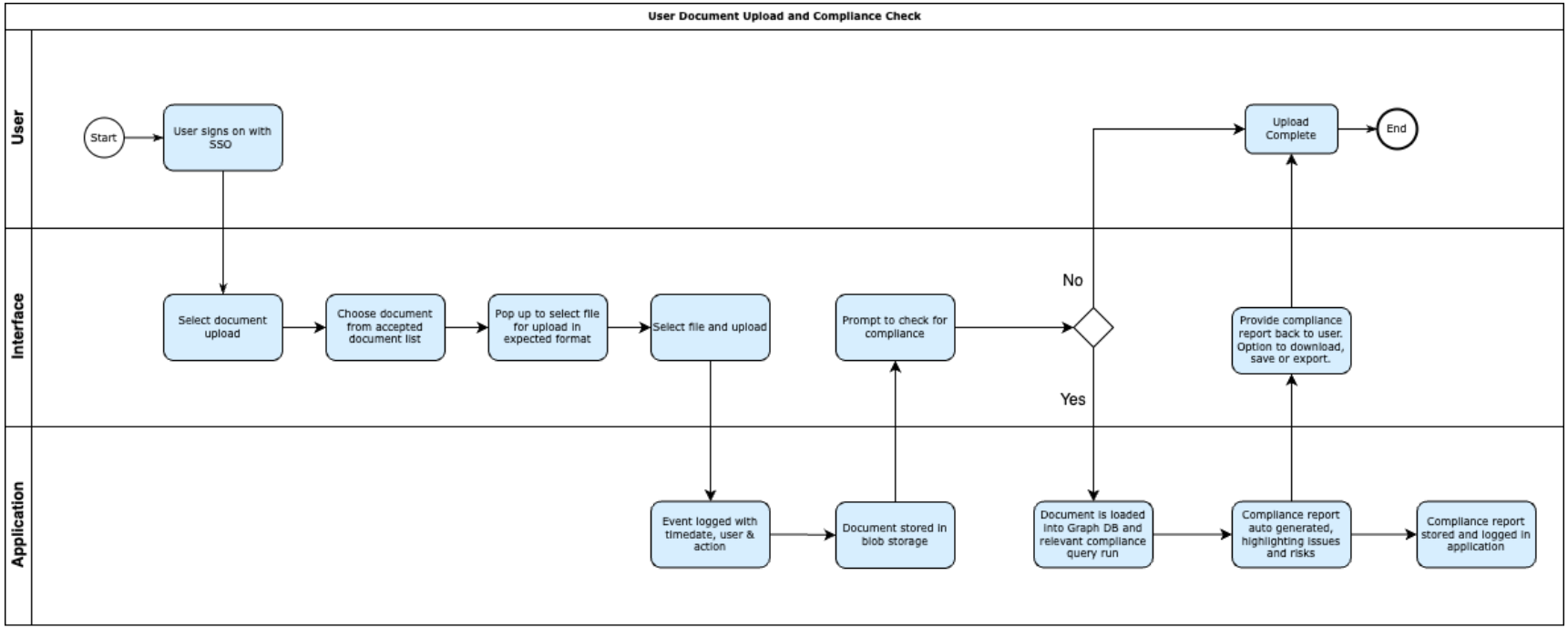
Computer User Document Compliance Check

User journey map details the path a user would take to upload a document and check for it's compliance against specified standards



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XR User Chat Query

Users will be able to chat directly with an AI to make queries against design standards and compliance