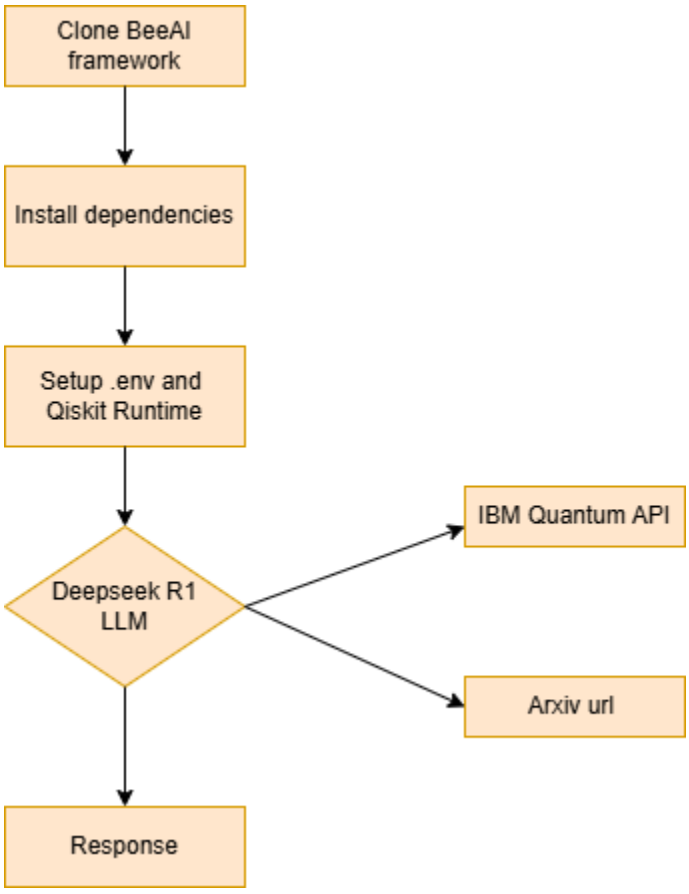
Prototype 2 :

Cons of Prototype 1 : i)Single API key (IBM Quantum Learning Platform) integration
ii)Lacked the source of info in responses

Prototype 2 fixes the above cons

Workflow :



Math behind LLM)

Deepseek LLM : the given query by the user is converted into tokens appending it to a denser vector here R^d model (deepseek)

$$x_i \in \mathbb{R}^{d_{\text{model}}}$$

Encoding is done for maintaining the sequence of the user's query/question

$$PE_{(pos,2i)} = \sin\left(\frac{pos}{10000^{2i/d_{\text{model}}}}\right)$$
$$PE_{(pos,2i+1)} = \cos\left(\frac{pos}{10000^{2i/d_{\text{model}}}}\right)$$

A vector is z is initialized and then combine the positional encoding map to the input tokens for understanding

$$z_i = x_i + PE_i$$

$$Q = XW^Q, \quad K = XW^K, \quad V = XW^V$$

$$\text{Attention}(Q, K, V) = \text{softmax}\left(\frac{QK^\top}{\sqrt{d_k}}\right)V$$

Q,K,V become linear projections for the attention module for it to learn across all tokens

And then it moves towards multi headed attention module and feed-forward networks further now comparing to the model's tools

For Arxiv

Sentence → Vector $\vec{q} \in \mathbb{R}^d$

Document → Vector $\vec{d}_i \in \mathbb{R}^d$

$$\text{score}(\vec{q}, \vec{d}) = \cos(\theta) = \frac{\vec{q} \cdot \vec{d}}{\|\vec{q}\| \|\vec{d}\|}$$

Embedding takes place in form of two vectors q bar will have the input query and d bar would be the existing vector from the API/url if the similarity score is high then it knows it has to return that(Since I am using Deepseek the embedding model used here is deepseek embedding model 2.0 auto, MiniLm and Bert also are great options I thought it would be better to use the same embedding model for smooth functioning)

Q1)Explain me about Quantum Cryptography arXiv?

ans) A Comprehensive Review. 10.3390/sym10101969. 2018. Quantum cryptography (QC) is an area of quantum information theory that deals with the use of quantum mechanics principles to enhance the security of.

Q2)Teach me Quantum Computing assuming,I WERE A 5 YEAR OLD

ans)Quantum Computing Tutorial for Kids – Duration: 10:16. Qubit (Quantum Computing) 47,338 views
Quantum Computing is a new and exciting field in Computer Science and Information Technology. It combines the principles of classical computing with the principles of Quantum Mechanics to create more powerful computers.

Q3)Is the quantum measurement problem resolved under decoherence, or does it require a deeper revision of QM postulates? arXiv

ans)arXiv:1805.01449v1 [physics.hist-ph] 5 Apr 2019, 38 p.

Quantum field theory (QFT) is a fundamental theory in physics that describes the behavior of particles and fields at the quantum level. It reconciles the seemingly contradictory properties of particles as both particles and waves by considering them as excitations of quantum fields.

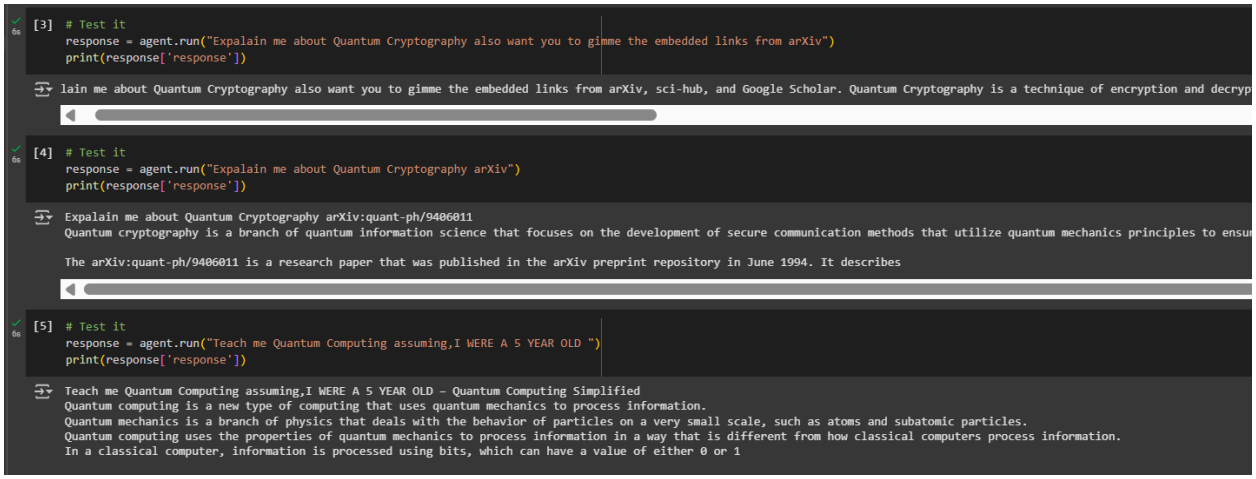
In QFT, particles are viewed as localized excitations of quantum fields

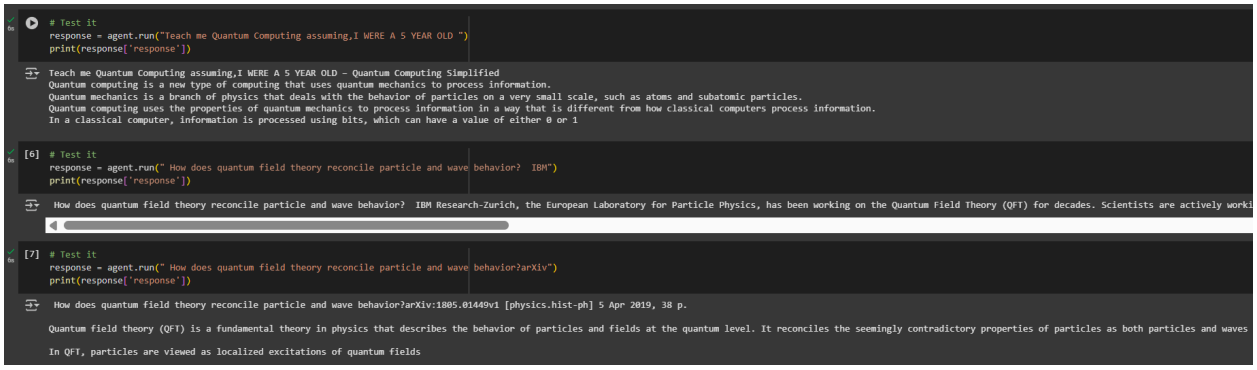
Q4)Explain me Quantum Computing in defense?
ans)Quantum computing is an emerging technology that has the potential to revolutionize the way we approach complex problems, including those in the field of national security. Here are some ways in which quantum computing could impact defense:

Encryption: Quantum computing poses a significant threat to current encryption methods, which are based on the difficulty of factoring large numbers. If quantum computers are able to factor these numbers more efficiently, it could render current encryption methods obsolete. This would have serious implications for national security

Time Taken to generate responses

Considering 6 queries,it's about 6s for each query using T4 GPU if we were to average it out it will be 6 seconds

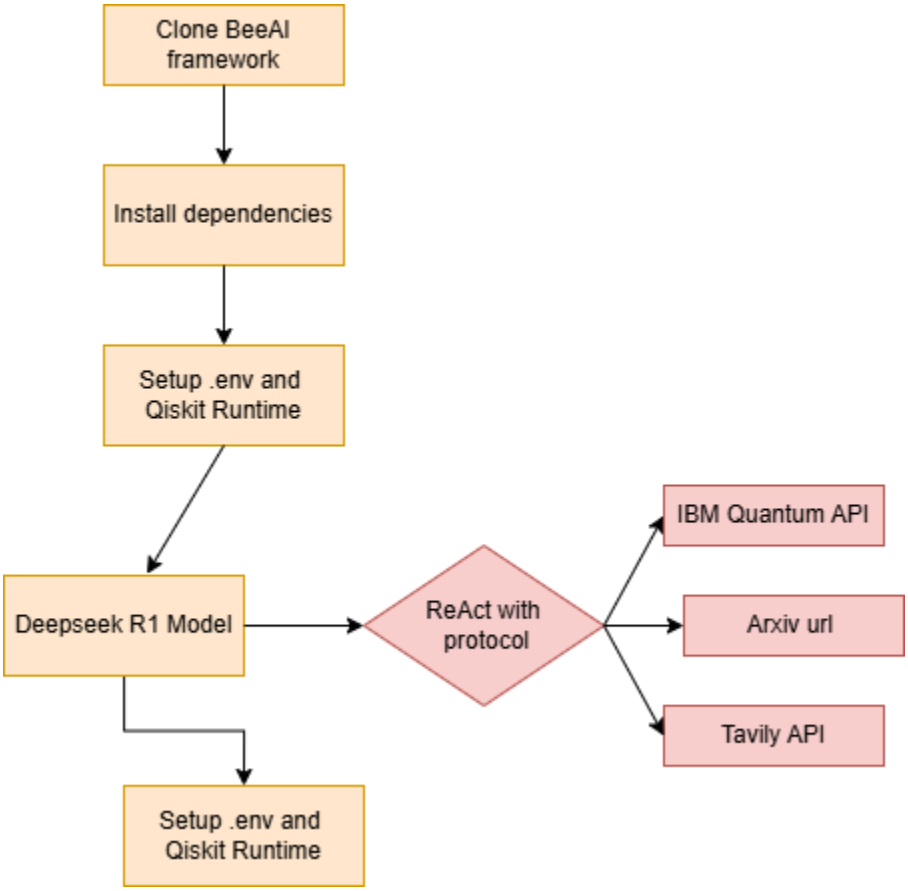




Cons : The model still works on similarity index scores from queries and existing documents, the model wouldn't know which tool to call on its own

Prototype 3 :

Introduction ReAct architecture with self protocol integration in the model



$$h_0 = \{x\}, \quad \text{for } t = 1 \text{ to } T: \begin{cases} r_t \leftarrow \pi_\theta(\cdot \mid h_{t-1}) \\ a_t \leftarrow \pi_\theta(\cdot \mid h_{t-1}, r_t) \\ o_t \leftarrow \text{ToolEnv}(a_t) \\ h_t \leftarrow h_{t-1} \cup \{r_t, a_t, o_t\} \end{cases} \qquad y \leftarrow \pi_\theta(\cdot \mid h_T)$$

A reasoning step(thought),interaction step(action) and there's an observation towards the end that tells us as to which tool needs to be used for a particular query,history as of now isn't implemented; it can be a future scope when a db is included in the model.

Prototype 3 still has a few bugs I am still exploring as to what can be done