ISRO-GPT: AI-Powered Help Bot for MOSDAC (Vikas Saptah Hackathon 2025)

Executive Summary

In the 6th edition of the Vikas Saptah Hackathon (2025), organized under the SSIP 2.0 program by the Gujarat Education Department, our team developed **ISRO-GPT** – an intelligent AI-based help bot. ISRO-GPT is designed as a conversational assistant for the Space Applications Centre (SAC) of ISRO, specifically targeting the MOSDAC portal. It delivers automated information retrieval and processing from MOSDAC's rich satellite data and document resources. Using a transformer-based large language model fine-tuned for this domain, ISRO-GPT offers fast, accurate, and multi-modal query responses. The platform combines a Python Flask web interface (with Jinja templates and Bootstrap) and a Flutter-based Android app, making it accessible across devices.

Our solution provides a natural, intuitive interface that supports multi-turn dialogue, follows-up on questions, and adapts over time. ISRO-GPT can generate rich content (essays, summaries, creative writing), answer factual and instructional queries, browse the web for up-to-date information, and even process voice and image inputs. Importantly, it handles multilingual input (e.g. English, Hindi, and other languages) and performs live translations. The system is fully developed and deployed: the web application is live at https://isro-gpt.onrender.com/, demo video at https://drive.google.com/file/d/1Iv3fpbCvCvrr5PSgynnW13glOFzwW5WG/view and a demonstration video is available online.

By automating routine inquiries about satellite data, ISRO-GPT aims to deliver efficient self-service to citizens, researchers, and agencies. It reduces the manual effort needed to search the MOSDAC portal and related ISRO resources. Studies show that advanced AI assistants can handle a large fraction of routine questions (on the order of 80%), dramatically improving response speed and freeing experts to focus on complex tasks. In summary, ISRO-GPT represents a complete, robust AI solution that enhances accessibility to space data, boosts user experience, and demonstrates scalable multi-platform technology for diverse information needs.

Problem Statement

The Space Applications Centre (ISRO) posed the challenge of creating an **AI-based help bot for information retrieval from web content**, specifically the MOSDAC portal. MOSDAC (Meteorological & Oceanographic Satellite Data Archival Centre) is a rich repository of satellite data and services maintained by SAC, ISRO. While MOSDAC provides valuable meteorological and oceanographic information, users often struggle to find and interpret data quickly. The goal is to build an automated assistant that can understand natural-language questions and return accurate information from MOSDAC and related SAC resources. The assistant must handle static content (FAQ, reports, tables) as well as dynamic data (real-time satellite feeds and updates), ensuring that end users need not browse or parse the portal manually.

In essence, the problem is to **empower users** – from citizens and students to government agencies – with a self-learning AI agent that can conversationally navigate the MOSDAC site, extract the relevant data or answers, and present them clearly. This involves bridging the gap

between complex satellite datasets and users' information needs through an intuitive chatbot interface.

Objectives

- **Natural, Intuitive Interaction:** Enable conversational dialogue with context awareness and follow-up questioning, so users can interact as they would with a human assistant. The bot should handle clarifications, contradictions, and admit mistakes gracefully.
- **Multi-modal Information Access:** Allow users to input queries in text, voice, or images (e.g., graphs or scanned documents), and support answers in multiple formats (textual summaries, charts, maps).
- **Multi-lingual Support:** Support queries and responses in English, Hindi, and other local/international languages, with automatic translation as needed, to make the system widely accessible.
- **Accurate Knowledge Retrieval:** Retrieve factual answers (definitions, timelines, data values) from the latest MOSDAC content and ISRO resources, as well as generate original content (summaries, essays, formal or creative writing) on relevant topics.
- **Real-time Updates:** Incorporate limited live web browsing or API access to fetch the latest information (e.g., current satellite observations) so that users always get up-to-date answers.
- **Usability and Accessibility:** Provide a user-friendly interface with features like chat history, search, dark mode, and multiple sessions. Ensure availability on web and Android platforms.
- **Safety and Reliability:** Include error handling, disclaimers, and content filters to ensure trustworthy responses. Collect user feedback (thumbs up/down, ratings) to continuously improve the model.

Overall, the objective is to "provide citizens, agencies, and end users with a natural, intuitive, accurate, and self-learning AI assistant capable of retrieving, processing, and presenting information efficiently," fully meeting the SAC/ISRO requirements.

Technical Implementation

The ISRO-GPT system is implemented as a full-stack AI application with the following components:

- **Web Platform:** The web interface is built using **Python Flask**, employing Jinja templates for dynamic pages and Bootstrap with custom CSS for a responsive design. The site is hosted on a cloud platform (Render) and accessible at https://isro-gpt.onrender.com/. The front-end chat UI supports multi-turn text conversation and can display rich content (formatted answers, images, maps).
- **Database:** We use **PostgreSQL** (with SQLite as an alternative for lightweight deployment) to store user accounts, chat histories, and system logs. This allows features like history search, session management, and analytics tracking.
- **Mobile App:** A companion Android app was developed in **Flutter**, providing the same chatbot functionality on mobile devices. The app uses the same backend APIs as the web, ensuring feature parity across platforms.

- **AI Model:** The core AI engine is a **transformer-based large language model** (similar to GPT-family models), fine-tuned specifically on SAC and MOSDAC documentation. During training, the model was augmented with domain-specific data (FAQs, reports, and archived satellite data) and optimized for speed and accuracy. The model supports **multi-modal inputs**, meaning it can process not only text queries but also images and audio (using OCR and speech-to-text preprocessing), enabling tasks like image analysis or voice conversation.
- **AI Backend:** On the server side, user queries are sent to the AI model via a RESTful API. The backend uses techniques like vector search to retrieve relevant document chunks and real-time web scraping for live data when needed. Prompt engineering ensures the model generates structured, factual answers, and multi-turn context is maintained for follow-ups. Safety filters and a fallback mechanism handle unsupported queries or ambiguous requests gracefully.
- **Continuous Learning:** The system logs anonymized user interactions and feedback. Periodically, this data is used to further fine-tune the model and improve its response quality, enabling it to learn from real usage patterns over time.

Together, these components create a seamless platform: users can type or speak questions in natural language, and the model quickly fetches and synthesizes answers from the MOSDAC portal and related datasets. The architecture prioritizes performance (fast response times) and scalability (able to serve many users simultaneously), demonstrating robust technical implementation.

Features

ISRO-GPT offers a comprehensive suite of user-oriented features to maximize utility and user satisfaction:

- **Natural Language Conversation:** The chat interface supports fluent, free-form dialogue. Users can ask follow-up questions and the bot retains context across turns. The system is designed to handle contradictions and admit errors, making the interaction feel human-like and trustworthy.
- **Multi-lingual Support:** Users can pose questions in English, Hindi, or other supported languages. The assistant automatically translates between languages as needed, allowing users from different linguistic backgrounds to access ISRO data.
- **Rich Content Generation:** Beyond simple answers, the model can generate essays, articles, summaries, and paraphrased content on demand. Whether the user needs a formal report, a creative description, or a concise summary of satellite data trends, ISRO-GPT produces well-structured text in various styles.
- **Knowledge Question Answering:** The bot can answer factual questions about satellite missions, instruments, weather events, and more. It handles definitions, instructions, timelines, and geographical queries (e.g., locations of satellite coverage). Answers are drawn from the latest satellite data, FAQs, and documentation on the MOSDAC portal.
- **Real-Time Web Browsing:** For up-to-date information, ISRO-GPT can perform limited live searches on approved web sources or APIs. For example, it can retrieve the latest weather forecast from MOSDAC or recent mission updates, ensuring answers reflect current data.

- **Voice and Speech Interaction:** The platform includes voice input and output. Users may speak questions naturally, and the assistant responds in a clear, natural-sounding voice. This feature enhances accessibility and provides a hands-free mode of operation.
- **Memory and Context Awareness:** The bot maintains a memory of the conversation context. It recognizes follow-up queries and references past parts of the discussion (e.g., if the user asks a follow-up about "yesterday's cyclone data," the bot understands the reference). This continuity makes multi-turn interactions effective and coherent.
- **Subscription Tiers:** While all users have access to core features, the platform supports different subscription levels. Premium tiers unlock advanced capabilities (faster responses, higher usage limits, domain-specific expert modes), whereas the basic tier provides substantial functionality for general use.
- **File Upload and Analysis:** Users can upload files (PDFs, images, data tables) through the interface. ISRO-GPT can parse these uploads to extract information or answer questions about their content. For instance, it can summarize a technical report PDF from MOSDAC or identify objects in a satellite image.
- **Code Execution Support:** The assistant can execute code snippets for data analysis when appropriate. For example, a user could ask for a quick plot of temperature data, and the backend Python engine would run the code and return the result.
- **Error Handling and Safety:** The system includes robust error handling; unclear queries prompt clarifying questions. Disclaimers are provided when information might be outdated or uncertain. Content filters block inappropriate or unsafe requests, ensuring the assistant remains professional and reliable.
- **User Feedback System:** After each response, users can give a thumbs up/down or a star rating. This feedback loop helps the team refine answers and retrain the model. Over time, the assistant becomes more accurate and aligned with user needs.
- **User Interface and Usability:** The chat interface is highly usable. It offers chat history where past conversations are stored, with search, filtering, and pinning features to easily retrieve important information. Multiple concurrent sessions are supported, so users can organize conversations by topic. A dark mode and other UI customization options (font size, color themes) are available for comfort.
- **Continuous Updates:** The platform is designed for continuous improvement. We regularly release updates that expand knowledge (e.g. new satellite data), refine the AI model, and add features based on user feedback. This ensures ISRO-GPT stays current with SAC's evolving data and user requirements.
- **Multi-Platform Access:** In addition to the web app, the Android mobile app (built with Flutter) provides on-the-go access. All features are synchronized across devices, allowing users to start a query on one device and continue on another.
- **Support and Documentation:** Comprehensive user guides, tutorials, and in-app help are provided. New users benefit from guided onboarding that introduces key features (chat commands, uploading files, voice mode). Help documentation explains how to frame queries for best results, ensuring a smooth learning curve.

In addition to these core features, ISRO-GPT incorporates advanced platform capabilities for power users and administrators:

- **Customizable Dashboard:** The homepage lets users add and arrange widget cards for quick access to frequently used data or tools (e.g. latest alerts, favorite satellite imagery). This dynamic dashboard provides personalized summaries of relevant information.
- **Prompt Suggestions Library:** An example prompt library suggests useful questions and templates (for common tasks like data analysis or report writing). Users can browse or copy these prompts to learn how to interact effectively with the AI.
- **Chat History Management:** Chats can be searched by keywords, filtered by date or topic, and pinned for quick retrieval. This makes it easy to manage large volumes of interaction history and resume any conversation thread.
- **Notifications and Onboarding:** Users receive notifications for important updates (e.g. when new satellite data is uploaded). A guided onboarding flow introduces new users to features step-by-step, ensuring they can leverage the assistant effectively from the start.
- **Collaboration and Teams:** The system supports multiple user roles and team workspaces. Groups (such as research teams) can share conversation logs, collaborate on queries, and build a collective knowledge base within the platform.
- **Real-Time Analytics and Monitoring:** Administrators have access to analytics dashboards showing usage statistics, common queries, and system performance. Monitoring tools help ensure the service stays responsive under load and allows proactive scaling.
- **Safety, Privacy, and Compliance:** ISRO-GPT is built with data privacy and security in mind. User data and queries are encrypted in transit and at rest. Compliance features (such as audit logging and access controls) ensure the platform meets organizational policies and regulatory standards.

Demo

We have deployed the ISRO-GPT platform and prepared a short demonstration for evaluators. The **web application** can be accessed live at https://isro-gpt.onrender.com/, **demo video** can be accessed https://drive.google.com/file/d/1Iv3fpbCvCvrr5PSgynnW13glOFzwW5WG/view where judges can test the chatbot with queries in text or voice. The interface showcases features like multilingual chat, file upload, and instant answer generation. Additionally, a **demo video** illustrating the system's capabilities is available online. (For reference, the demo video can be viewed at the provided Google Drive link.) These demos highlight real example interactions, such as asking about current weather data from a satellite or requesting a summary of a technical PDF. The video also shows the mobile app interface, demonstrating seamless access on an Android device.

Expected Outcomes

The ISRO-GPT project is expected to deliver significant benefits:

- **Efficient Self-Service Support:** Users will receive instant, 24/7 answers to routine questions without waiting for human assistance. This drastically reduces the time spent by staff manually retrieving and explaining MOSDAC data. (Indeed, studies show AI chatbots can handle roughly 80% of routine queries, allowing experts to focus on complex issues.)

- **Improved Accessibility:** Natural-language interaction makes SAC's satellite data accessible to non-specialists. Students, researchers, and the general public can explore meteorological and oceanographic information without needing specialized training in data interpretation. This democratizes access to ISRO resources.
- **Reduced Manual Effort:** By automating the search and retrieval of information, ISRO-GPT minimizes manual intervention. Routine document lookups, data formatting, and simple analytics can be done automatically, saving manpower. Even in complex cases, the bot provides a starting point that users can refine.
- **Enhanced User Experience:** The rich conversational interface, multimedia capabilities, and supportive UI (history search, dark mode, etc.) create an engaging user experience. Feedback mechanisms ensure users see their inputs valued and the system improving over time.
- **Knowledge Retention and Learning:** The AI assistant itself "learns" from interactions. By fine-tuning on user feedback and new data, the model's accuracy and domain knowledge will continuously improve. This creates a virtuous cycle where usage drives better performance.
- **Scalable Multi-Platform Solution:** The project demonstrates a robust architecture capable of scaling. The cloud-based backend, coupled with an optimized model, can support a growing number of users. The multi-platform availability (web and mobile) ensures broad reach.

Together, these outcomes mean ISRO-GPT will enable SAC/ISRO to serve stakeholders more effectively, increase engagement with satellite data, and showcase the power of AI in government services. Users will benefit from faster, more intuitive data access, and the organization will see smoother operations and higher satisfaction.

Potential Impact

Beyond immediate outcomes, ISRO-GPT has the potential for far-reaching impact. By offering a user-friendly AI interface to complex scientific data, the project can inspire greater public interest in space and Earth science. It provides a model for how government agencies can leverage AI to make information transparent and actionable. Educational institutions might use ISRO-GPT as a teaching aid, helping students learn about meteorology and remote sensing through interactive Q&A.

The platform's modular design allows it to be extended to other data portals or scientific domains in the future. For example, similar AI assistants could be developed for other ISRO centers or for environmental agencies worldwide. This scalability means the core technology (multi-modal AI assistant with web integration) could address a variety of public information needs.

Finally, by implementing continuous improvement and analytics, ISRO-GPT establishes a feedback-driven development cycle. This promotes a culture of user-centric design: insights from usage will guide future feature enhancements and ensure the assistant remains aligned with real-world needs. In the long term, this project contributes to the digital transformation of space science outreach, strengthening ISRO's mission of education and public service.

Conclusion

In conclusion, our team has delivered a **complete, production-ready** AI assistant – ISRO-GPT – that meets the hackathon objectives with innovation and depth. The system integrates advanced AI technology into a fully functional web and mobile platform, encompassing all the requested features and more. With natural dialogue, multi-modal support, and continuous learning, ISRO-GPT stands ready to revolutionize how users interact with MOSDAC and ISRO's data. We have ensured the platform is user-friendly, secure, and designed for ongoing enhancement. We believe ISRO-GPT will significantly improve efficiency, accessibility, and user satisfaction, and we look forward to demonstrating its capabilities to the judges.

Demo Links: Web app at https://isro-gpt.onrender.com/; Drive link at https://drive.google.com/file/d/1Iv3fpbCvCvrr5PSgynnW13glOFzwW5WG/view;
Demonstration video available via the provided Google Drive link.

Sources: Official hackathon problem statement and MOSDAC portal information provide context for this project. Additional industry insights on AI chatbots' efficiency were referenced. All features and technical details described are based on our implementation of the ISRO-GPT platform.

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1. **Smart Gujarat Hackathon**

   https://ssipgujarat.in/hackathon25/

2. **Problem Statement | Hackathon**

   https://ssipgujarat.in/hackathon25/problem_statement.php

3. **Meteorological & Oceanographic Satellite Data Archival Centre**

   https://www.mosdac.gov.in/

4. **Top Benefits of AI Chatbots for Self Service Solutions | NiCE**

   https://www.nice.com/info/top-benefits-of-ai-chatbots-for-self-service-solutions