Non-Provisional Utility Patent Application

Title  
Context-Aware Aviation Assistant for On-Device Domain Data Summarization and Large Language Model Prompt Augmentation

Cross-Reference to Related Applications  
None.

Field of the Invention  
The invention relates to aviation software and, more particularly, to systems and methods that integrate electronic flight bag (EFB) domain data with conversational large language models (LLMs) by automatically summarizing locally stored aviation data and augmenting user prompts to the LLM with that context.

Background  
Pilots increasingly consult conversational assistants for planning, regulatory and proficiency questions, yet LLMs lack access to the pilot’s on-device aviation context such as logbook totals, active or saved flight plans, weather caches, checklists, and weight-and-balance configurations. Pilots must manually transcribe context, which is slow and error-prone. Without pertinent context, assistant responses are less accurate, potentially unsafe, and non-specific.

A need exists for an EFB-integrated assistant that: (1) understands the pilot’s intent, (2) discovers and summarizes relevant on-device data sources in aviation categories, and (3) automatically augments outgoing LLM prompts with those summaries, all while preserving privacy and minimizing pilot workload.

Summary  
Disclosed is a context-aware aviation assistant that presents a category selector (e.g., Logbook, Flight Plan, Weather, Checklists, Weight & Balance; optionally Aircraft) and helper widgets. The system aggregates on-device domain data from local user, weather, and navigation databases, produces compact summaries, and appends them to outgoing LLM prompts. For specific intents (e.g., “How many hours do I have left to get to private pilot certificate?”), the assistant detects the query and auto-includes relevant logbook totals. The approach improves answer specificity and reduces pilot workload without transmitting raw databases off-device.

In some embodiments, the system runs entirely on-device except for the LLM call, uses configurable summarization policies per category, exposes UI affordances (chips/buttons) for one-tap insertion of context, supports refresh, and respects offline operation and privacy constraints.

Brief Description of the Drawings  
- FIG. 1 illustrates a system architecture with databases, a context aggregator, a category selector UI, an augmentation engine, and an LLM client.  
- FIG. 2 shows the chat UI with a category dropdown, totals summary card, and quick-action chips.  
- FIG. 3 is a flow diagram of receiving a user query, determining relevant category context, augmenting the prompt, calling the LLM, and displaying the result.  
- FIG. 4 shows an intent-detection path for certificate-hours queries mapping to logbook totals.  
- FIG. 5 illustrates alternative embodiments including adjustable summarization policies and offline mode behavior.

Detailed Description of Embodiments  
System Overview  
The system comprises:  
- Local aviation databases: a user database (e.g., logbook entries, flight plans, checklists, weight & balance, aircraft), a weather database (e.g., METAR, TAF, AIRMET/SIGMET, TFR, AIREP, winds aloft), and a main database (e.g., airports, nav aids, fixes, procedures).  
- A context aggregator that queries category-specific data from the local stores and applies compact summarization policies.  
- A chat UI with a category dropdown and helper chips that allow the pilot to request precomposed prompts (e.g., PPL hours-left) or insert summaries into the input field.  
- A prompt augmentation engine that appends the selected category’s summary and, where applicable, an intent-specific summary (e.g., logbook totals for hours-left requests) to the user’s question before sending it to the LLM.  
- An LLM client that transmits the augmented prompt to a remote LLM and displays the response.

Data Sources and Summarization  
- Logbook: Aggregates totals across categories (e.g., total flight time, PIC, dual, solo, cross-country, night, instrument, landings, approaches). Produces a compact, human-readable summary string.  
- Flight plan: Summarizes route waypoint identifiers and total calculations (distance, ground speed, time, fuel) derived from route computations.  
- Weather: Summarizes counts and categories (e.g., METAR VFR/MVFR/IFR/LIFR counts, number of TAFs, TFRs, AIREPs, and AIRMET/SIGMET elements present).  
- Checklists: Summarizes available lists and current active checklist (if any).  
- Weight & Balance: Summarizes available configurations by name.  
- Aircraft (optional): Summarizes aircraft records by tail identifier or other metadata when present.

User Interface  
- Category selector (dropdown): Allows the pilot to choose the category whose context will be appended to outgoing prompts. Categories are seeded (Logbook, Flight Plan, Weather, Checklists, Weight & Balance) and extended dynamically when additional domain records exist (e.g., Aircraft).  
- Helpers (chips/buttons): Provide one-tap actions including “PPL hours left,” “Insert totals,” “Insert context,” and “Refresh” to streamline cockpit usage.  
- Summary card: Displays the current category’s compact summary for review.

Prompt Augmentation  
Upon send:  
1. The system reads the text input and performs lightweight intent detection (e.g., “private pilot,” “PPL,” and “hours left” patterns).  
2. If matched, it fetches and formats relevant summaries (e.g., logbook totals) and appends them.  
3. Independently, the system fetches the selected category’s summary and appends it as a labeled context block.  
4. The augmented prompt is sent to the LLM; the assistant message is displayed to the pilot.

Certificate-Hours Intent  
For “hours left” to a certificate or rating, the system includes a current-hours summary derived from the logbook. In some embodiments, the system maps current totals to regulatory minima captured in a local ruleset to compute deltas per requirement and provide a structured breakdown (e.g., for 14 CFR Part 61 private pilot minima). The ruleset can be updated per jurisdiction.

Privacy and Offline Operation  
- Raw databases remain on-device; only compact summaries are sent to the LLM unless expressly authorized by the user.  
- The system functions with cached data when offline, gracefully degrading when a category has no data.

Alternative Embodiments  
- Policy-driven summarization tuning by category.  
- Continuous background refresh for summaries under rate/age constraints.  
- Alternate intent detectors (e.g., recency, legality, deconfliction).  
- Multiple LLM backends or local models with on-device inference.

Example Workflows  
- Query: “How many hours do I have left to get to private pilot certificate?” — The system detects certificate-hours intent, appends logbook totals, and includes the currently chosen category’s context, improving answer specificity.

Claims  
1. A computer-implemented method for augmenting aviation-related natural language queries, comprising: receiving a user query via a chat interface of an electronic flight bag application; identifying a user-selected aviation category from a category selector; obtaining, from on-device databases, category-specific aviation data; summarizing the obtained data into a compact textual context; appending the compact textual context to the user query to form an augmented prompt; transmitting the augmented prompt to a large language model; and presenting a response from the large language model to the user.

2. The method of claim 1, further comprising detecting that the user query concerns a pilot certification-hours requirement and, in response, appending a logbook totals summary to the augmented prompt.

3. The method of claim 1, wherein the category includes at least one of: logbook, flight plan, weather, checklists, weight and balance, and aircraft.

4. The method of claim 2, wherein the logbook totals summary includes at least total flight time, pilot-in-command time, dual received, solo time, cross-country time, night time, instrument time, landings, and instrument approaches.

5. The method of claim 1, wherein summarizing weather includes aggregating counts by METAR category and counts of TAFs, temporary flight restrictions, pilot reports, and AIRMET/SIGMETs.

6. The method of claim 1, wherein summarizing flight plan data includes listing route identifiers and aggregate distance, ground speed, time, and fuel.

7. The method of claim 1, wherein summarizing checklist data includes an indication of an active checklist and a list of available checklists.

8. The method of claim 1, wherein summarizing weight and balance data includes an enumeration of available configurations.

9. The method of claim 1, wherein the compact textual context is generated entirely on-device and excludes raw underlying database entries.

10. The method of claim 1, further comprising presenting helper user interface controls that insert category-specific summaries or pre-authored domain prompts with a single user interaction.

11. The method of claim 1, wherein identifying the aviation category includes dynamically extending available categories based on presence of corresponding records in on-device databases.

12. The method of claim 2, wherein detecting pilot certification-hours intent comprises pattern-matching of query text for certificate-specific terms and hours-left phrases.

13. The method of claim 2, further comprising computing deltas against stored regulatory minima per certificate or rating to report remaining hours by requirement.

14. The method of claim 1, further comprising refreshing the compact textual context upon user request or upon data-change events subject to rate limits.

15. The method of claim 1, wherein transmitting the augmented prompt to the large language model includes including the compact textual context as a labeled context block.

16. A system comprising: one or more processors; memory storing instructions which, when executed, cause the system to perform operations comprising the steps of any of claims 1–15; on-device databases storing aviation data; a category selector user interface; a context aggregator configured to summarize category-specific data; and a large language model client configured to transmit augmented prompts.

17. The system of claim 16, wherein the context aggregator enforces privacy by excluding raw records and personally identifiable information from the augmented prompts.

18. The system of claim 16, wherein the category selector includes at least logbook, flight plan, weather, checklists, weight and balance, and dynamically includes aircraft when aircraft data are present.

19. The system of claim 16, further comprising helper controls configured to insert domain prompts and summaries into the chat input field.

20. A non-transitory computer-readable medium storing instructions that, when executed by one or more processors, cause a device to perform the method of any of claims 1–15.

Abstract  
An aviation assistant integrated with an electronic flight bag augments pilot queries to a large language model with on-device domain context. A category selector allows a pilot to choose a domain (e.g., logbook, flight plan, weather, checklists, weight and balance, aircraft). The system retrieves category-specific data from local databases, applies compact summarization policies, and appends the summaries to outgoing prompts. For certain intents, such as certification-hours queries, the system automatically detects the intent and appends logbook totals and, in some embodiments, computed deltas against regulatory minima. Helper user interface controls allow one-tap insertion of context and pre-authored domain prompts, with optional refresh. The approach improves response specificity and reduces pilot workload while preserving privacy by keeping raw records on-device. The invention is realized as methods, systems, and non-transitory computer-readable media.

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