HIGH LEVEL DESIGN(HLD)

DATA VISUALIZATION OF BIRD STRIKES BETWEEN 2000 – 2011

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DOCUMENT VERSION CONTROL:

Version	Date	Author	Comments
1.0	17-April-2023	Md Sahil	First Version of complete High-Level Design

Contents:

Abstract

Transport and communication is one of the crucial domain in field of analytics. Environmental impacts and safety are, nowadays, two major concerns of the scientific Community with respect to transport scenarios and to the ever-growing urban areas.

A bird strike is strictly defined as a collision between a bird and an aircraft which is in Flight or on a take-off or landing roll. The term is often expanded to cover other wildlife Strikes - with bats or ground animals. Bird Strike is common and can be a significant Threat to aircraft safety. For smaller aircraft, significant damage may be caused to the Aircraft structure and all aircraft, especially jet-engine ones, are vulnerable to the loss of Thrust which can follow the ingestion of birds into engine air intakes. This has resulted in several fatal accidents. Bird strikes may occur during any phase of flight, but are most likely during the take-off, initial climb, approach and landing phases due to the greater Numbers of birds in flight at lower levels. To have a closer look the following document visually depicts the data collected on Bird Strikes by FAA Between 2000-2011.

1. Introduction

1.1 Why this High-Level Design Document?

The purpose of this High-Level Design (HLD) Document is to add the necessary detail to the current project description to represent a suitable model for coding. This document is also intended to help detect contradictions prior to coding, and can be used as a reference manual for how the modules interact at a high level.

The HLD will:

- Present all of the design aspects and define them in detail
- Describe the user interface being implemented
- Describe the hardware and software interfaces
- Describe the performance requirements
- Include design features and the architecture of the project
- List and describe the non-functional attributes like:
    - Security
    - Reliability
    - Maintainability
    - Portability
    - Reusability
    - Application compatibility
    - Resource utilization
    - Serviceability

1.2 Scope

The HLD documentation presents the structure of the system, such as the database architecture, application architecture (layers), application flow (Navigation), and technology architecture. The HLD uses non-technical to mildly-technical terms which should be understandable to the administrators of the system.

2 General Description

2.1 Product Perspective & Problem Statement

Transport and communication is one of the crucial domain in field of analytics. Environmental impacts and safety are, nowadays, two major concerns of the scientific community with respect to transport scenarios and to the ever-growing urban areas. These issues gain more importance due to the increasing amount of vehicles and people. Seeking for new solutions is reaching a point where available technologies and artificial intelligence, especially MAS, are being recognized as ways to cope and tackle these kinds of problems in a distributed and more appropriate way.

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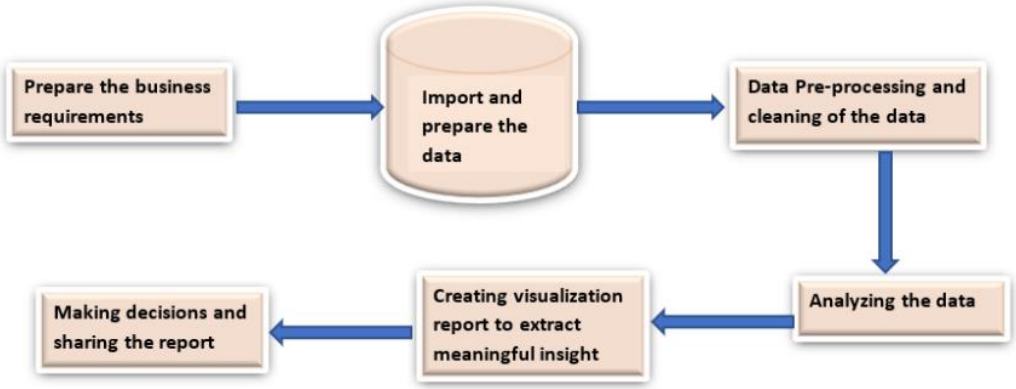
2.2 Tools used

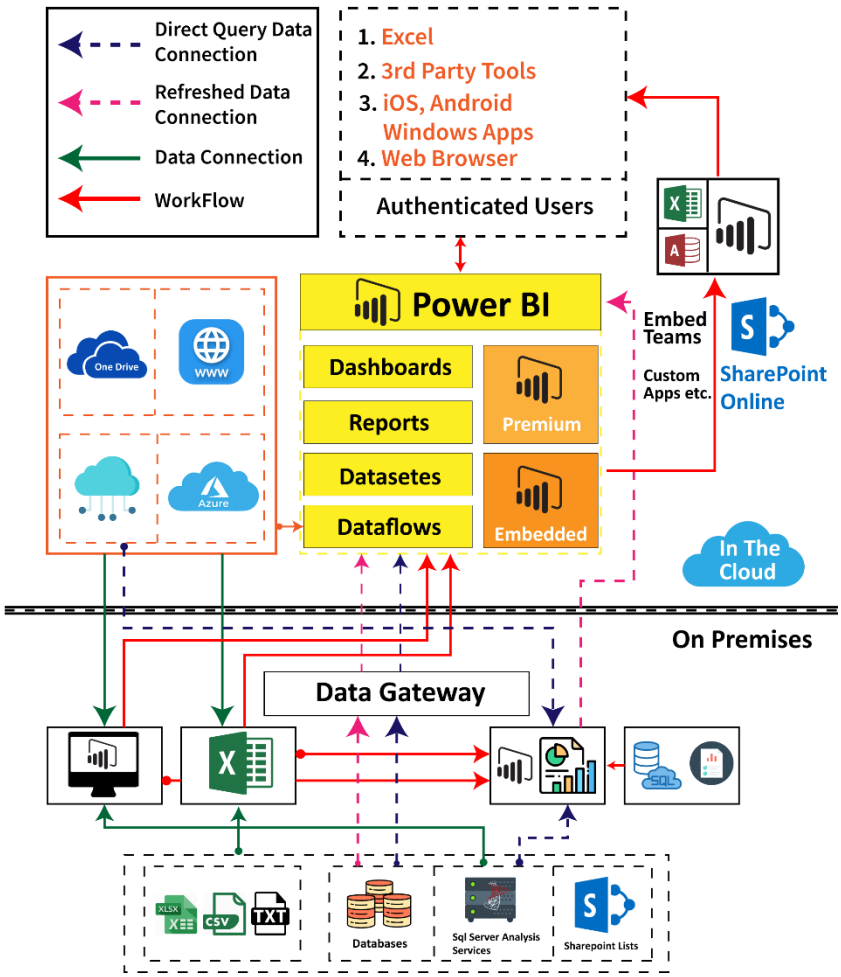
Business Intelligence tools and libraries works such as NumPy, Pandas, Matplotlib, Seaborn, Excel, Jupyter notebook, and Power BI are used to build the whole framework.

3. Design Details

3.1 Functional Architecture



Working of Power BI



3.2 Optimization

Data strategy drives performance

- Minimize the number of fields
- Minimize the number of records
- Optimize extracts to speed up future queries by materializing calculations, removing columns and the use of accelerated views

Reduce the marks (data points) in view

- Practice guided analytics. There's no need to fit everything we plan to show in a single view. Compile related views and connect them with action filters to travel from overview to highly-granular views at the speed of thought.
- Remove unneeded dimensions from the detail shelf.
- Explore. Try displaying your data in different types of views.

Limit filters by number and type

- Reduce the number of filters in use. Excessive filters on a view will create a more complex query, which takes longer to return results.
- Use Boolean or numeric filters. Computers process integers and Booleans (t/f) much faster than strings.
- Use parameters and action filters. These reduce the query load (and work across data sources).

Optimize and materialize your calculations

- Perform calculations in the database
- Reduce the number of nested calculations.
- Use Booleans or numeric calculations instead of string calculations. Computers can process integers and Booleans (t/f) much faster than strings.
  Boolean>Int>Float>Date>DateTime>String

4. KPI

Dashboards will be implemented to display and indicate certain KPIs and relevant indicators for the given problem.

Key indicators displaying a summary Bird Strikes and its relationship with different metrics:

1. Visuals Depicting the Number of Bird Strikes:

i) Yearly Analysis
ii) Bird Strikes in US
iii) Top 10 US Airlines in terms of having encountered bird strikes
iv) Airports with most incidents of bird strikes – Top 50

2. Yearly Cost Incurred due to Bird Strikes:

3 When do most bird strikes occur?

i) Altitude of airplanes at the time of strike
ii) Phase of flight at the time of strike
iii) Average Altitude of the airplanes in different phases at the time of strike

4. Effect of Bird Strikes

i) Impact on Flight
ii) Effect of Strike at Different Altitude
iii) Were Pilots Informed?
iv) Prior Warning and Effect of Strike Relation

5. Deployment

Organizations can choose to deliver and manage their Power BI deployment through IT and standard project workflows or to empower certain business users to take advantage of Self-Service BI capabilities with tools such as Power BI Desktop and Excel. In many scenarios, a combination of IT resources, such as the On-premises data gateway and Power BI Premium capacity, can be combined with the business users' knowledge of requirements and familiarity with data analysis and visualization.

Organizations may also utilize alternative deployment modes per project or with different business teams based on available resources and the needs of the project.

There are three main deployment options when considering Power BI.

- **On-Premises:** Refers to data, applications and infrastructure entirely owned by client at client data center and client has complete control over it.
- **Cloud:** Refers to data, infrastructure and/or services residing in a public cloud environment and completely managed /controlled by third party. Microsoft Azure and web based Power BI service are examples of the cloud offerings.
- **Hybrid:** This denotes to the implementation which spans both on premises and cloud sources which can be services, infrastructure and data sources.

Pros of Power BI:

Here, are pros/benefits of Power BI

- Offers pre-built dashboards and reports for SaaS Solutions
- Provide real-time dashboard updates.
- Secure and reliable connection to your data sources in the cloud or on-premises
- Power BI offers quick deployment, hybrid configuration, and a secure environment.
- Data exploration using natural language query.
- Feature for dashboard visualization
- New features frequently added that are great for excel users.
- Extensive database connectivity capabilities Q&A feature publish to the web.
- integration with both Python and R coding to use visualizations.

- Power Query provides many options related to wrangling and clean the data.
- Post publishing the data into Power BI web service can schedule refresh without manual intervention.
- Power BI backed by the superpower of with artificial intelligence and machine learning.
- ***MSFT integration:*** Power BI can easily integrate with Azure/O365 and anything else that Microsoft has created, which proves to be a huge advantage for the user by smoothly running all operations on Microsoft.
- Embedding PowerBI report supports to embed in other websites.

Cons of Power BI:

Here, are cons/drawbacks of Power BI

- Dashboards and reports only shared with users having the same email domains.
- Power Bl will never mix imported data, which is accessed from real-time connections.
- Power BI can't accept file size larger than 1 GB.
- Dashboard never accept or pass user, account, or other entity parameters.
- **Table relationships:** Power BI is prone to running into difficulties while handling data that has complex relationships with tables. In many cases, data models need to be carefully created with unique fields for the sole purpose of joining tables together.
- Very few data sources permit real-time connections to Power BI reports and dashboards.