Serverless Expense Tracker with AWS Quicksight

A Course Project Report Submitted in partial fulfillment of the course requirements for the award of grades in the subject of

CLOUD BASED AIML SPECIALITY
(22SDCS07R)

by

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April 2025

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Certificate

This is Certified that the project entitled **"Project Title"** which is a experimental &/ theoretical &/ Simulation&/ hardware work carried out by Name of the student (ID No), in partial fulfillment of the course requirements for the award of grades in the subject of **CLOUD BASED AIML SPECIALITY**, during the year **2024-2025**. The project has been approved as it satisfies the academic requirements.

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1. INTRODUCTION

- **Importance of Effective Expense Management**
  Managing expenses is a crucial activity for both individuals and businesses. For individuals, it ensures personal financial stability, helping to avoid debt and plan for future needs. For businesses, effective expense management is integral to controlling costs, maintaining profitability, and making data-driven decisions about resource allocation. The growing complexity of financial transactions, along with the increasing volume of data that needs to be processed, makes it essential for both individuals and businesses to adopt efficient tools to track, analyze, and manage expenses.
- **The Shift to Cloud Computing and Serverless Architectures**
  With the advancement of cloud computing technologies, many organizations are transitioning away from traditional on-premise solutions towards more scalable and flexible cloud-based architectures. Among these innovations, **serverless computing** stands out. Serverless architectures eliminate the need for businesses to manage infrastructure, as the cloud provider handles all of the backend management tasks like server provisioning, scaling, and maintenance. This results in significant cost savings, operational efficiency, and the ability to scale resources based on demand. Serverless models also bring enhanced security and reliability due to the use of cloud providers' established infrastructure. As a result, businesses and individuals can leverage these solutions to streamline their operations and focus more on their core objectives rather than technical maintenance.
- **Project Overview:**
  This project, titled **"Serverless Expense Tracker with AWS QuickSight,"** aims to address the challenges of expense management by providing a **comprehensive serverless solution** built entirely on **AWS (Amazon Web Services)**. The system is designed to track and analyze expense data efficiently, offering organizations and individuals a powerful tool to gain deeper insights into their financial activities. By adopting a serverless approach, the project eliminates the need for complex infrastructure management, allowing users to focus on leveraging the data for better decision-making rather than worrying about the underlying technical setup.

2. AWS Services Used as part of the project

The following AWS services were integral to the implementation of the Serverless Expense Tracker:

Amazon S3 (Simple Storage Service)

- **Purpose**: Amazon S3 is a scalable cloud storage service designed for storing and retrieving data. In this project, it is used to store the **raw expense data** in CSV format, as well as the **manifest.json** file, which contains metadata that helps define and organize the dataset.
- **Key Features**:
    - **Durability**: Amazon S3 offers **99.999999999% durability**, meaning your data is highly reliable and can be accessed or restored even if there is an issue with the underlying hardware.
    - **Scalability**: S3 scales automatically as your data grows, meaning it can handle small to large datasets with ease. **[7]**
    - **Encryption**: S3 provides **built-in encryption** capabilities to ensure that stored data is secured both in transit and at rest, protecting sensitive financial information.
    - **Accessibility**: The data stored in S3 can be accessed from anywhere and integrated with various other AWS services like AWS QuickSight.
    - These features make S3 an ideal choice for storing large amounts of raw financial data securely and reliably **[1]**.

AWS QuickSight

- **Purpose**: AWS QuickSight is a **business intelligence (BI) service** that enables users to easily create **interactive visual dashboards** and perform data analysis. It is designed to work with data stored in AWS services like **Amazon S3**. In this project, QuickSight is used to transform the raw expense data stored in S3 into actionable insights through visualizations like graphs and charts. **[8]**
- **Key Features**:
    - **Data Analysis and Visualization**: QuickSight enables users to turn raw data from Amazon S3 (e.g., CSV files) into meaningful insights by creating visualizations such as bar charts, line graphs, and pie charts.
    - **Automatic Scaling**: QuickSight is a serverless service, meaning it can automatically scale based on the amount of data being analyzed, allowing users to work with large datasets without worrying about infrastructure management.
    - **Integration with S3**: QuickSight uses the **manifest.json** file stored in S3 to understand the structure and metadata of the dataset, allowing it to create detailed and accurate visual representations of the data.
    - **Insights and Reporting**: It helps in generating automated reports, dashboards, and data insights that users can access in real-time, providing actionable intelligence for business decision-making.
    - QuickSight's integration with S3 and its scalability make it an ideal tool for financial analysis in a serverless environment **[3]**.

- AWS Management Console: The web-based interface through which all services were configured and monitored during the project [4].

3. Steps involved in solving project problem statement

- Problem Understanding

  The primary objective of this project was to develop a cost-effective, serverless expense tracking system that allows users to view dynamic, real-time visualizations **[8]** of their financial data. The system leverages AWS QuickSight for data visualization and uses Amazon S3 to store expense data in a secure and scalable manner. The serverless nature of the solution ensures that users do not need to worry about managing infrastructure, which aligns with modern cloud computing practices that focus on automation, cost-efficiency, and scalability. This approach enables real-time insights into financial activities, enhancing decision-making capabilities for businesses and individuals alike **[5]**.

- Create S3 Bucket and Upload Files

  The first step involved creating an Amazon S3 bucket to securely store the expenses.csv file, which contains raw expense data, and the manifest.json file, which provides metadata about the dataset. The bucket was configured with encryption to ensure that data is securely stored, both in transit and at rest. Additionally, public access to the S3 bucket was restricted to prevent unauthorized access, ensuring the data remained private and secure. These security measures are critical for protecting sensitive financial information and align with AWS's best practices for data storage and security **[1]**.

- IAM Configuration for Permissions

  Next, AWS Identity and Access Management (IAM) was used to configure roles and policies to manage access permissions securely. IAM ensures that AWS QuickSight can access the S3 bucket where the dataset is stored, but only with the minimum permissions necessary for the task—this adheres to the principle of least privilege. By limiting permissions, the system ensures that other services or users cannot access sensitive financial data, maintaining a high level of security and compliance. This access control is critical for maintaining the integrity and confidentiality of the data being processed **[2].**

- Connect Dataset in AWS QuickSight

  Once IAM roles and permissions were set up, the next step was to connect the dataset to AWS QuickSight. QuickSight was configured to read the manifest.json file stored in the S3 bucket. This file contains critical metadata, such as column names, data types, and file format information, which enables QuickSight to automatically parse and load the CSV dataset into its analytics engine. Using the manifest file ensures that the data is accurately read and understood, simplifying the data integration process. QuickSight's ability to handle data from S3 and automatically ingest it using the manifest file is a key feature that supports efficient and error-free data analysis **[3].**

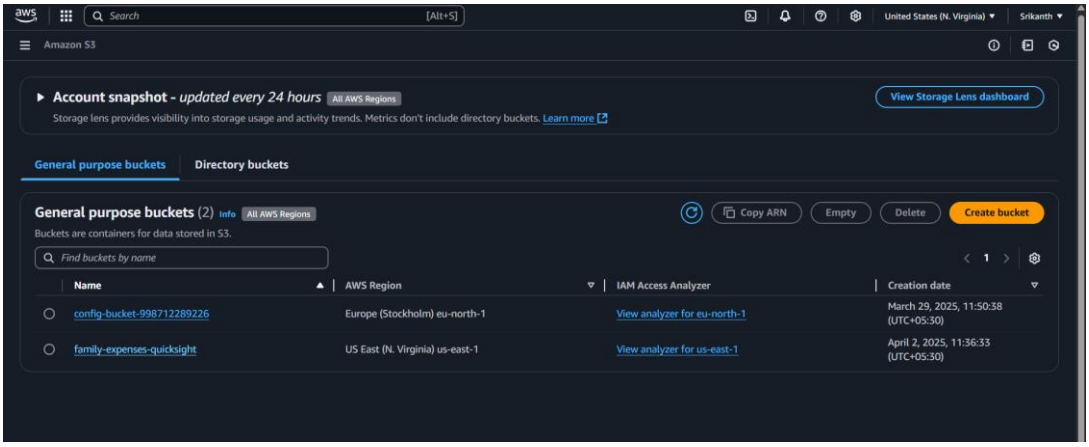
- ## Create Visual Dashboards

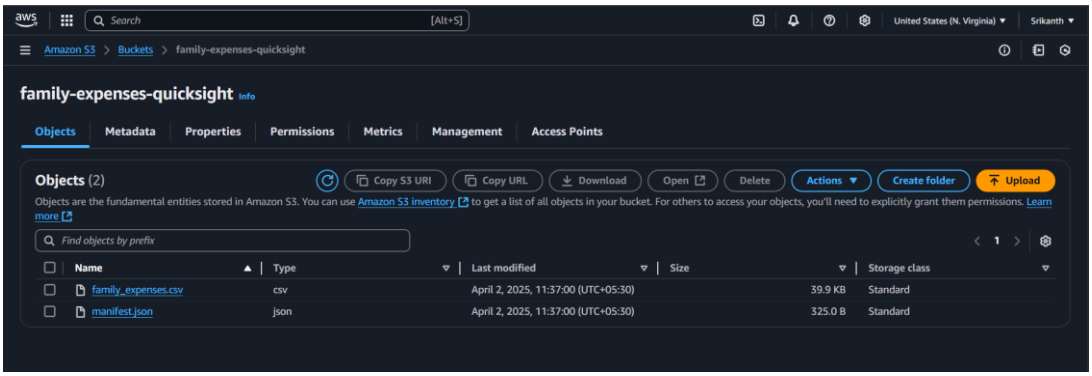
  After the dataset was successfully loaded into QuickSight, the next step was to create interactive visual dashboards to help users better understand their financial data. Various visualizations such as bar charts, pie charts, and tables were created to represent the expenses by different categories, dates, and amounts. These visualizations make it easier to track trends, compare expenses, and identify areas for cost savings. To further enhance the user experience, filters and calculated fields were added to allow users to customize the data they wish to view, providing more granular insights into their financial activities. QuickSight's interactive nature and ability to create rich, dynamic visualizations are crucial for enabling real-time decision-making based on up-to-date data [3]**.**

4. Stepwise Screenshots with brief description

1: Create S3 Bucket

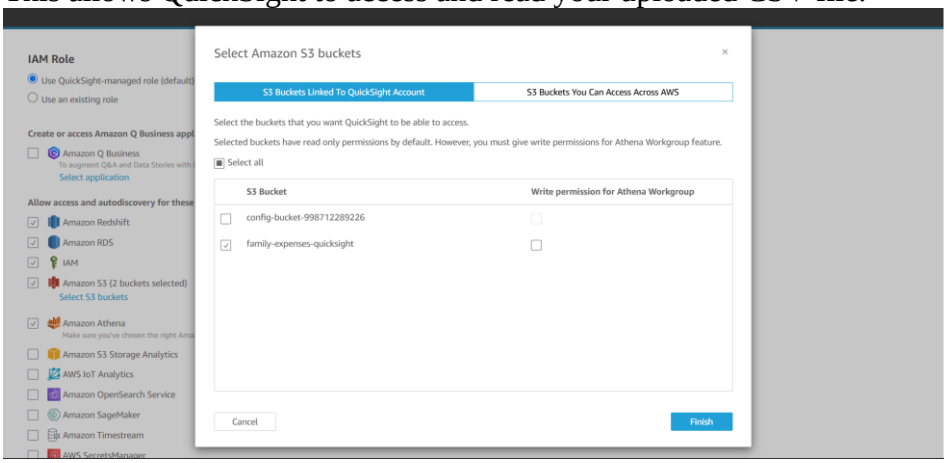
Navigate to AWS S3 → Click "Create bucket" → Set a unique name and region.
Upload your `expenses.csv` file and the corresponding `manifest.json` file to the bucket.
Enable default encryption for data security.





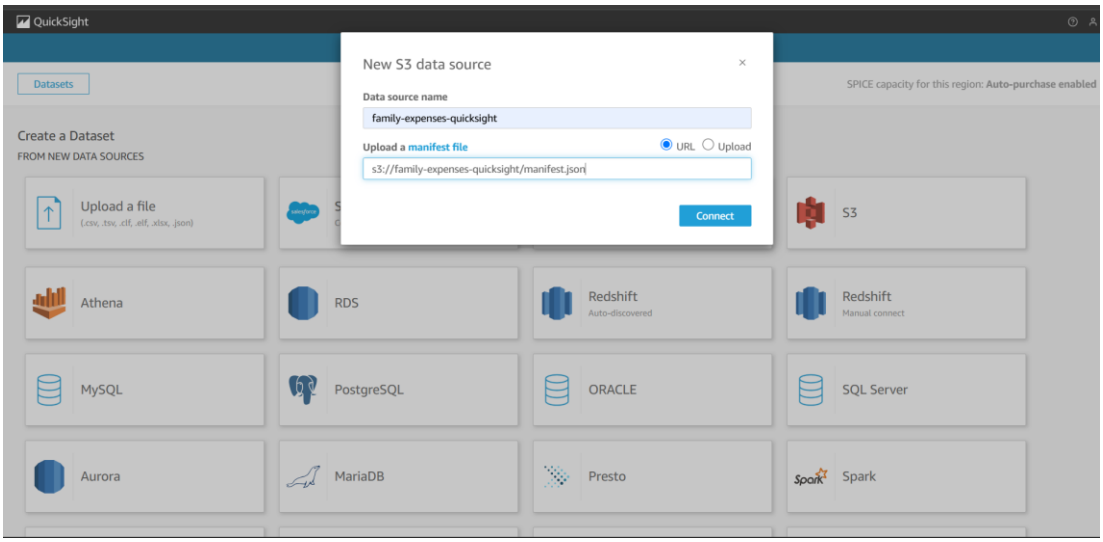
2: Grant QuickSight Access to S3

Open AWS QuickSight → Go to "Manage QuickSight" → Choose "Security & permissions".
Add the S3 bucket path (with manifest.json URI) to the list of allowed buckets.
This allows QuickSight to access and read your uploaded CSV file.



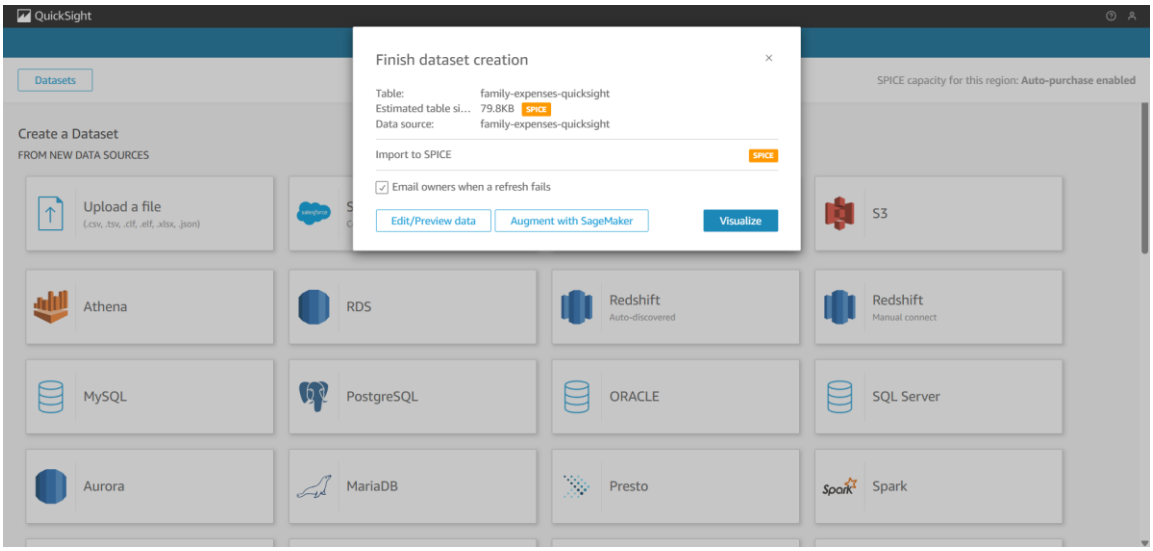
3: Connect Dataset in QuickSight

In QuickSight → Go to "Datasets" → Click “New dataset” → Choose "S3" as source.
Paste the manifest file URI → QuickSight reads the CSV file schema using the manifest. **[7]**
Click “Edit/Preview data” to validate and prepare your dataset.



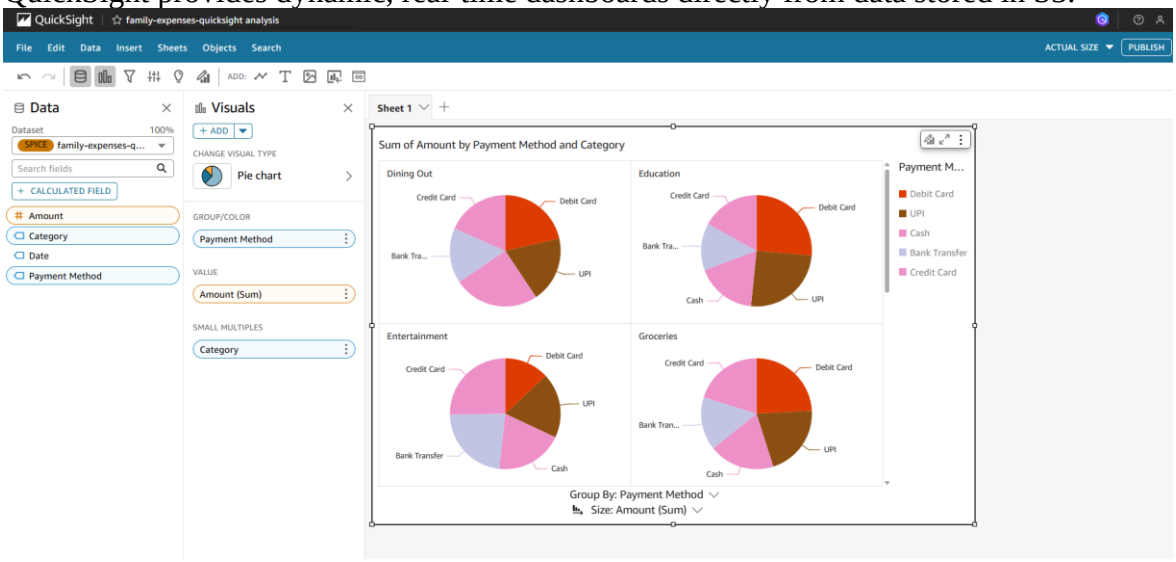
4: Create Visual Dashboard

Click “New Analysis” → Select your prepared dataset.
Add visual elements like bar charts, tables, and KPIs to analyze expenses by category, date, or amount.
Use filters and calculated fields for deeper insights.



5: Final Outcome

You now have a fully serverless, secure, and scalable expense tracking solution. QuickSight provides dynamic, real-time dashboards directly from data stored in S3.



5. Learning Outcomes

- Gained practical experience with serverless architecture using AWS services [5]

  This project provided hands-on experience with serverless architecture by using AWS services like **S3**, and **QuickSight**. I learned how serverless computing allows for automatic scaling and cost efficiency, eliminating the need to manage infrastructure.

- Understood the structure and purpose of manifest.json in data ingestion [6]

  I learned how the **manifest.json** file defines the dataset's structure, making it easier for **QuickSight** to automatically parse and load the data from **S3**. This simplified the data integration process and ensured consistency during data ingestion.

- Developed skills in creating dynamic dashboards using AWS QuickSight [3]

  Using **AWS QuickSight**, I created interactive **visualizations** like bar charts and tables to display expense data. I also added filters and calculated fields, enhancing the user experience and providing actionable insights in real time.

- Understood best practices for secure and scalable S3 bucket configuration [1]

  I configured **S3 buckets** with proper encryption and access controls, ensuring both security and scalability. These best practices are essential for safely storing and retrieving data as the system grows.

6. Conclusion

The "Serverless Expense Tracker with AWS QuickSight" project effectively demonstrates the power of cloud-native services in building a secure, scalable, and real-time expense tracking solution. By leveraging Amazon S3 for secure storage and AWS QuickSight for powerful data visualization, the solution eliminates the need for traditional infrastructure, ensuring ease of use and minimal operational overhead.

Key highlights of the project include:

- Amazon S3 for Secure Storage: Expense data is securely stored in Amazon S3, benefiting from its durability, scalability, and cost-effectiveness. This approach ensures that the data is easily accessible without managing physical infrastructure.
- AWS QuickSight for Real-Time Visualization: By using AWS QuickSight, dynamic dashboards were created to provide real-time insights into expenses. This enables users to track their finances and make data-driven decisions quickly.
- Elimination of Infrastructure Management: The serverless nature of the solution means there is no need to maintain traditional servers or infrastructure, reducing operational complexity and costs.
- Suitable for Personal Finance and Small Businesses: This solution is perfect for personal finance management and small businesses or startups that need a low-maintenance, cost-efficient analytics tool.
- Reinforces Cloud Computing Principles: The project reinforces critical concepts in cloud computing, such as serverless architecture, data security, and business intelligence, offering valuable hands-on experience with modern cloud services.

7. References

[1] Amazon S3 documentation. https://docs.aws.amazon.com/s3/

[2] IAM documentation. https://docs.aws.amazon.com/iam/

[3] QuickSight User Guide. https://docs.aws.amazon.com/quicksight/

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[5] Serverless Expense Tracker. https://namrata-bhaumik.medium.com/my-aws-adventure-building-a-serverless-expense-tracker-392091e60207

[6] Using manifest files for data ingestion in QuickSight. https://aws.amazon.com/blogs/big-data/

[7] Dataset. http://kaggle.com/datasets/tharunprabu/my-expenses-data

[8] QuickSight visualizations documentation https://docs.aws.amazon.com/quicksight/latest/user/working-with-visual-types.html