# Real-Time Smart Bank Data Streaming Capture

Gourp 03

# Team Members

Sindhu Nagesha - 017419987

Prayag Nikul Purani - 017416737

Syed Faraaz Ahmed - 017428619

Sai Vivek Chunduri- 017435301

# Overview

# Abstract


- Developing a real-time data analytics pipeline for the banking sector.
- Utilizing Docker, Kafka, and Apache Spark.
- Gathering data from sensors, transactions, and applications.
- Enabling swift processing and integration with Flask and Elastic search.
- Providing actionable insights and enhancing customer satisfaction.

# Introduction

- This project aims to redefine how banks leverage data through two workflows: one involving sensor data and the other application and transactional data.
- Sensor data is processed via Amazon IoT Core, Timestream, Python, and Grafana for fraud detection and visualization.
- Application and transactional data are streamed through Python, Kafka, MongoDB, and Kibana, utilizing Apache sessions and complex logic for fraud detection.
- Real-time data processing empowers banks to detect patterns, anticipate trends, and make precise decisions swiftly.
- Smart bank data streaming captures the potential to transform customer experiences, enabling hyper-personalized services and enhancing engagement and loyalty..

# Motivation

- Real-time data analytics in banking enhances customer experience.
- It enables prompt identification and prevention of fraud.
- Improves operational efficiency by adapting to market dynamics.
- Provides a competitive edge through innovative services.
- Represents a strategic shift towards a data-centric approach, transforming the industry landscape.

# Literature Survey

01 Apache Spark: A Big Data Processing Engine Eman Shaikh, Iman Ahmed Mohiuddin, Yasmeen Alufaisan and Irum Nahvi (2019). Apache Spark: A Big Data Processing Engine.

02 Information Security in Big Data: Privacy and Data Mining Xu, L., Jiang, C., Wang, J., Yuan, J. and Ren, Y. (2014). Information Security in Big Data: Privacy and Data Mining.

03 Beyond Batch Processing: Towards Real-Time and Streaming Big Data. Shahrivari, S. (2014). Beyond Batch Processing: Towards Real-Time and Streaming Big Data. Computers

04 Real-Time Processing of Big Data Streams: Lifecycle, Tools, Tasks, and Challenges. F. Gürcan and M. Berigel, "Real-Time Processing of Big Data Streams: Lifecycle, Tools, Tasks, and Challenges," 2018 2nd International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT), Ankara, Turkey, 2018

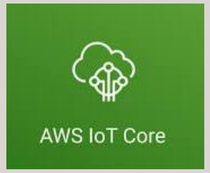
05 KAFKA:The modern platform for data management and analysis in big data domain. R. Shree, T. Choudhury, S. C. Gupta and P. Kumar, "KAFKA: The modern platform for data management and analysis in big data domain,"

06 Event-Based Sensor Data Scheduling: Trade-Off Between Communication Rate and Estimation Quality J. Wu, Q. -S. Jia, K. H. Johansson and L. Shi, "Event-Based Sensor Data Scheduling: Trade-Off Between Communication Rate and Estimation Quality,"

# TECHNOLOGY STACK

Python

Flask




AWS
Iot core

AWS
Lambda

Streaming



Analytics

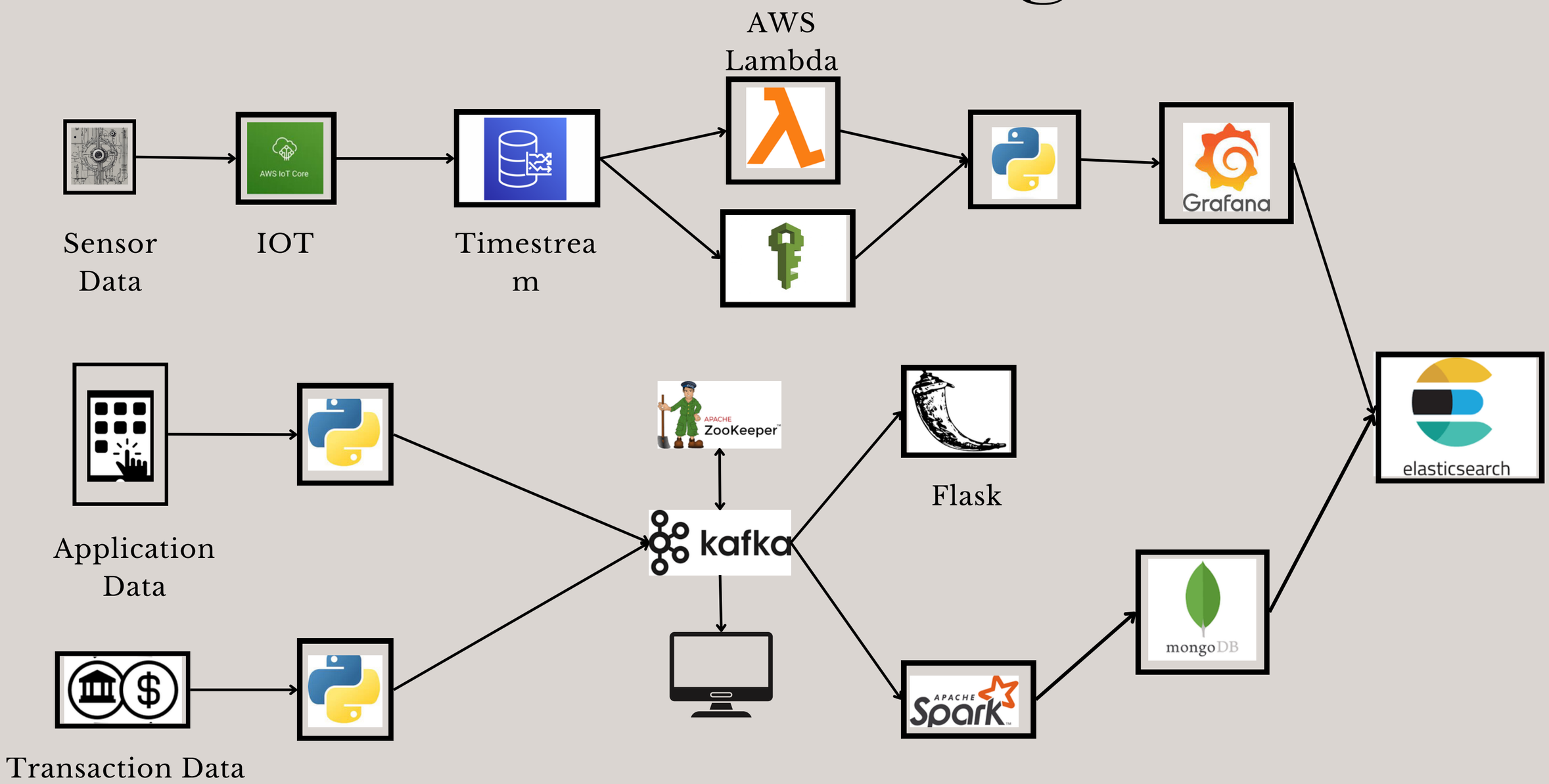


Storage

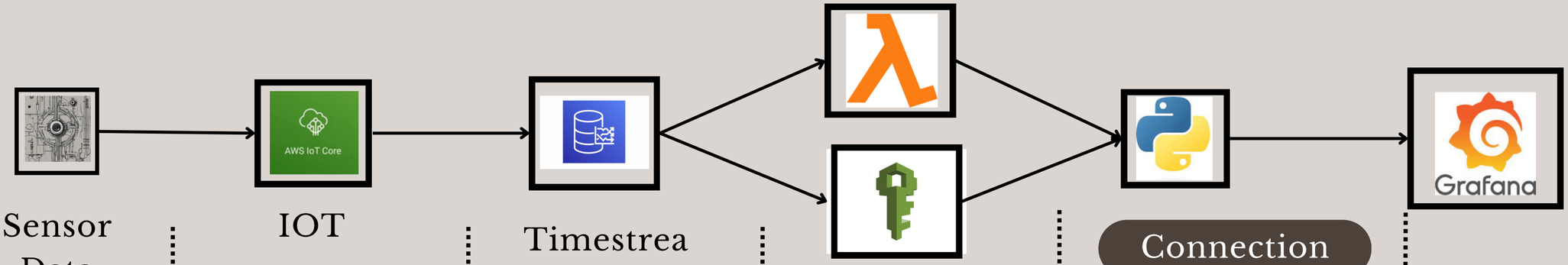

Co-ordination


Timestream

# Architecture diagram



# Work-flow 1 (Sensor)




Sensor Data

- Data Generation
- Addition of noise
- Encryption of data

IOT

- Subscribing data
- Creating Rules
- Creation of keys

Timestrea m

- Schema
- Table
- Connection

- Users API's
- Roles and Permission

- Connection
- Converting data
- Random Sampling Reservoir
- Bloom-filter
- Conn. Grafana
- Conn. Elastic

- Visualization
- Dashboard

# Result


Fig: Dashboard using Grafana For Workflow 1

# Result

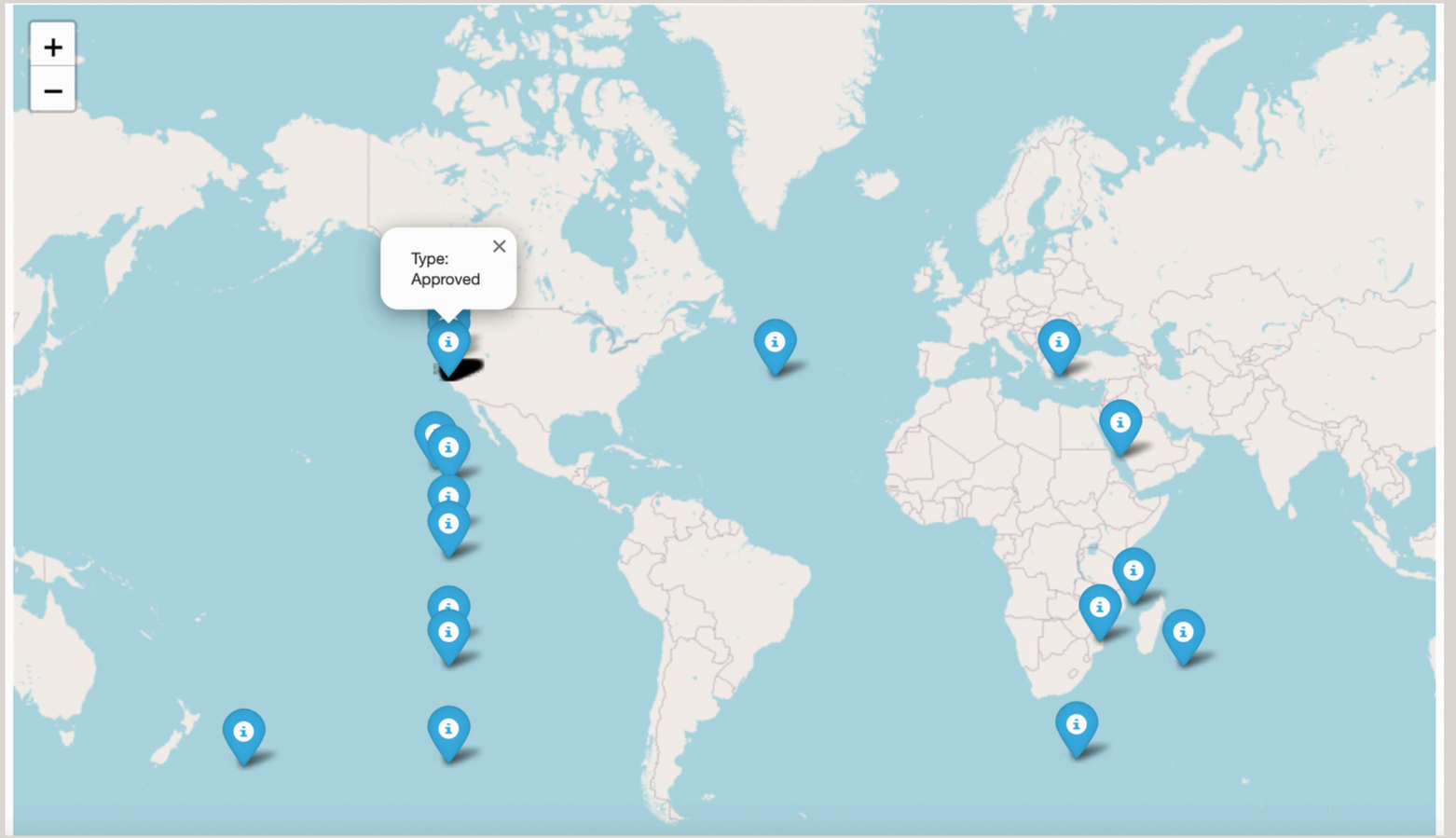
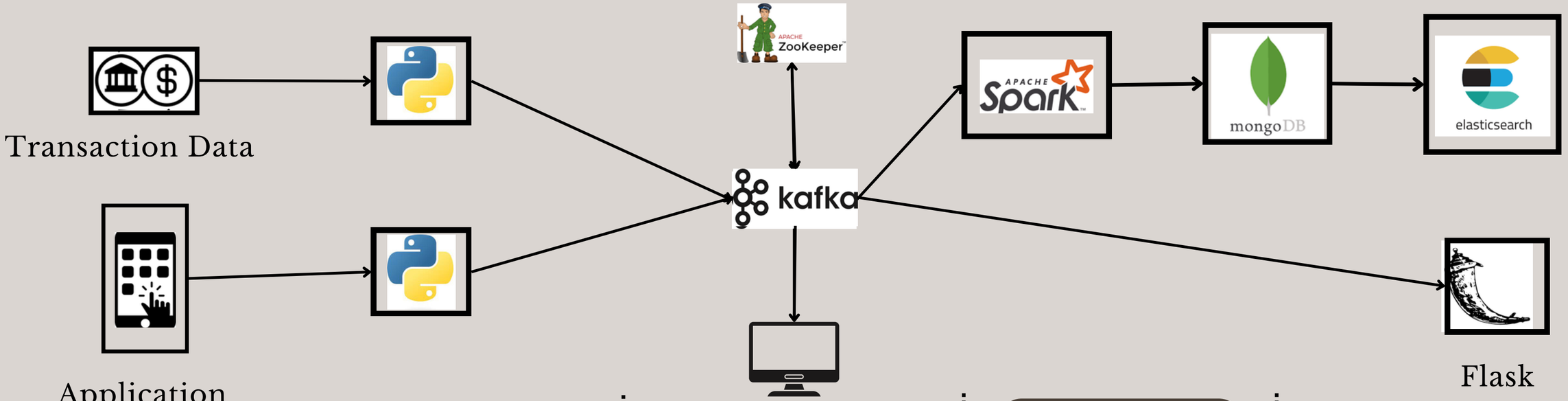



Fig: Ploting the Samples

# Work-flow 2 (Transaction & App)




Data Generation

Addition of noise

Connection

Sending data

Fraud Detection Logic

Spark Session

Tokenization

K-anonymity

LSH

Visualization

Dashboard

# Result

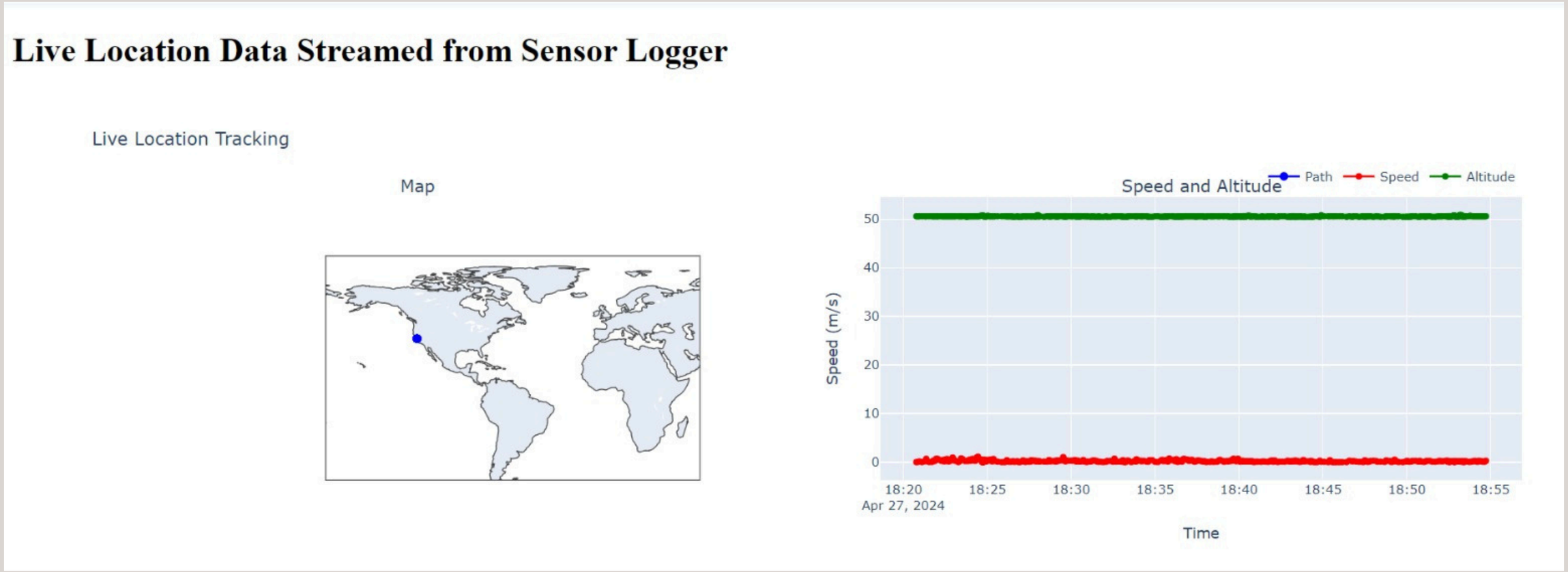



**Fig: Visual using Flask**

# Result

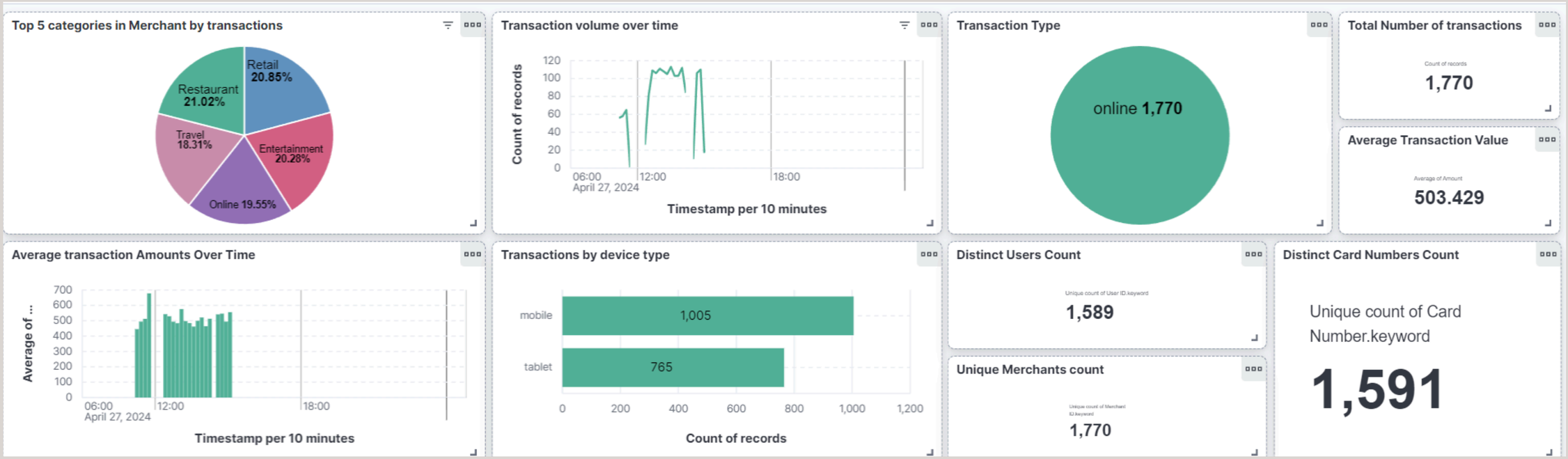
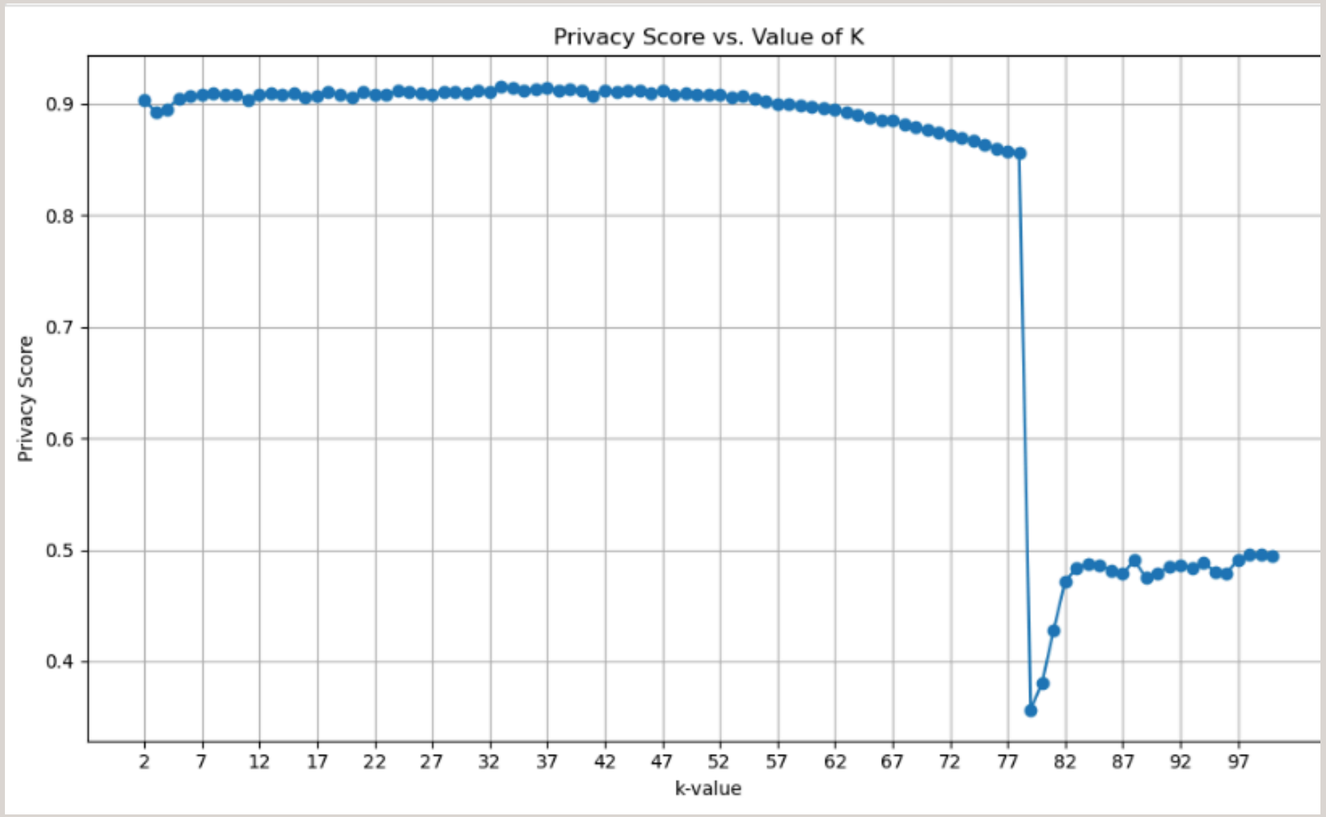



Fig: Kibana Dashboard for Workflow 2

# Result



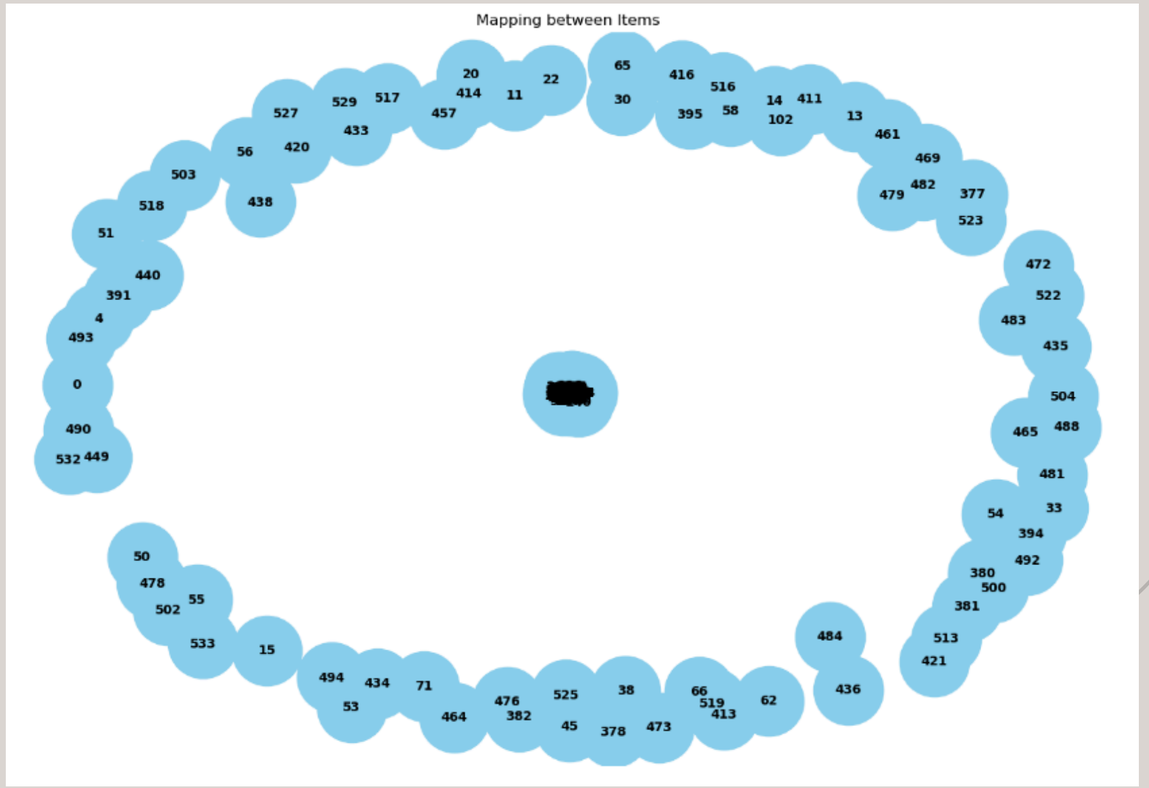




**Fig: k-value Vs Privacy and cluster from LSH**

# Technical Difficulties

- Scalability and fault tolerance: Ensuring infrastructure can handle large volumes of streaming data while maintaining high availability.
- Data quality and consistency: Addressing issues like duplication, out-of-order arrival, and data skew to ensure accurate analytics results.
- Data privacy and security: Implementing encryption, access control, and anonymization techniques to protect sensitive financial information.
- Interoperability: Integrating disparate data sources and systems within the banking environment to achieve seamless data exchange.

# Key Learnings

- AWS Integration: Leveraging AWS IoT and Timestream ensures scalable and reliable infrastructure for real-time analytics.
- Synthesizing Data: Introducing fake data alongside original sensor data enriches datasets for more representative analysis.
- Real-time Streaming: Kafka facilitates seamless communication and data flow for efficient processing and analysis.
- Efficient Data Handling: Bloom filters optimize large data volumes for fast queries and enhanced analysis.
- Reservoir Sampling: Ensures creation of representative data subsets crucial for accurate analysis and Bloom filter implementation.
- Data Anonymization: Protects user privacy while preserving data integrity, crucial for regulatory compliance.
- Locality-Sensitive Hashing (LSH): Enables efficient data clustering for fraud detection and anomaly identification.
- Web Application Development: Flask along with Dash empowers development of web applications and APIs for user interaction.
- Analytics with Elasticsearch: Elasticsearch provides robust analytics for diverse analyses and data visualization.

# Conclusion

- The implementation of a real-time data analytics pipeline in the banking sector marks a significant advancement in meeting digital banking demands, leveraging robust technologies and integrations for efficient processing and analysis.
- Leveraging Docker, Kafka, and Apache Spark alongside innovative integrations like IOT and Timestream enables streamlined data processing.
- Deployment of Flask, Elastic search, and Grafana enhances pipeline capabilities, providing prompt visuals and alerts for critical scenarios
- Real-time data analytics offer invaluable insights into customer behavior, fraud detection, and personalized banking experiences, enhancing satisfaction and loyalty
- This project represents a strategic move towards a data-driven approach, positioning itself to transform the industry landscape and foster innovation and competitiveness in the ever-evolving market.

# Thank You :)