**Question 2: Penetration Rate in Amazon Athena**

-- Step 1: Create a spatial join to identify CV vehicles per sensor

-- This query creates a buffer of 2 miles around each Wavetronix sensor and performs a spatial join to identify CV vehicles within that buffer

WITH sensor\_buffer AS (

SELECT

device\_id,

ST\_Buffer(ST\_Point(CAST(latitude AS DOUBLE), CAST(longitude AS DOUBLE)), 2) AS buffer\_geom

FROM raghu\_wavetronix\_locations

),

cv\_with\_buffer AS (

SELECT

cv.\*,

sensor.device\_id AS sensor\_id

FROM raghu\_cv\_data AS cv

JOIN sensor\_buffer AS sensor

ON ST\_Within(ST\_Point(CAST(cv.latitude AS DOUBLE), CAST(cv.longitude AS DOUBLE)), sensor.buffer\_geom)

),

-- Step 2: Aggregate the number of CV vehicles per hour per sensor

cv\_vehicle\_hourly AS (

SELECT

sensor\_id,

DATE\_FORMAT(capturedtimestamp, '%Y-%m-%d %H:00:00') AS hour,

COUNT(\*) AS cv\_vehicle\_count

FROM cv\_with\_buffer

GROUP BY sensor\_id, DATE\_FORMAT(capturedtimestamp, '%Y-%m-%d %H:00:00')

),

-- Step 3: Aggregate the number of vehicles from Wavetronix per hour per sensor

wavetronix\_hourly AS (

SELECT

device\_id,

DATE\_FORMAT(cst\_time, '%Y-%m-%d %H:00:00') AS hour,

SUM(lane\_count) AS total\_vehicle\_count

FROM raghu\_wavetronix\_data

GROUP BY device\_id, DATE\_FORMAT(cst\_time, '%Y-%m-%d %H:00:00')

)

-- Step 4: Calculate Penetration Rate

SELECT

w.device\_id,

w.hour,

w.total\_vehicle\_count,

c.cv\_vehicle\_count,

CASE WHEN w.total\_vehicle\_count > 0 THEN (c.cv\_vehicle\_count / w.total\_vehicle\_count) \* 100 ELSE 0 END AS penetration\_rate

FROM wavetronix\_hourly AS w

LEFT JOIN cv\_vehicle\_hourly AS c

ON w.device\_id = c.sensor\_id AND w.hour = c.hour;

**Question 3: Tableau**

1. Hourly Variation of Penetration Rates

A graph showing the number of rows and rows

Description automatically generated

A graph showing a line

Description automatically generated

A screenshot of a graph

Description automatically generated

A screenshot of a graph

Description automatically generated

Locations with Highest and Lowest Penetration Rates

1. Locations with Highest and Lowest Penetration Rates

A screenshot of a computer

Description automatically generated

1. Map of All Sensors with Average Penetration Rate

A screenshot of a computer

Description automatically generated

1. Highlighted tables for hour and penetration rate

