TRAFFIC MANAGEMENT SYSTEM

PHASE 2: INNOVATION

PROJECT DEFINITION: The project involves using IoT devices and data analytics to monitor traffic flow and congestion in real-time, providing commuters with access to this information through a public platform or mobile apps. The objective is to help commuters make informed decisions about their routes and alleviate traffic congestion. This project includes defining objectives, designing the IoT traffic monitoring system, developing the traffic information platform, and integrating them using IoT technology and python.

Consider integrating historical traffic data and machine learning algorithms to predict congestion patterns.

HISTORICAL TRAFFIC DATA:

SUMMARY:

Provides information about the historical traffic information stored in the network dataset such as the speed profile table and time slice durations.

PROPERTIES:

PROPERTY	EXPLANATION	DATASET
Time interval	The time interval of the traffic data.	Double
Time interval units	The units of the time interval of the traffic data. This property returns the following keywords: • Millisecond • Second • Minutes • Hours • Days • Weeks • Months • Years • Decades • Centuries • Unknown	String
First time slice field name	The field name of the first time slice of the given period in the profile table.	String
Last time slice field name	The field name of the first time slice of the given period in the profile table.	String
First slice duration in minutes	The duration of the time slice in minutes.	Integer

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First time slice start time	The start time of valid period of day for traffic data.	String
Profiles table name	The name of the table containing profiles.	String
Join table name	The name of the table containing profiles.	String
Join table base travel time field name	The field name for base travel time in the join table.	String
Join table base speed field name	The field name for base speed in the join table.	String
Join table base travel time field name	The field name for base travel time in the join table.	String
Join table base travel time units	The units for the base travel time in the join table. This property Returns the following keywords: • Seconds • Minutes • Hours • Days	String
Join table profile Id field names	A python list containing field names of the join table pointing to speed profiles.	List
Join table base speed units	The units for the base speed in the join table. This property returns the following keywords: • Miles Per Hour • Kilometers Per Hours • Unknown	String

Code sample:

Historical traffic data properties example
Display a summary of the historical traffic information for the network dataset.

```
import arcpy
import sys
{
arcpy.env.workspace = "C:/Data/SanFrancisco.gdb/Transportation"
desc = arcpy.Describe("Streets_ND")
if desc.supportsHistoricalTrafficData:
    traffic = desc.historicalTrafficData
else:
print("No historical traffic information")
sys.exit()
{
print("Historical Traffic Information ----")
print("Time interval: " , traffic.timeInterval)
print("Time interval units: " , traffic.timeIntervalUnits)
print("First time slice field name: " , traffic.firstTimeSliceFieldName)
print("Last time slice field name: " , traffic.lastTimeSliceFieldName)
```

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```
print("First time slice start time: " , traffic.firstTimeSliceStartTime)
print("Time slice duration in minutes: ",traffic.timeSliceDurationInMinutes)
print("Profiles table name: ", traffic.profilesTableName)
print("Join table name: ", traffic.joinTableName)
print("Join table base travel time field name: ",
traffic.joinTableBaseTravelTimeFieldName)
print("Join table base travel time units: ",
traffic.joinTableBaseTravelTimeUnits)
print("Join table ProfileID field names: ", traffic.joinTableProfileIDFieldNames)
}
};
```

OUTPUT:

Vehicle_ID	Road_ID	Time_group	Start_time	End_time	Travel_time (min)	Velocity (km/min)
1	1	6	16:50	16:57	7	1.8725
2	1	6	17:20	17:31	11	1.1916
3	1	6	17:43	17:56	13	1.0082
4	1	6	16:02	16:11	9	1.456
5	1	6	16:16	16:32	16	0.8192
6	1	6	16:05	16:18	13	1.0082
7	1	6	17:03	17:10	7	1.8725
8	1	6	17:11	17:18	7	1.8725
9	1	6	17:35	17:46	11	1.1916
10	1	6	16:09	16:16	7	1.8725

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MACHINE LEARNING ALGORITHMS TO PREDICT CONGESTION PATTERNS IN TRAFFIC DATA:

There are several types of machine learning algorithms that can be used for traffic prediction, including regression, time-series analysis, and artificial neural networks. Regression models use historical traffic data to predict future traffic conditions based on past trends.

SAMPLE CODE:

```
1. import numpy as np
2. import pandas as pd
3. import matplotlib.pyplot as plt
4. import seaborn as sns
5. import datetime
6. import tensorflow
7. from statsmodels.tsa.stattools import adfuller
8. from sklearn.preprocessing import MinMaxScaler
9. from tensorflow import keras
10. from keras import callbacks
11. from tensorflow.keras import Sequential
12. from tensorflow.keras.layers import Conv2D, Flatten, Dense, LSTM, Dropout, GRU, Bidirectio
    nal
13. from tensorflow.keras.optimizers import SGD
14. import math
15. from sklearn.metrics import mean_squared_error
16.
17. import warnings
18. warnings.filterwarnings("ignore")
```

Loading the Dataset

```
1. dataset = pd.read_csv("traffic.csv")
2. dataset.head()
```

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Output:

	DateTime	Junction	Vehicles	ID
0	2015-11-01 00:00:00	1	15	20151101001
1	2015-11-01 01:00:00	1	13	20151101011
2	2015-11-01 02:00:00	1	10	20151101021
3	2015-11-01 03:00:00	1	7	20151101031
4	2015-11-01 04:00:00	1	9	20151101041