DEVELOPING AN INTELLIGENT TRAFFIC MANAGEMENT SYSTEM FOR SMART CITIES

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APPENDICES:

Appendix A: Code

Python Code

```
import pandas as pd
import numpy as np
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split

# Load data
data = pd.read_csv('traffic_data.csv')

# Preprocess data
X = data.drop(['traffic_volume'], axis=1)
y = data['traffic_volume']

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
random_state=42)

# Train random forest model
model = RandomForestRegressor(n_estimators=100, random_state=42)
```

```
model.fit(X_train, y_train)

# Make predictions
y_pred = model.predict(X_test)
```

MATLAB Code

```
% Load data
data = readtable('traffic_data.csv');

% Preprocess data
X = data{:, 2:end};
y = data{:, 1};

% Split data into training and testing sets
[X_train, X_test, y_train, y_test] = trainTestSplit(X, y, 0.2);

% Train random forest model
model = fitrensemble(X_train, y_train, 'Method', 'Bag', 'NumLearningCycles', 100);

% Make predictions
y_pred = predict(model, X_test);
```

Appendix B: Mathematical Derivations

Derivation of Traffic Flow Model

The traffic flow model used in this project is based on the fundamental diagram of traffic flow, which relates traffic flow rate to traffic density. The fundamental diagram can be represented mathematically as:

$$Q = \rho * v$$

where Q is the traffic flow rate, ρ is the traffic density, and v is the traffic speed.

The traffic flow model used in this project assumes a linear relationship between traffic flow rate and traffic density, which can be represented mathematically as:

$$Q = a * \rho + b$$

where a and b are constants that can be estimated from traffic data.

Derivation of Machine Learning Algorithm:

The machine learning algorithm used in this project is based on the random forest algorithm, which is an ensemble learning method that combines multiple decision trees to improve the accuracy of predictions. The random forest algorithm can be represented mathematically as:

$$y\_pred = \sum(w\_i * y\_i)$$

where y_pred is the predicted value, w_i is the weight assigned to each decision tree, and y_i is the predicted value from each decision tree.

Appendix C: Data Tables

Traffic Volume Data

Time	Traffic Volume
7:00 AM	1000
8:00 AM	1500
9:00 AM	2000
...	...

Traffic Speed Data

Time	Traffic Speed
7:00 AM	40 km/h
8:00 AM	50 km/h
9:00 AM	60 km/h
...	...

Traffic Incident Data

Time	Traffic Incident
7:00 AM	Accident
8:00 AM	Congestion
9:00 AM	Roadwork
...	...