Introduction

In this experiment, we used a car with a motion detector and Loggerpro to measure the distance, velocity, and acceleration over time. We collected three sets of data and calculated it in loggerpro derived equations for position vs. time, velocity vs. time, and acceleration vs. time.

Data Collection

Three sets of data were collected using the motion detector and Loggerpro. The data sets are as follows:

((You can view the data sets in the excel file(.csv)). The equations we got from fitting the curve are:

<u>Position vs Time</u>

Y= -0.07t+1.046

Y= 0.18t+0.33

Y=-0.074+0.74

<u>Acceleration vs Time</u>

Y=0.122t-0.43

Y=-0.06t+0.15

Y=0.06t-0.12

<u>Velocity vs Time</u>

Y=-0.09t+0.39

Y=-0.09t+0.03

Y=0.15t-0.43

Analysis

<u>Position vs. Time Analysis:</u>

The position vs. time graphs indicate how the car's position changes over time.

A negative slope indicates the car is moving backwards, while a positive slope indicates forward movement.

Velocity vs. Time Analysis:

The velocity vs. time graphs show how the car's speed changes over time.

A negative slope suggests deceleration, while a positive slope indicates acceleration.

Acceleration vs. Time Analysis:

Acceleration vs. time analysis

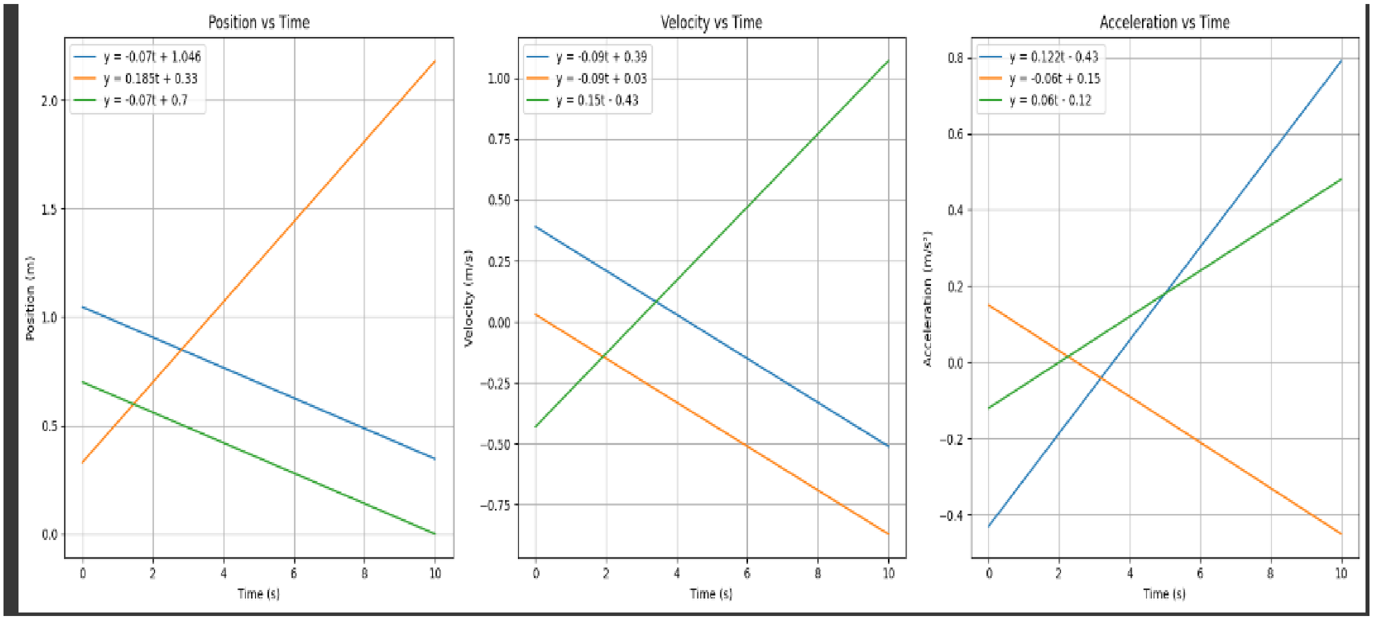
The graphs illustrate how the car's acceleration changes over time.

Positive acceleration values indicate speeding up, while negative values indicate slowing down.

If we plot the graph in python using this code, we get

```
import matplotlib.pyplot as plt

import numpy as np


# Define the time range for plotting

t = np.linspace(0, 10, 400)


# Velocity vs Time equations

v1 = -0.09 * t + 0.39

v2 = -0.09 * t + 0.03

v3 = 0.15 * t - 0.43


# Acceleration vs Time equations

a1 = 0.122 * t - 0.43

a2 = -0.06 * t + 0.15

a3 = 0.06 * t - 0.12


# Plotting Velocity vs Time

plt.figure(figsize=(12, 6))
```

```
plt.subplot(1, 2, 1)
plt.plot(t, v1, label='y = -0.09t + 0.39')
plt.plot(t, v2, label='y = -0.09t + 0.03')
plt.plot(t, v3, label='y = 0.15t - 0.43')
plt.title('Velocity vs Time')
plt.xlabel('Time (s)')
plt.ylabel('Velocity (m/s)')
plt.legend()
plt.grid(True)

# Plotting Acceleration vs Time
plt.subplot(1, 2, 2)
plt.plot(t, a1, label='y = 0.122t - 0.43')
plt.plot(t, a2, label='y = -0.06t + 0.15')
plt.plot(t, a3, label='y = 0.06t - 0.12')
plt.title('Acceleration vs Time')
plt.xlabel('Time (s)')
plt.ylabel('Acceleration (m/s²)')
plt.legend()
plt.grid(True)

plt.tight_layout()
plt.show()
```



Discussion

The graphs illustrate the relationships between time, velocity, and acceleration for the car:

Each set of data provides insights into the car's motion behavior, helping us understand how it accelerates and decelerates under different conditions with respect to the position and time.

Conclusion

This experiment successfully demonstrated the use of a motion detector and LoggerPro to measure and analyze the motion of a car. The data collected allowed us to derive meaningful equations and create informative plots of velocity and acceleration over time.