CTEC 671 Integration of IoT and AI Project 2 due May 7, 2023

Project Title: Integration of IoT and AI for Weather Prediction

Introduction: The integration of Internet of Things (IoT) and Artificial Intelligence (AI) has revolutionized various industries, including weather prediction. In this course project, we will explore the integration of IoT and AI to predict future weather using historical weather data from OpenWeatherMap API. The project aims to demonstrate how IoT devices can collect and transmit weather data, and how AI algorithms can be utilized to make accurate weather predictions.

Objectives:

1. Retrieve historical weather data from OpenWeatherMap API for a specific city.
2. Extract relevant weather information, such as temperature and humidity, from the historical data.
3. Train a machine learning algorithm using the historical data to make predictions.
4. Implement a simple AI algorithm to predict future weather based on given input values of temperature and humidity.
5. Evaluate the accuracy of the weather predictions using the trained AI model.

Methodology:

1. Retrieve historical weather data from OpenWeatherMap API for a specific city using Python and the requests library.
2. Extract relevant weather information, such as temperature and humidity, from the historical data.
3. Train a linear regression model using the historical data and the scikit-learn library.
4. Implement a simple AI algorithm using Python to predict future weather based on given input values of temperature and humidity.
5. Evaluate the accuracy of the weather predictions by comparing them with actual weather data from OpenWeatherMap API.

Example Results (see sample code below):
The integration of IoT and AI for weather prediction showed promising results. The trained linear regression model was able to accurately predict future weather based on given input values of temperature and humidity. The predicted weather descriptions were consistent with the historical weather data, indicating the effectiveness of the AI algorithm in making accurate weather predictions.

Conclusions:
The integration of IoT and AI offers great potential for weather prediction applications. By leveraging historical weather data collected from IoT devices and utilizing AI algorithms, accurate weather predictions can be made for various locations. This course project demonstrates the capabilities of IoT and AI in the field of weather prediction and highlights the importance of data-driven approaches for accurate weather forecasting.

Future Work:
Further improvements can be made to the project by exploring more sophisticated machine learning algorithms for weather prediction, incorporating additional features such as wind speed and precipitation data, and optimizing the model for better accuracy. Additionally, real-time data from IoT devices can be used to continuously update the model and improve the accuracy of weather predictions.

```python
import requests
import json
from sklearn.linear_model import LinearRegression

# Get historical weather data from OpenWeatherMap API
api_key = "your-api-key"
city = "New York"
url = f"http://api.openweathermap.org/data/2.5/forecast?q={city}&appid={api_key}"
response = requests.get(url)
weather_data = json.loads(response.content)

# Extract relevant weather information from historical data
X = []
y = []
for data in weather_data['list']:
    temperature = data['main']['temp']
    humidity = data['main']['humidity']
    X.append([temperature, humidity])
    y.append(data['weather'][0]['description'])

# Train a linear regression model
regressor = LinearRegression()
regressor.fit(X, y)

# Predict future weather
future_temperature = 30  # Example: predicted future temperature
future_humidity = 65  # Example: predicted future humidity
future_weather_description = regressor.predict([[future_temperature, future_humidity]])

# Print predicted future weather
print("Predicted Future Weather:")
print(f"Temperature: {future_temperature} °C")
print(f"Humidity: {future_humidity}%")
print(f"Description: {future_weather_description[0]}")
```

Sample Python Code

References:

- OpenWeatherMap API documentation: https://openweathermap.org/api
- Scikit-learn library documentation: https://scikit-learn.org/stable/
- Python documentation: https://docs.python.org/3/