PUBLIC TRANSPORTATION OPTIMIZATION

Developing a complete IoT-based public transportation optimization program involves a complex system with various components and technologies. Writing the entire code for such a program here is not feasible due to its extensive nature. However, I can provide you with a simplified Python example using a hypothetical scenario to get you started.

Let's consider a basic example of tracking the location of buses and providing estimated arrival times for passengers. You would need IoT devices on buses, a server to process data, and a mobile app for passengers. Here's a simplified code snippet to demonstrate the concept:

1. *Bus (Simulated IoT Device) Code* (Python):

python

```
import random
import time

def simulate_bus_location(bus_id):
    while True:
        # Simulate GPS data (latitude and longitude)
        latitude = random.uniform(37.0, 38.0)
        longitude = random.uniform(-122.0, -123.0)
        # Send data to the server
        send_location_data(bus_id, latitude, longitude)
        time.sleep(60)  # Update location every minute

def send_location_data(bus_id, latitude, longitude):
    # Send data to the server (you would use an IoT protocol like MQTT here)
    print(f"Bus {bus_id} Location - Latitude: {latitude}, Longitude: {longitude}")

if __name__ == "__main__":
    bus_id = "Bus001"
    simulate_bus_location(bus_id)
```

2. *Server Code* (Python):

python

```
# In a real system, you would use a web framework like Flask or Django for the server.


# Receive and process location data from buses (MQTT or similar)
def process_location_data(bus_id, latitude, longitude):
    # Perform route optimization, calculate estimated arrival times, etc.
    estimated_arrival_time = calculate_estimated_arrival_time(bus_id, latitude, longitude)
    # Update database or send data to the passenger app


def calculate_estimated_arrival_time(bus_id, latitude, longitude):
    # Calculate ETA based on route data, traffic conditions, and bus location
    # You may use machine learning models for more accurate predictions


if __name__ == "__main__":
    # Set up MQTT or data processing logic here
    pass
```

3. *Passenger Mobile App*: Develop a mobile app (iOS/Android) to receive and display estimated arrival times to passengers. This app would communicate with the server to retrieve the data.

Remember that building a complete public transportation optimization system is a significant project, and this code represents just a small part of it. You'll need to consider scalability, data storage, security, and user interfaces, among other things. Additionally, consider using IoT platforms and cloud services to simplify development and deployment.