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PUBLIC TRANSPORTATION OPTIMIZATION - IOT

Phase:- IV

Abstract:-

It is expected that in the next decade, the majority of the world's population will be living in cities. Satisfying the demands for mobility through public services and infrastructures in the city is a significant challenge.

Introduction:-

IoT aims to support rapid and precise identification such as location tracking, monitoring and management. Therefore, IoT is based on multiple integration of communications solutions, technology identification and tracking, sensor networks and actuators, and sharing of other information distribution

Problem Definition for Public Transportation Optimization:-

The problem is to optimize public transportation systems using IoT (Internet of Things) technologies. Public transportation often faces challenges such as inefficient routes,

overcrowding, irregular schedules, and lack of real-time information. The goal is to address these issues to create a more efficient, reliable, and user-friendly public transportation system.

Design Thinking Approach:-

Empathize:

Understand the needs and pain points of public transportation users through surveys, interviews, and observations.Collect data on current transportation system performance, including delays, congestion, and passenger feedback.

Define:

Clearly define the problem, considering the pain points identified.Create a user-centric problem statement, such as "How might we create a more efficient and user-friendly public transportation system?"

Ideate:

Brainstorm potential IoT solutions that could address the defined problem.Encourage creative thinking and consider both hardware and software solutions. Explore ideas like real-time tracking, predictive maintenance, and smart ticketing.

Prototype:

Develop prototypes or proof-of-concept systems for the selected IoT solutions. Test these prototypes in controlled environments or pilot programs to validate their effectiveness.

Test:

Gather feedback from users, operators, and other stakeholders on the prototype's performance. Iterate on the design based on the feedback received.

Implement:

Once a viable IoT solution is identified, plan for a phased implementation across the public transportation system. Consider scalability, budget, and integration with existing infrastructure.

Monitor and Evaluate:

Continuously monitor the IoT-enabled transportation system's performance. Collect data on key metrics like on-time performance, passenger satisfaction, and resource utilization.

Iterate:

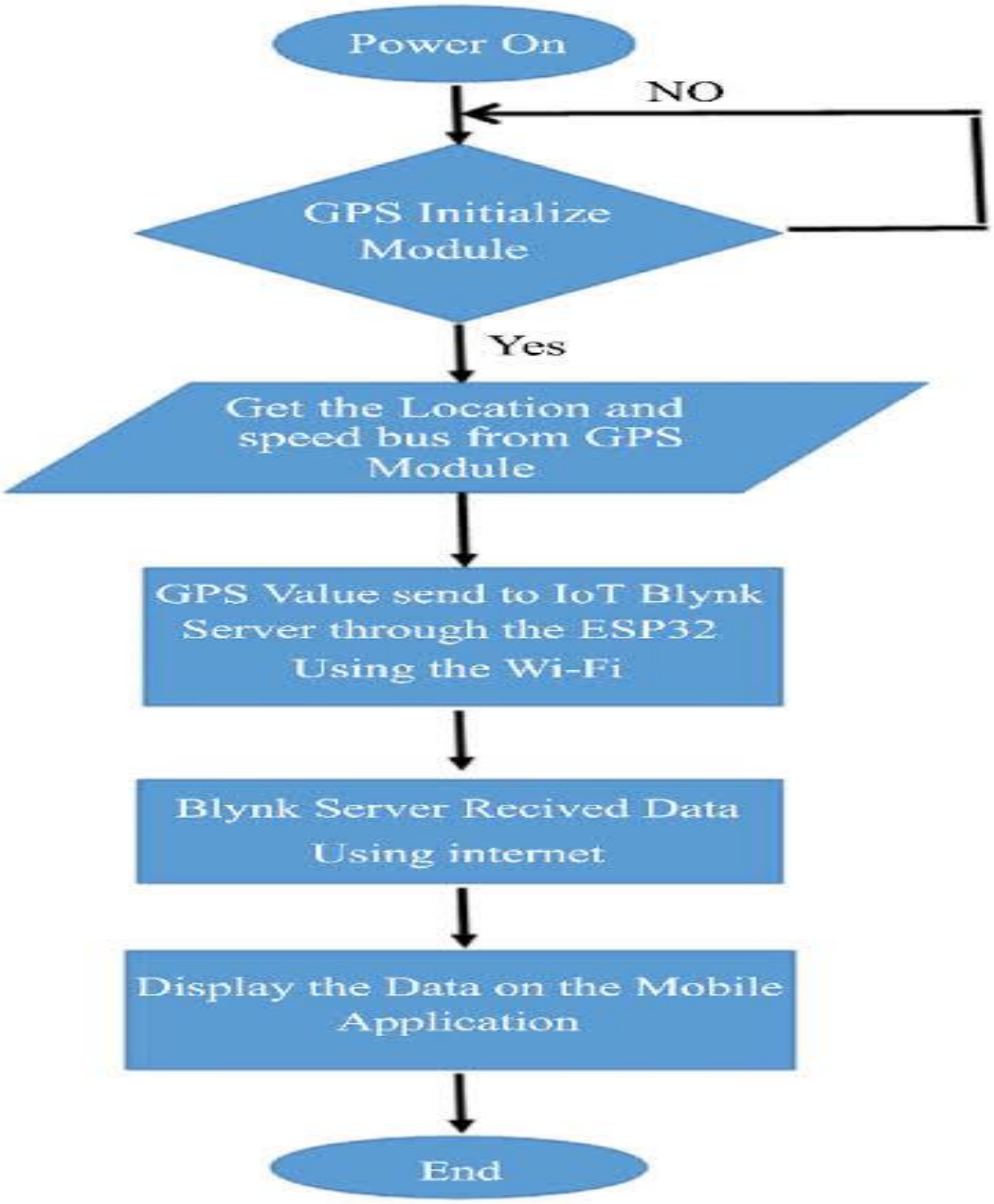
Use the collected data and user feedback to make ongoing improvements to the system. Be

open to adapting and expanding IoT capabilities as technology advances.

Key IoT Technologies and Components to Consider:

GPS tracking for real-time location data. Sensors to monitor passenger occupancy, temperature, and other variables. Communication networks for data transmission. Cloud computing for data storage and analysis. Mobile apps or web platforms for passenger information. Predictive analytics for maintenance scheduling and route optimization. By following a design thinking approach and leveraging IoT technologies, you can work towards optimizing public transportation systems, improving user experiences, and enhancing overall efficiency.

Block Diagram:-



Real-time Location Monitoring:

To accurately track and monitor the location of vehicles, assets, or people in real-time, providing visibility and control.

Fleet Management:

Optimize fleet operations, reduce fuel consumption, and improve vehicle maintenance by tracking vehicle locations and performance.

Route Optimization:

Improve efficiency and reduce costs by finding the most efficient routes for transportation or delivery.

Data Analysis:

Collect and analyze location data to gain insights, make informed decisions, and improve business processes.

Emergency Response:

Enable quick response in case of emergencies or accidents by providing accurate location data.

Environmental Monitoring:

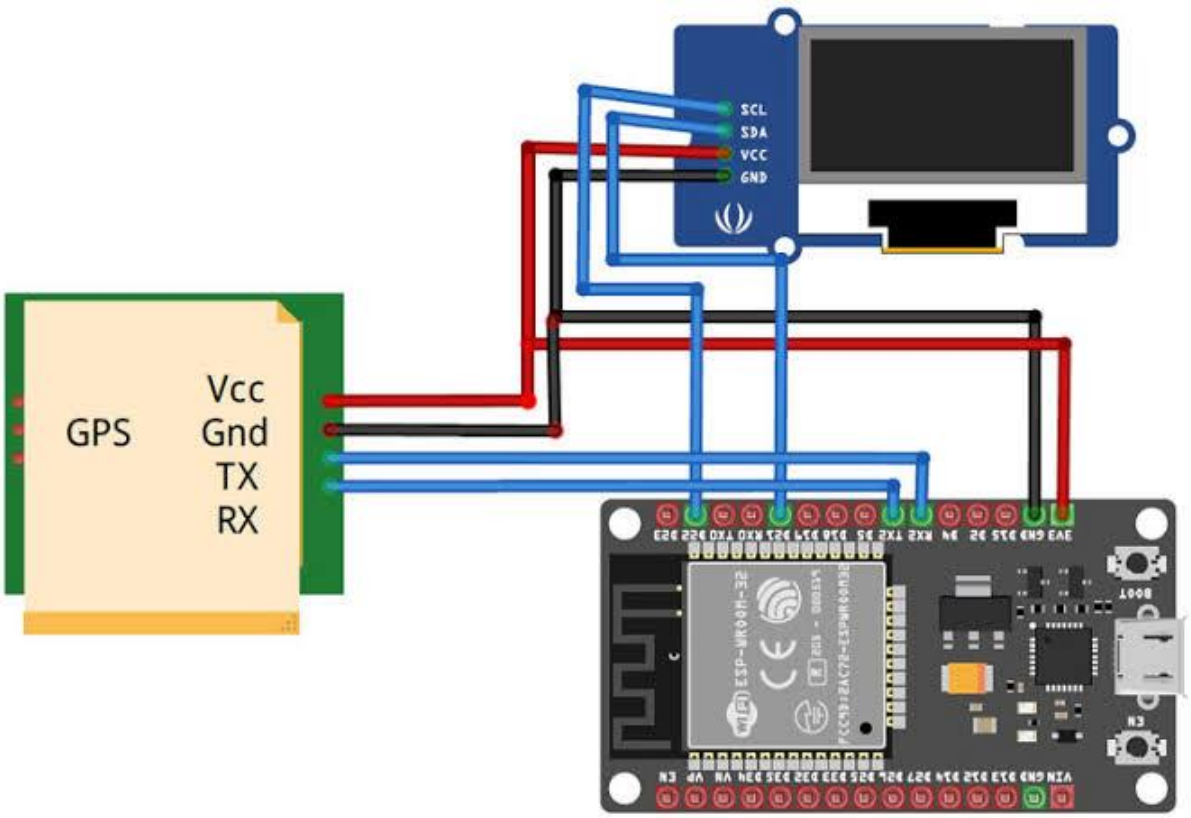
Monitor and manage environmental factors like temperature, humidity, or air quality in various locations.

Personal Safety:

Enhance personal safety by enabling location tracking for individuals, especially in situations like outdoor activities or emergencies.

Theft Recovery:

Increase the chances of recovering stolen assets or vehicles by tracking their location. The specific objective will depend on the industry, use case, and requirements of the GPS tracking system.



IOT SET UP::

Choose the IoT Device:

Select the specific IoT device that suits your needs. It could be a sensor, as mart appliance, a camera, or any other device designed to connect to the internet.

Unbox and Assemble:

Unbox the device and assemble it according to the manufacturer's instructions. This may include attaching antennas, connecting cables, or inserting batteries.

Power On:

Power on the device by plugging it into an electrical outlet, using batteries, or any other power source specified by the manufacturer.

Developmentation:-

Connect to a Network:

Most IoT devices connect to the internet via Wi-Fi or Ethernet. Follow the device's instructions to connect it to your local network.

Wi-Fi:

Enter the network name (SSID) and Password through the device's interface.

Ethernet:

Plug in an Ethernet cable to connect directly to your router.

Download the Companion App:

Many IoT devices come with companion mobile apps. Download the app from the App Store (iOS) or Google Play (Android) and follow the app's instructions to set up your device

Device Configuration:

Configure the device using the app or a web-based interface, if applicable. You may need to set preferences, configure sensors, or define how the device should interact with other smart devices.

Create User Accounts:

If the device requires user accounts or cloud service integration, create accounts on the respective platforms and link the device to your account.

Firmware/Software Updates:

Check for and install any firmware or software updates for the IoT device to ensure it has the latest features, security patches, and bug fixes.

Set Up Automation and Integration:

If your device is part of a smart home or smart office ecosystem, integrate it with other devices or platforms (e.g., Amazon Alexa, Google Assistant, or Apple HomeKit). Set up automation routines or voice control, if desired.

Security Considerations:

Pay attention to security. Change default passwords, enable encryption, and follow best practices for securing your IoT device. Be cautious about sharing sensitive data with the device.

PYTHON CODE:-

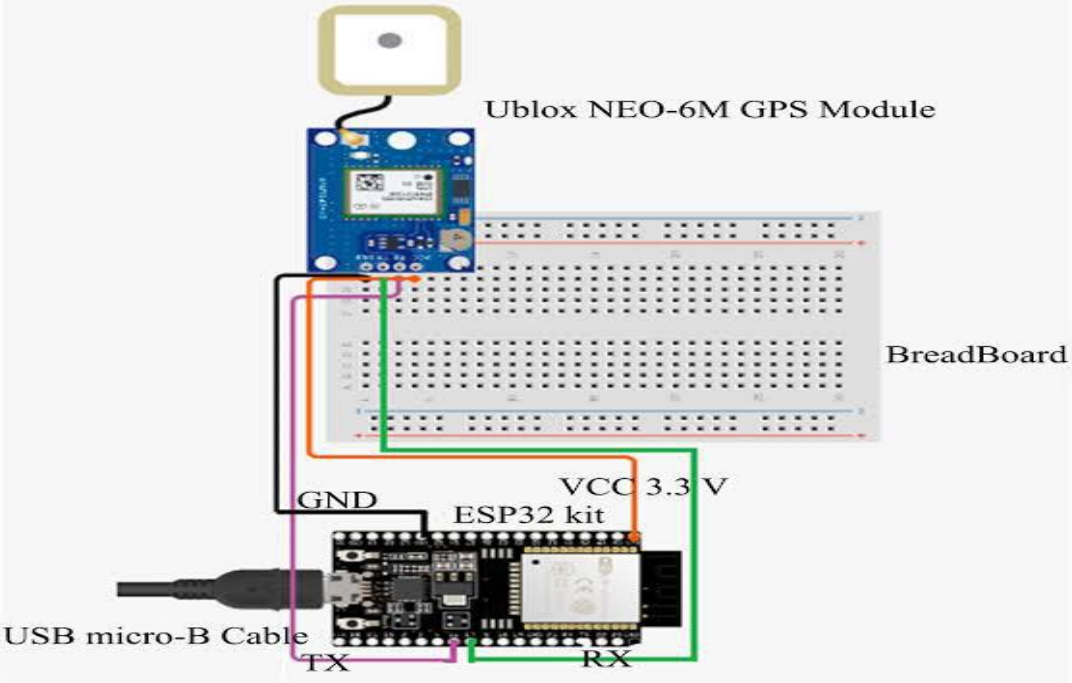
```
# Import necessary libraries

import random

import time

from threading import Thread

# Simulate IoT data from buses (longitude, latitude, passenger count)
```

```
class BusSimulator:
def _init_(self, bus_id):
self.bus_id = bus_id
self.latitude = random.uniform(30.0, 35.0)
self.longitude = random.uniform(-120.0, -115.0)
self.passenger_count = random.randint(0, 50)
def update_data(self):
while True:
# Simulate data changes
self.latitude += random.uniform(-0.01, 0.01)
self.longitude += random.uniform(-0.01, 0.01)
self.passenger_count = random.randint(0, 50)
time.sleep(10)
# Simulate data update every 10 seconds
# Simulate multiple buses
num_buses = 5
buses = []
for i in range(num_buses):
bus = BusSimulator(bus_id=i)
```

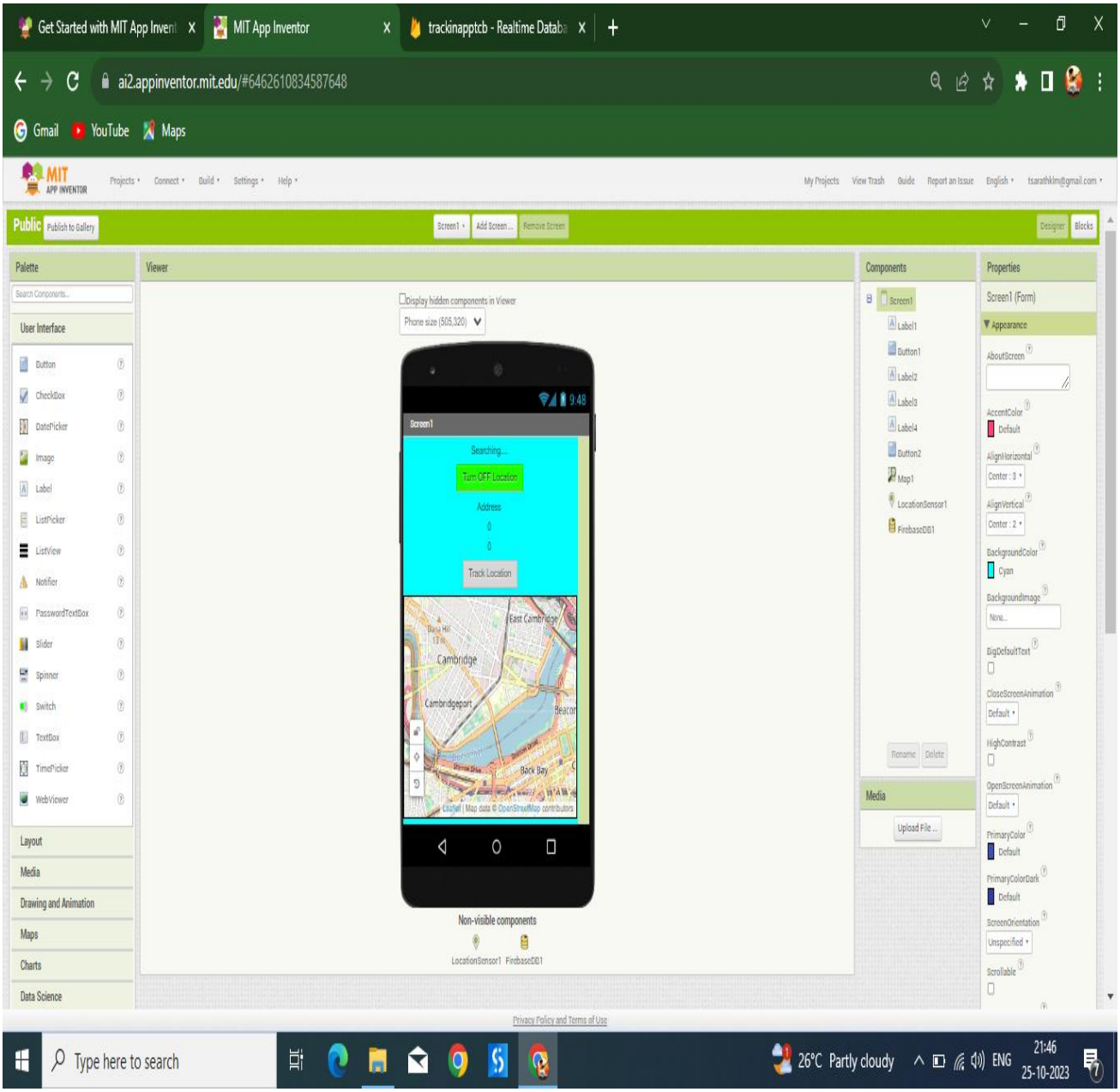
```
buses.append(bus)
t = Thread(target=bus.update_data)
t.daemon = True
t.start()
# Passenger app to get real-time information
class PassengerApp:
def _init_(self):
pass
def get_real_time_info(self, bus):
while True:
print(f"Bus{bus.bus_id}-Latitude: {bus.latitude:.4f}, Longitude: {bus.longitude:.4f}, Passengers: {bus.passenger_count}")
time.sleep(10)
# Check for updates every 10 seconds
# Simulate passenger apps
passenger_apps = []
for bus in buses:
```

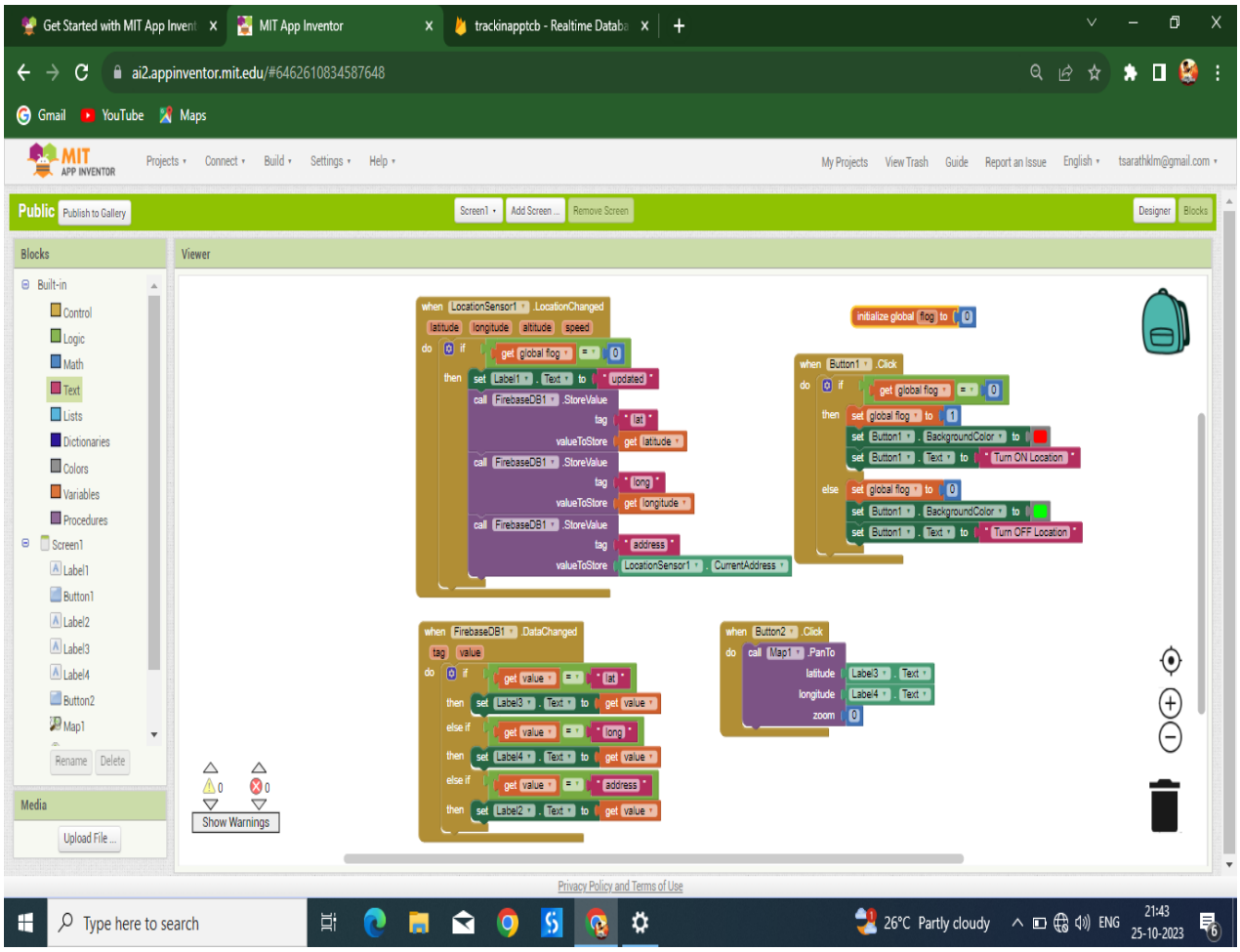
passenger_app=PassengerApp()
t=Thread(target=passenger_app.get_real_time_info, args=(bus,))

t.daemon = Truet.start()



Public Transportation Optimization Project is Tracking using MIT App Inventor





Hardware Setup:

Install IoT devices like GPS trackers, sensors, and cameras on public transportation vehicles (buses, trains, etc.).Ensure these devices are capable of collecting data related to location, passenger count, weather conditions, and vehicle health.

Hardware Setup:

GPS Module:

You'll need a GPS module to track the bus's location.

Microcontroller (e.g., Raspberry Pi or Arduino):

This will serve as the IoT device on the bus.

I**nternet Connectivity:**

To transmit data, you need internet connectivity, which could be through a GSM module or Wi-Fi.

GPS Data Retrieval:

Use Python libraries to interface with the GPS module and retrieve location data.

Data Transmission:

Transmit the GPS data to a central server. This can be done using MQTT, HTTP, or other communication protocols.

Server-Side Programming:

Develop a server application in Python or any other suitable language to receive and store the GPS data. Store data in a database to track the historical location of the bus.

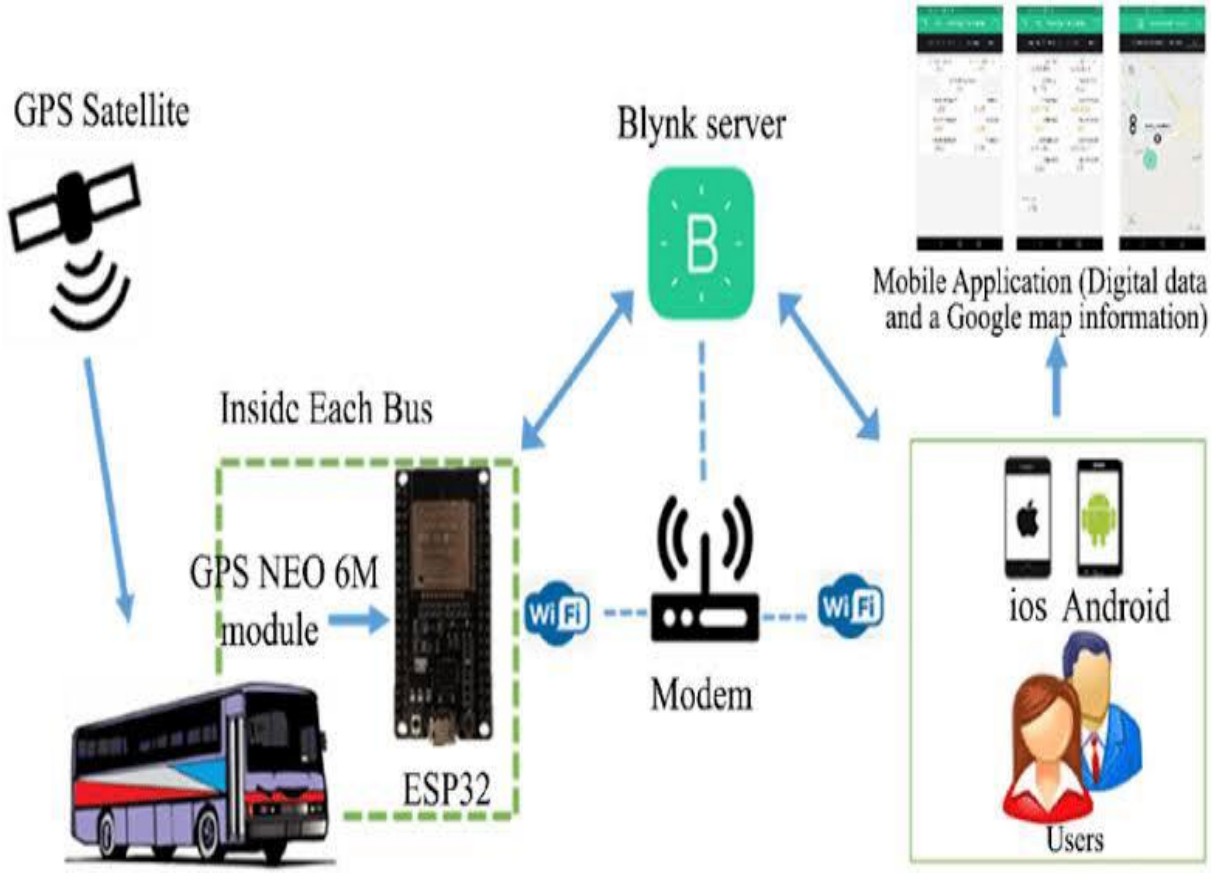
Web Interface (Optional):

Create a web-based interface for users to track the bus's real-time location.

Real-time Monitoring:

Implement real-time monitoring features to display the bus's current location and possibly other information (speed, direction, etc.).

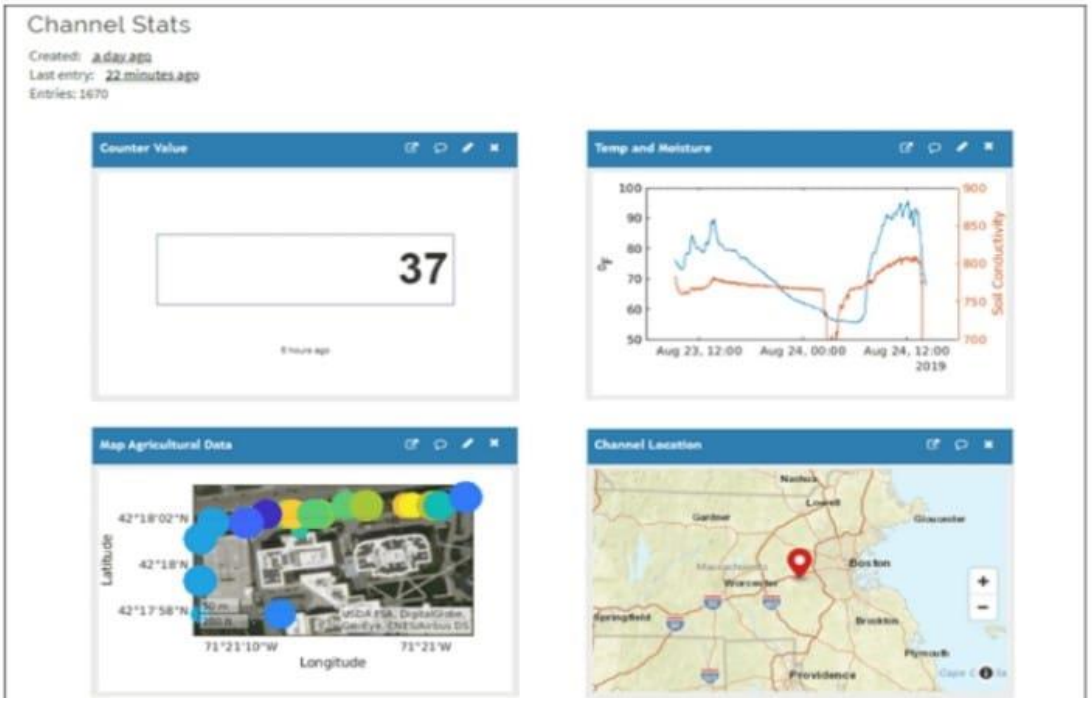
Real Time Public Transportation Optimization:-



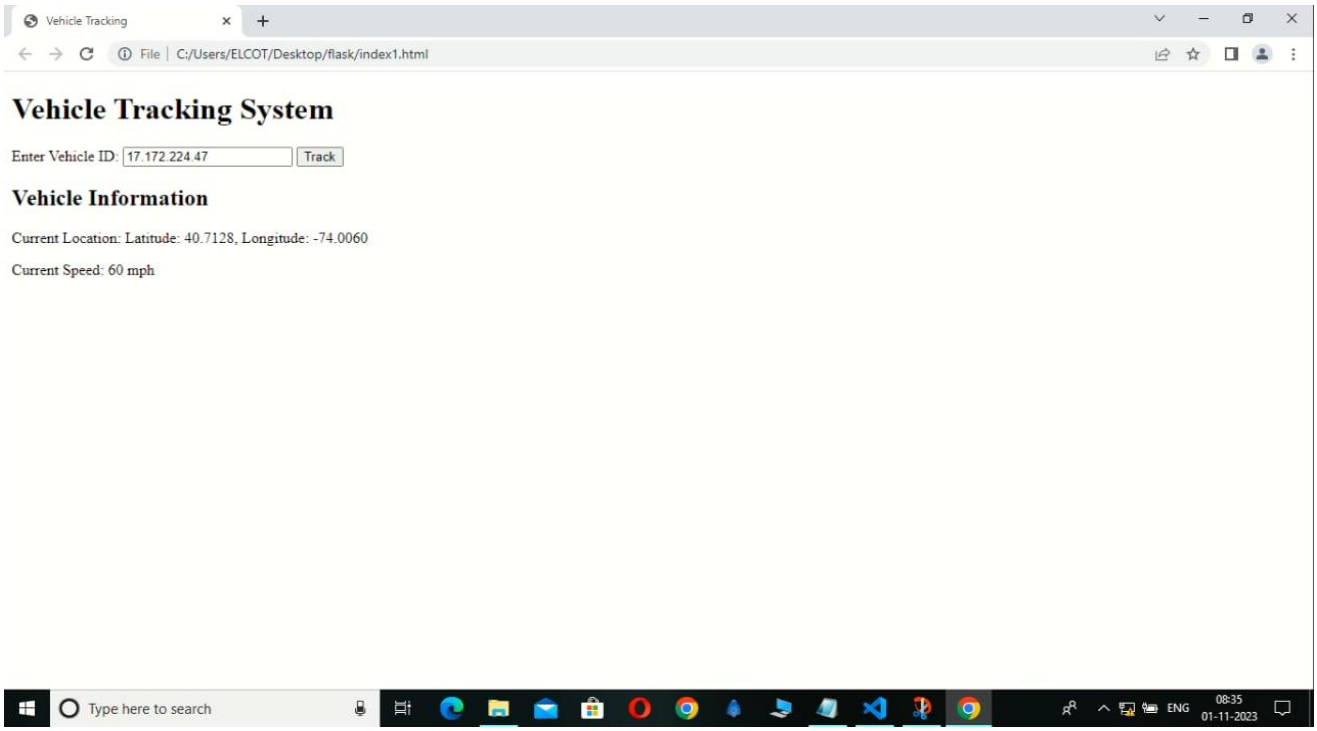
HTML Code:-

```
<!DOCTYPE html>
<html>
<head>
    <title>Real-time  Vehicle Tracking</title>
</head>
<body>
    <h1>Vehicle Tracking System</h1>
    <div id="map"></div>

    <script        src="https://code.jquery.com/jquery-3.6.0.min.js"></script>
    <script>
        function updateMap() {
            $.getJSON('/get_location', function (data) {
                const latitude = data.latitude;
                const longitude = data.longitude;
```

```
            // Use a mapping library like Leaflet.js or
Google Maps to display the vehicle's location
            // Update the map with the new
coordinates
        });
    }

    // Periodically update the map
    setInterval(updateMap, 5000); // Update
every 5 seconds
  </script>
</body>
</html>
```



Output:-



Conclusion:-

IoT solutions improved the passenger experience by providing accurate arrival times and allowing for convenient mobile ticketing. the public transportation optimization IoT project has demonstrated the potential of IoT in revolutionizing urban transportation. It has paved the way for more sustainable and efficient public transportation systems, benefiting both passengers and the environment. Future developments in IoT and data analytics will continue to shape the future of urban mobility.