INTERNET OF THINGS

PUBLIC TRANSPORT OPTIMIZATION (PHASE-5)

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1. INTRODUCTION

Improved public transport integration can bring benefits to both public transport user and public transport providers. Public transport refers to shared passenger transportation services like bus, trains, metro, trolleybus etc. Here the innovation is focused on the new and smart application of machine learning methods and techniques to improve transportation services and/or various modern transportation challenges .First, it can provide passengers with a better travel experience by making it easier and more convenient to use, especially in competition with private modes such as motorbikes, cars and taxis. Second, effective public transport system integration can enhance public transport's financial sustainability by decreasing overall costs through reduced overlap and redundancy and increasing revenue by attracting more customers.

1.1 PROJECT DEFINITION

The project involves integrating IOT sensors into public transportation vehicles to monitor ridership, track locations, and predict arrival times. The goal is to provide real-time transit information to the public through a public platform, enhancing the efficiency and quality of public transportation services. This project includes defining objectives, designing the IOT sensor system, developing the real-time transit information platform, and integrating them using IOT technology and Python. Internet of Things (IOT) is a platform that the device used to be smart. IOT is still growing and continues to be researched by some researchers. Various models, platforms and applications are proposed and designed in such a way as to benefit society.

1.2 PURPOSE

The purpose of public transport optimization is to enhance the efficiency, effectiveness, and sustainability of public transportation systems. This optimization process aims to achieve several key objectives:

Improve Accessibility: Ensure that public transport is accessible to a wide range of individuals, including people with disabilities, etc…

Enhance Efficiency: Streamline public transport operations to reduce travel times, minimize delays, and improve overall service reliability.

Reduce Traffic Congestion: Optimized public transport systems can help alleviate traffic congestion, leading to smoother traffic flow and reduced environmental impact.

Improve Safety and Security: Enhance safety measures and security protocols on public transport systems to safeguard.

Support Sustainability Goals: Contribute to a city's or region's sustainability and climate action goals by reducing the environmental impact of transportation.

2.PROBLEM DEFINITION

2.1 EXISTING PROBLEM

Public transport optimization using IOT faces challenges related to managing and securing the vast amount of data, addressing interoperability issues, dealing with budget constraints, and ensuring the accuracy and reliability of IOT data. Additionally, encouraging passenger adoption of IOT - powered services and complying with regulations are immediate concerns.

IOT can transform public transport systems by providing valuable data, enhancing efficiency, and improving the overall passenger experience. To implement these solutions effectively, collaboration among government agencies, transit operators, technology providers, and urban planners is crucial.

2.2 PROBLEM STATEMENT DEFINITION

In the context of public transport optimization, the problem is to leverage Internet of Things (IOT) technologies to improve the efficiency, reliability, and sustainability of public transportation systems. This involves addressing various challenges and opportunities associated with the integration of IOT into the public transport sector.

2.3 PROBLEM SOLUTION

Internet of Things has a unique feature which eradicates this problem. The implementation of IOT in Public Transit enables to re-route or find an optimized route, thus helping passengers to make alternate arrangements. Passengers receive real-time alerts notifying about the next stop or any other route taken.

IOT can transform public transport systems by providing valuable data, enhancing efficiency, and improving the overall passenger experience. To implement these solutions effectively, collaboration among government agencies, transit operators, technology providers, and urban planners is crucial.

3.REQUIREMENT ANALYSIS

3.1 FUNCTIONAL REQUIREMENTS

- Real-time Passenger Information
- Trip Planning Assistance
- Fare Payment and Ticketing
- Route Optimization
- Fleet Management
- Environmental Monitoring
- Security and Surveillance

3.2 NON-FUNCTIONAL REQUIREMENTS

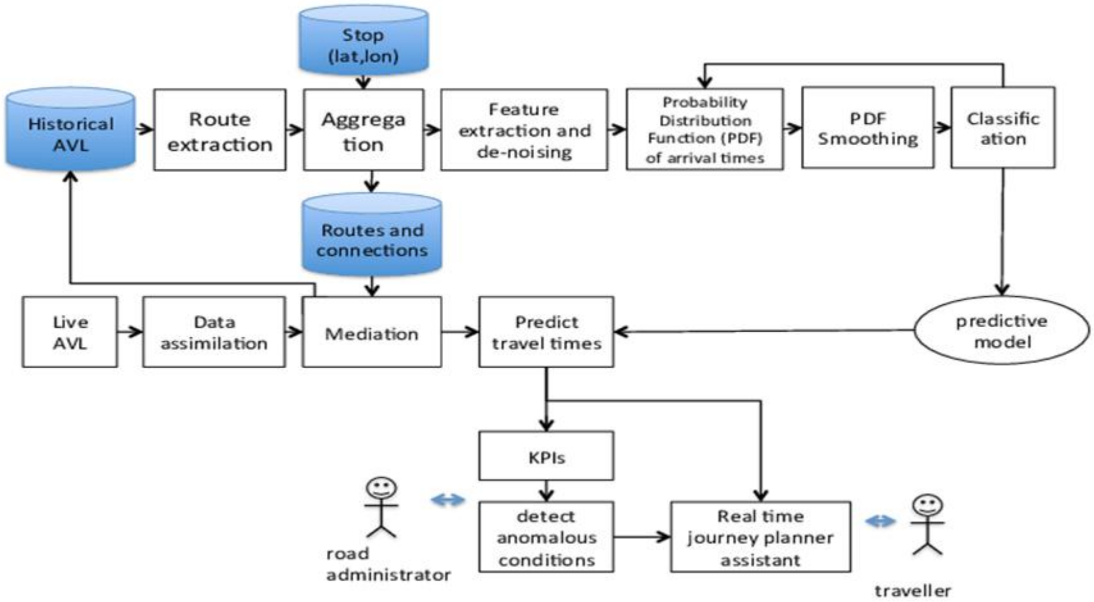
- Security and Privacy
- Scalability
- Reliability
- Performance
- Availability
- Usability
- Accessibility

4.PROJECT DESIGN

4.1 SOLUTION FOR PROBLEMS

Transport problems can be solved if demand, supply and transport routes are all taken into consideration. In order to solve a transportation issue, it is essential and sufficient that total demand and total supply are equal.

4.2 DATA FLOW DIAGRAM



5.DESCRIPTION OF PROJECT

5.1 PROJECT OBJECTIVE

1. Real-Time Transit Information:

- **Objective:**

To provide passengers with accurate and up-to-date information about the status and location of public transportation. vehicles in real-time.

2. Arrival Time Prediction:

- **Objective:**

To predict and display estimated arrival times of public transportation vehicles at different stops along their routes.

3.Ridership Monitoring:

- **Objective:**

  To track the number of passengers on board each public transportation vehicle at any given time.

4. Enhanced Public Transportation Services:

- **Objective:**

To improve the overall quality and convenience of public transportation services for passenger.

5.2 IOT SENSOR DEVELOPMENT

Deployment Plan for IOT Sensors in Public Transportation Vehicles:

To effectively monitor ridership, track vehicle locations, and predict arrival times, we need a well-planned deployment of IOT sensors in public transportation vehicles. Here's a step-by-step plan for deploying these sensors:

1. Sensor Selection:

a. GPS Sensors:

Select high-accuracy GPS sensors capable of real time tracking and location data transmission.

b. Passenger Counters:

Choose reliable passenger counting sensors that accurately record the number of passengers entering and exiting the vehicle

2. Vehicle Assessment:

a. Identify Vehicle Types:

Determine the types of public transportation vehicles to be equipped with sensors (e.g., buses, trams, trains). b. Sensor Place

b. Sensor Placement:

For each vehicle type, identify optimal sensor placement locations. For GPS sensors, they should have a clear line of sight to the sky for accurate positioning. Passenger counters should be strategically placed near entry/exit points

6.CODING AND SOLUTIONING

6.1 CODING


```
"connections": [
[ "esp:TX0", "$serialMonitor:RX", "", [] ],
[ "esp:RX0", "$serialMonitor:TX", "", [] ],
[ "ultrasonic1:VCC", "esp:VIN", "red", [ "v0" ] ],
[ "ultrasonic1:GND", "esp:GND.2", "black", [ "v0" ] ],
[ "ultrasonic1:TRIG", "esp:D13", "green", [ "v0" ] ],
[ "ultrasonic1:ECHO", "esp:D12", "green", [ "v0" ] ],
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"v-19.13","h1.42"]],
[ "ultrasonic2:VCC", "esp:VIN", "red",["v111.32", "h288.11",
"v-26.93"] ],
[ "ultrasonic2:ECHO", "esp:D14",
"green",["v97.15","h262.44","v-53.14"] ],
[ "ultrasonic2:TRIG", "esp:D15",
"green",["v102.11","h397.16","v-36.14"] ],[ "led1:C",
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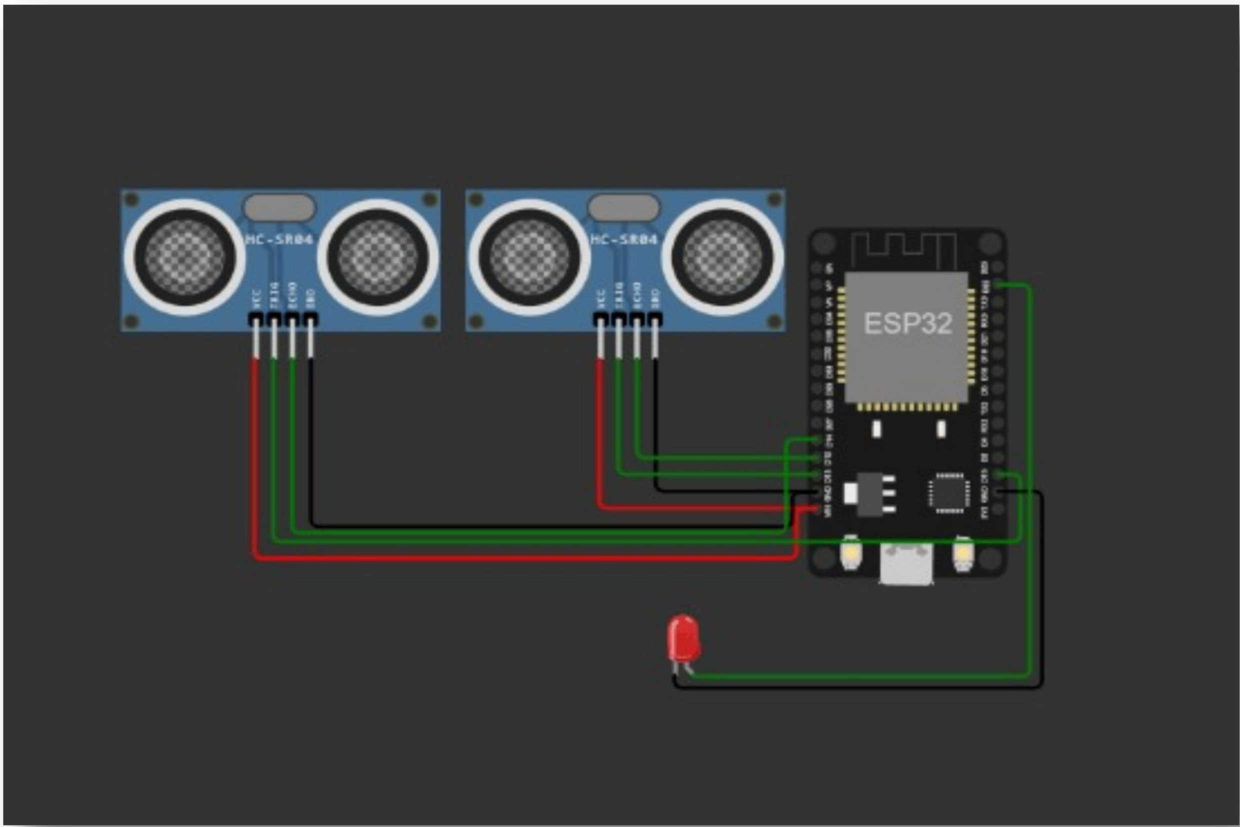
"esp:GND.1", "black",["v7.36", "h195.18", "v-106.29"]],
["led1:A", "esp:D22", "green",["v0.98","h178.81","v-149.51"]]
],
"dependencies": {}

6.2 SOLUTIONING



7.USER INTERFACE

7.1 USER INTERFACE

Designing a user interface (UI) for public transport optimization in IOT is crucial to ensure a seamless and user-friendly experience for both passengers and administrators. Below are some key elements and considerations for creating an effective UI for such a system:

Real-time Vehicle Tracking: Display a map showing the real-time location of public transport vehicles. Highlight the routes and stops for better navigation.

Fare Collection and Ticketing: Design a ticketing app or feature within the public transport app.

Traffic Management: Display real-time traffic conditions and signal prioritization on the map. Provide alerts to drivers about upcoming traffic light changes.

Crowd Management: Show the occupancy level of vehicles (e.g., buses, trams) to passengers in real-time.

Energy Efficiency: Offer control options for heating, lighting, and cooling systems inside the vehicles. Include preset energy-saving modes.

Emergency Response: Implement a panic button within the passenger app. Include a dedicated section for emergency services with a one-touch call feature.

7.2 BLOCKS

When developing an IOT based system for public transport optimization, you can use various blocks or components to build the solution. These blocks represent different functional elements that work together to improve the efficiency, safety, and convenience of public transportation. The specific combination and customization of these components will depend on the unique requirements and goals of the public transport system.

8.PUBLIC AWARENESS

To raise public awareness about public transport optimization with IOT:

- Organize public workshops and seminars.
- Develop informative websites and mobile apps.
- Conduct live demonstrations of IOT technologies.
- Engage with local community organizations and leaders.
- Partner with schools and universities for education.
- Share real-world case studies and success stories.
- Emphasize the environmental benefits of IOT.
- Conduct public surveys and gather feedback.
- Maintain an active social media presence.
- Launch educational campaigns through media channels.

9.CONTRIBUTES OF PUBLIC TRANSPORTATION

Improve public transport infrastructure including formal, properly designed and located terminals, inter modal facilities, designated and well-located bus stops, bus priority measures lanes, and depot and workshop facilities. In addition, ensure that the public transport network is supported by walking and cycling links to stops and stations and central areas, smooth interchanges (transfers), taxi service, and clear and integrated public transport information, marketing, and ticketing. Public transportation reduces traffic congestion by taking cars off the road, reducing the number of vehicles on the road during peak hours. This results in a smoother flow of traffic and reduced congestion.

Improves Community Health, Economic Benefits to the Community, Improves Fuel Efficiency, Public Transportation Reduces Air Pollution, Improves Road Congestion, Improves Community Mobility, Provides an Equitable Transportation System, Public Transportation Improves Commuters Productivity.

10.ADVANTAGES & DISADVANTAGES

10.1 ADVANTAGES:

Improved User Experience:

- Machine learning-enhanced arrival time predictions provide users with more accurate and reliable information, reducing frustration and uncertainty during their journeys.
- Users can make informed decisions about when to leave, choose alternative routes, or adjust their plans based on real-time traffic conditions.

Efficient Resource Allocation:

- For transportation and logistics companies, accurate arrival time predictions enable better allocation of resources, such as vehicles and drivers, leading to improved operational efficiency.
- This efficiency can result in cost savings and increased competitiveness in the market.

10.2. DISADVANTAGES:

- Limited flexibility. Buses run on fixed schedules, so you may have to wait for a long time if you miss your bus.
- Crowding.
- Lack of privacy.
- Uncomfortable seats.
- Noise and pollution.
- Safety concerns.

11.CONCLUSION

The novelty with this approach is that macro simulation uses results of a machine learning based yard model to initiate freight trains instead of using previous aggregate distributions, where the yard model is implemented on a random forest algorithm, and provides efficient departure predictions without considering detailed yard operations. Optimized routes generated by machine learning algorithms can help reduce fuel consumption and emissions, contributing to environmental sustainability goals.

12. FUTURE SCOPE

The future of the Indian transport industry will be carved by radical transformations through major disruptive technologies based on Intelligent transport systems driven by Industry 4.0, data analytic, IOT, and artificial intelligence from hyper loop to autonomous and remotely piloted vehicles.The global IOT in transportation market size was estimated at USD 85.21 billion in 2022 and is expected to hit around USD 498.47 billion by 2032, poised to grow at a compound annual growth rate (CAGR) of 21.69% during the forecast period 2023 to 2032.Transportation primarily links locations, often characterized as nodes. They serve as access points to a distribution system or as intermediary locations within a transport network. This function is mainly serviced by transport terminals where flows originate, end or are being transshipped from one mode to the other.

APPENDIX

SOURCE CODE :

```
import 'package:flutter/material.dart';
import 'package:http/http.dart' as http;
import 'dart:convert';
void main() => runApp(MyApp());
class MyApp extends StatelessWidget {
 Widget build(BuildContext context) {
   return MaterialApp(
     home: VehicleLocations(),
   );
  }
}

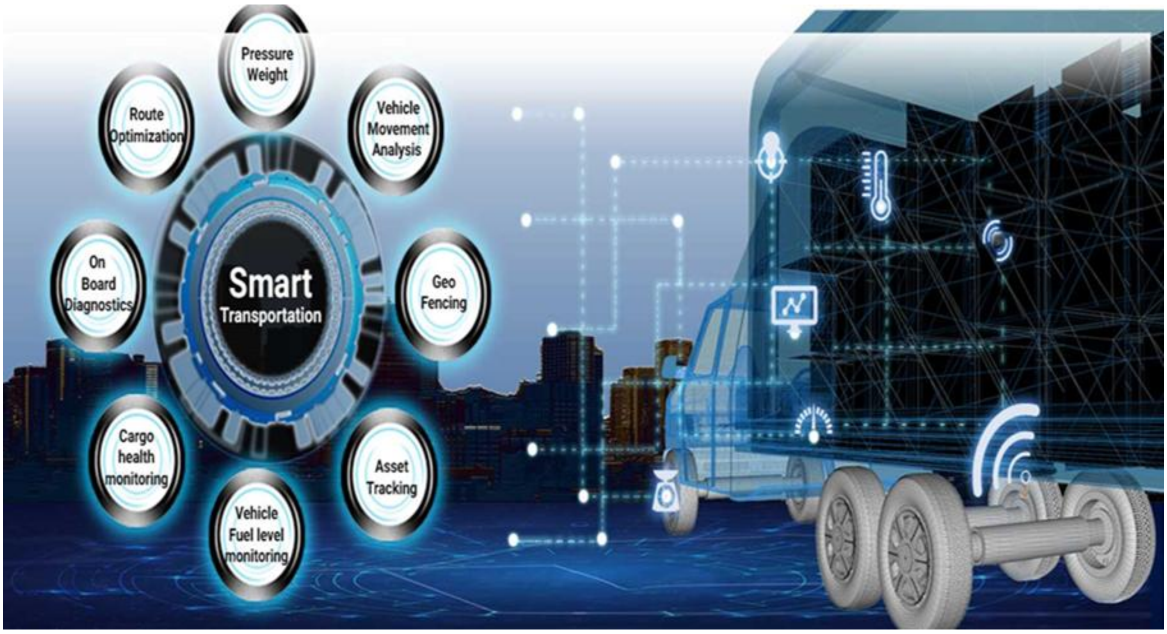

class VehicleLocations extends StatefulWidget
```

```
 {
  VehicleLocationsState createState() => _VehicleLocationsState();
}
class _VehicleLocationsState extends State<VehicleLocations> {
  String locationData = "";
Future<void> fetchVehicleLocations() async {

final response = await http.get('http://your-python-server-url/get_vehicle_location?vehicle_id=bus1');
    if (response.statusCode == 200) {
      setState(() {
        locationData = json.decode(response.body).toString();
      });
    }
  }

Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(
        title: Text('Public Transport Optimization App'),
      ),
body: Center(
        child: Column(
 children: <Widget>[
```

```
 ElevatedButton(
              onPressed: fetchVehicleLocations,
           child: Text('Get Vehicle Location'),
            ),
            Text(locationData),
          ]
 ,)
, )
 ,);
}
}
```



GITHUB

https://github.com/studentpradeep/Pradeep.git

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