Public Transport Optimization using IoT with Sensors

Project Description:

This project aims to solve the problem of tracking and accountability of vehicles by providing a software platform. This project would serve as an important step to help in Vehicle tracking, component monitoring, vehicle analysis and fleet management. An efficient vehicle tracking system is implemented for monitoring of any equipped vehiclefrom any location at any time with the help of Global Positioning System (GPS) and Arduino Board, which will enable users to locate their vehicles with ease and in a convenient manner.

GPS Sensor:

Application: Used for real-time vehicle tracking and route optimization.

Benefits: Provides accurate location data, helping to monitor vehicle movement, calculate ETA, andoptimize routes based on traffic conditions.

Application: This project can be deployed in various fields like elderly and disabled care services, logistic division, emergency services and rescue operation, school bus tracking, and accounting...

1. Real-Time Tracking:

- ✓ **GPS Tracking:** The system employs GPS receivers installed on vehicles to continuously gather precise location data, including latitude and longitude.

- ✓ **Data Transmission:** This location data is then transmitted to a central web server through HTTP requests, ensuring real-time data flow.

- ✓ **Live Map Display**: The system's user interface, accessed through a web browser, features a PHP web page with integrated Google Maps. This dynamic web page directly plots the received coordinates on the map in real-time, eliminating the need for page refreshes. As a result, users can observe the live location of the vehicles as they move along their routes.

2. History:

- ✓ **Date Selection:** Users have the option to select a specific date for a historical journey.

- ✓ **Vehicle Selection:** A list of vehicles that were active on the chosen date is provided to the user. This selection leads to journey history specific to the chosen vehicle.

- ✓ **Journey Details:** The journey history includes a Google Map display illustrating the entire route taken on that date, with markers indicating significant points. Additionally, a time-speed graph charts the vehicle's speed at various time intervals during the journey. Driver details are also provided, offering a comprehensive overview of the historical trip.

3. Report Generation:

- ✓ **Driver Reports:** Users can generate PDF reports for individual drivers. Upon selecting a driver, the system compiles a report containing essential driver details and a record of all journeys completed by that driver.

- ✓ **Truck Reports:** For trucks, the system generates PDF reports displaying essential truck information and a history of journeys conducted by the selected vehicle.

- ✓ **Journey Reports:** Selecting a specific date and vehicle enables users to generate detailed journey reports in PDF format. These reports feature essential journey information, Google Maps displaying the complete route, and a graphical representation of the vehicle's speed at different points in time during the journey.

4. Geofencing:

- ✓ **Geofencing Definition:** Geofencing is a critical feature implemented to address issues where drivers may intentionally take longer routes to increase fuel consumption or unintentionally deviate from optimized paths, affecting journey efficiency and vehicle performance.

- ✓ **Virtual Boundaries:** At the time of journey creation, a virtual boundary (geofence) is established, defined by a specified radius in meters. This geofence represents the optimized path from the source to the destination.

- ✓ **Geofencing Alerts:** When a vehicle deviates from the established optimized path and surpasses the defined geofence radius, the system triggers a geofencing break. This deviation generates a notification popup, enabling users to promptly identify instances of route divergence.

5. SMS Module:

- ✓ **Location Inquiry:** The SMS module serves as a user-friendly option for checking a vehicle's real-time location. This is particularly valuable for busy vendors who may not have continuous access to a computer or web interface.

- ✓ **SMS Request:** To inquire about a vehicle's location, users send an SMS to the SIM cards associated with the hardware devices installed on the vehicles.

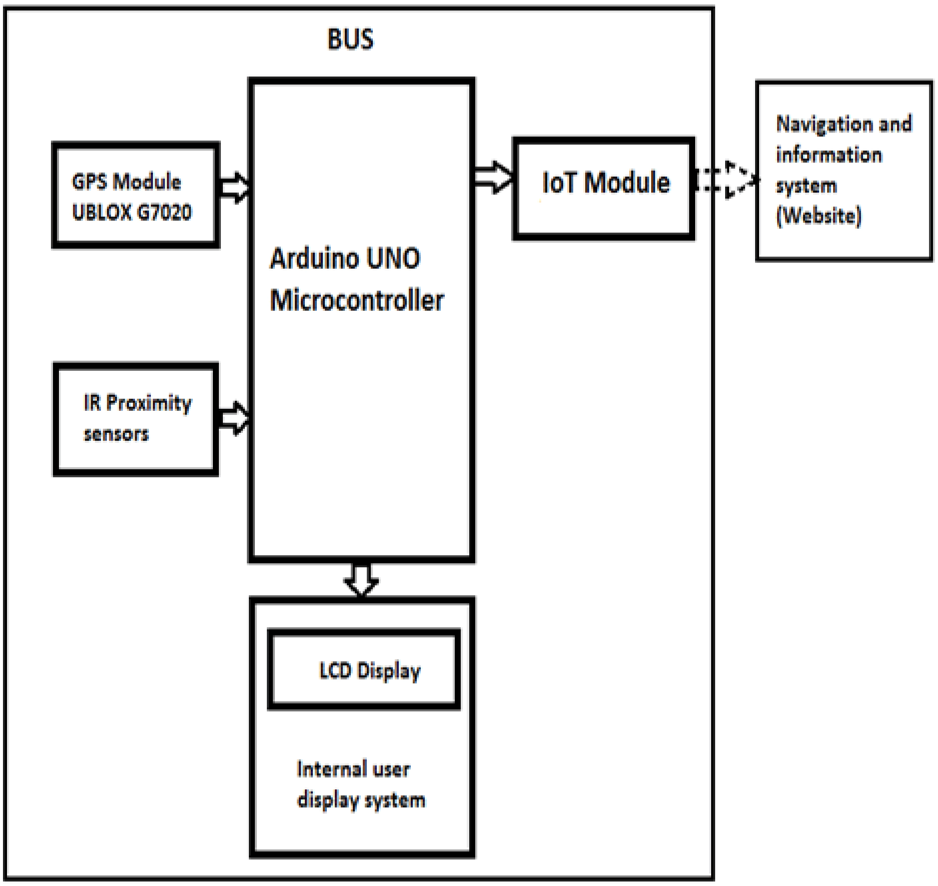
- ✓ **Location Response:** In response to the SMS request, the system generates an SMS containing a link. Clicking this link in a web browser displays a Google Map with a marker pinpointing the vehicle's exact current location. This feature offers a convenient method for users to obtain immediate location updates.

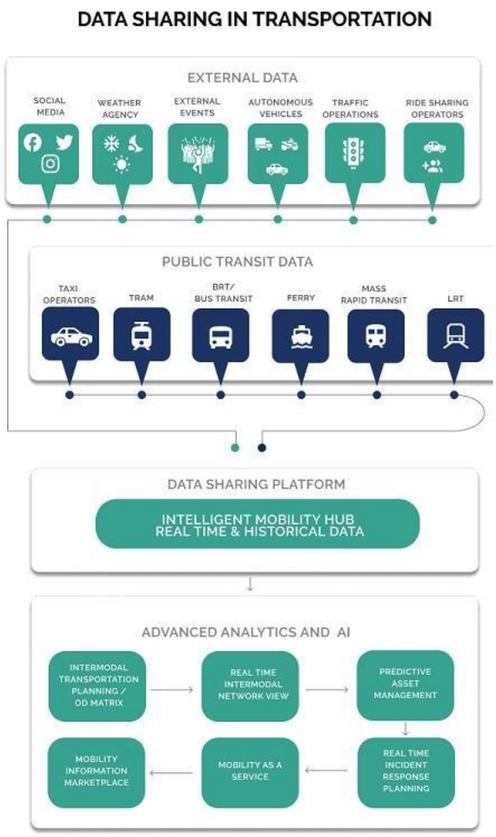
6. Agile Hardware:

- ✓ **Hardware Description:** The hardware used in the system is characterized by its reliability, cost-effectiveness, and compact design. This hardware is essential for collecting GPS data and ensuring the real-time transmission of vehicle location information.

- ✓ **Hardware Stability:** The hardware's construction and functionality are considered fixed and stable, ensuring consistent and reliable operation. It is specifically designed to support the system's tracking and management capabilities, making it a fundamental component of the solution.

Diagram for Transit Information Platform:





Improve public transportation services and passenger experience.

1. Improved Punctuality:

- Real-time tracking allows transit operators to monitor vehicle locations and make real-time adjustments to routes and schedules.
- Passengers benefit from more accurate arrival times, reducing wait times and uncertainty.

2. Enhanced Route Efficiency:

- Operators can identify traffic congestion, accidents, or other obstacles in real-time and adjust routes to avoid delays.
- This results in faster and more efficient journeys for passengers.

3. Better Capacity Planning:

- Transit systems can optimize vehicle allocation based on real-time passenger demand data.
- Passengers experience reduced overcrowding and improved comfort.

4. Passenger Information:

- Real-time systems provide passengers with up-to-date information on vehicle locations, expected arrival times, and any service disruptions.
- Passengers can make informed decisions about when and where to catch their rides, reducing stress and frustration.

5. Increased Safety and Security:

- In-vehicle cameras and sensors enhance passenger safety and deter misconduct.
- Operators can respond more quickly to incidents, ensuring a safer environment for passengers.

6. Environmental Benefits:

- Efficient route planning and reduced idling time lead to reduced fuel consumption and emissions, contributing to a greener and more sustainable transportation system.

7. Accessibility and Inclusivity:

- Real-time information benefits passengers with special needs by helping them plan their journeys more effectively.
- Improved services for all passengers make public transportation more inclusive.

8. Passenger Convenience:

- Passengers can use mobile apps or displays at stops and stations to track vehicles in real-time.
- This convenience makes public transportation more attractive and user-friendly.

9. Data-Driven Decision Making:

- Transit operators can use historical data to improve long-term planning, identify high-traffic routes, and allocate resources efficiently.
- This leads to better service quality and a more responsive transit system.

10. Reduced Costs:

- Improved efficiency and reduced fuel consumption lead to cost savings for transit operators.
- These savings can potentially be reinvested in improving services or maintaining lower fares.