**Phase 2**

**PROBLEM, IDENTIFICATION AND DESIGN THINKING**

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| **Team Id** | **Proj\_223982\_team** |
| **Project Name** | Public Transport Optimization |
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**Introduction**

Public transport management involves the planning, operation and organization of various forms of public transport to ensure efficient, safe and convenient transport services for the public

**Step 1: Planning and Requirements**

Define the project scope, objectives, and features based on the challenges identified (seat control, traffic accidents, lack of communication). Determine the hardware components needed, including Arduino, ESP32, sensors (for seat availability and traffic monitoring), and displays (for real-time information).

**Step 2: Hardware Setup**

* ***Seat Availability Monitoring***:

Attach seat occupancy sensors (e.g., pressure or IR sensors) to each seat. Connect these sensors to the Arduino board. The Arduino should process the sensor data and send it to the ESP32.

* ***Traffic Accident Prevention:***

Implement a traffic monitoring system using appropriate sensors (e.g., ultrasonic sensors, cameras).Connect these sensors to the Arduino for data collection and processing.

* ***Real-time Communication:***

Utilize ESP32 for real-time communication capabilities, connecting it to Wi-Fi for data transmission.Set up displays or LEDs to convey real-time information such as seat availability, alerts for traffic issues, or delays.

**Step 3: Arduino Programming**

* ***Seat Availability Monitoring:***

Write Arduino code to read data from seat occupancy sensors and send the status (e.g., occupied or vacant) to the ESP32 via serial communication.

* ***Traffic Accident Prevention:***

Develop code to process data from traffic sensors, identify potential risks, and trigger alerts or warnings based on predefined criteria.

* ***Communication with ESP32:***

Establish communication between Arduino and ESP32 using serial communication or other appropriate protocols (e.g., I2C, SPI) to transmit data.

**Step 4: ESP32 Programming**

* ***Receive Seat Availability Data:***

Write code to receive seat occupancy data from Arduino and process it.Update the real-time display to show the seat status (e.g., a display panel showing available seats).

* ***Traffic Monitoring and Alerting:***

Process traffic data received from Arduino and trigger alerts or warnings if traffic issues are detected. Display traffic-related alerts on the designated display.

* ***Communication with External Systems:***

Implement code to send relevant data to a central server or cloud platform for further analysis and centralized management.

**Step 5: Real-time Display and User Interface**

* ***Design User Interface:***

Create a user-friendly interface for the display to present real-time seat availability and traffic information.

* ***Display Real-time Data:***

Update the display based on the data received from the ESP32 regarding seat occupancy and traffic conditions.

**Step 6: Integration and Testing**

* ***Hardware Integration:***

Assemble all components and connect the Arduino, sensors, ESP32, and displays as per the designed system.

* ***Functional Testing:***

Conduct thorough testing to ensure proper functionality of seat monitoring, traffic monitoring, communication, and display systems.

**Step 7: Deployment and Monitoring**

Deploy the integrated system in public transportation vehicles (buses, trains, etc.). Continuously monitor the system's performance, gather feedback from users, and make necessary adjustments to improve the system's effectiveness and user experience.

**Conclusion**

It proposed Public Transport Improvement Program addresses challenges in management, enhancing passenger experience through real-time seat availability and control technology. It prioritizes safety, streamlines logistics, and promotes flexibility. The program also emphasizes sustainability and efficiency, reducing carbon emissions and creating an environmentally friendly system.