**PHASE 2 PROJECT SUBMISSION**

**PROJECT 5 – PUBLIC TRANSPORT OPTIMISATION**

**TEAM MEMBERS:**

1. Muhil J- 2021504530
2. Shakti A P– 2021504541
3. Shamitha G– 2021504543
4. Shreejan A – 2021504544
5. Sushmitha A-2021504551

**STEPS INVOLVED:**

**DESIGN THINKING:**

**DATA COLLECTION AND PROCESSING:**

Deploy IoT devices such as sensors, GPS trackers, and cameras on vehicles, stops, and other relevant locations.

Collect real-time data on vehicle location, passenger load, traffic conditions, and environmental factors.

Use edge computing or cloud-based systems to process and analyze the collected data.

Implement algorithms to derive meaningful insights, such as predicting traffic congestion, estimating arrival times, and identifying optimal routes.

**HARDWARE IMPLEMENTATION:**

The hardware design of the system includes multiple sensors, GPS module, and communication module which are discussed below.

1. **IR sensor interfacing:** To count the number of passengers in and out of the vehicle using two IR sensors.
2. **Level interfacing:** To measure the fuel level using level recognition sensor.
3. **Speed sensor interfacing:** To determine the speed of the vehicle using speed module which has an IR transmitter /receiver and comparator.
4. **Tempeature and humidity interfacing:**To monitor temperature and humidity using DHT11 sensor
5. **GPS module interfacing:** To track the location of the vehicle at that particular instant we use GPS module
6. **Wi-Fi module interfacing:** The system uses a low-cost Wi-Fi module to connect to the internet. It communicates with a microcontroller using special commands, has a max voltage of 3.3V, and six pins for power, communication, and control.
7. **LCD interfacing:** For local display of the data in the bus, we used a LCD, which is connected to microcontroller.

**SENSOR OPERATION:** The system's Arduino sketch manages multiple tasks, including GPS data retrieval, LCD module interaction, Wi-Fi access point connection, and real-time data transmission to a web page. The code uses 16KB out of 32KB program memory, efficiently utilizing the available space. In terms of dynamic memory (RAM), global variables consume 1248 bytes out of 2048 bytes. This sketch enables the system to continuously fetch GPS coordinates, display them on an LCD, connect to Wi-Fi, and update a real-time webpage, making it a versatile and memory-efficient solution for location-based tracking and reporting.

**WORKFLOW OF THE PROJECT:**

* When system is powered up, it goes through initializing phase during which it sets the baud rate for connected devices communicating a Universal Asynchronous Received Transmitted (UART) serial connected devices such as Wi-Fi module, GPS, and serial monitor as well initializes the LCD and DHT sensor
* After that microcontroller scans all the sensors and reads both analogue and digital sensors.
* The microcontroller then performs analogue to digital conversion for all analogue read sensors. It then process the data read and computes passenger count, calculate bus speed, compute GPS coordinates, passenger count, temperature, and humidity.
* All computed parameters are displayed on the LCD locally.
* The same values are also sent to serial monitor for testing and debugging purpose.

**INNOVATION OF THE PROJECT:**

In the realm of public transport optimization, recent innovations have transformed traditional transit models into dynamic, user-centric ecosystems. Notable advancements include the integration of autonomous vehicles, revolutionizing safety and efficiency while minimizing labour costs. These transformative innovations collectively propel public transport systems into a future characterized by efficiency, sustainability, and enhanced user experiences.

In particular,

After thorough research and analysis, we arrived at an innovative solution to solve the above problem as detailed in phase 1 of our project

* We will be using the ESP32 micro controller as well as Arduino UNO microcontroller as both these suit the best for our project
* Non local processing of data is required and hence we chose not to use Raspberry Pi Single board computer
* Implementing IoT sensors to monitor passenger occupancy in buses and trains, allowing for efficient allocation of resources.
* Using IoT devices to monitor the health of public transport vehicles and predict maintenance needs, reducing downtime and improving service reliability.