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INSO 4116 - Project Phase 1

A. **Domain Description** - *University Transportation*

- The transportation services of the university, specifically the trolley service, takes passengers (primarily students and staff) throughout the different buildings inside and outside the campus.
- The Department of Transportation is in charge of authorizing and dispatching each trolley trip.
    - Specifically, the department of transportation creates a new trip ticket with basic details pertaining to the driver, vehicle and tracking device.
    - Each time a new trip is created, the tracking device turns on and starts tracking the vehicle's location.
    - The tracking device (which is also a tablet) sends its location and its stored so that a full trip report can be generated.
        - This report contains: mileage, fuel costs & levels, passenger statistics, as well as miscellaneous information concerning vehicle damages.
        - This report is supposed to be written by the driver. *However, once the whole system is implemented, the system will be incharge of handling the report as it is continuously gathering the information being sent by the tracking devic*e.
    - Once the trip is ended (either via geofencing or manual deactivation from the driver/administration) the driver is to submit the trip report before their shift is complete.
- While on the road, the trolley follows the route that was specifically assigned. The only exception is when there are obstacles (traffic jams, closed roads, etc.). The driver documents when and where they were "off-route".
- Every certain amount of time (usually monthly), the Department of Transportation must complete a report which contain statistics about vehicle usage and costs, passenger turnout, driver efficiency and any other statistic that is needed to be shown to the Dean's office.

B. **Requirements**

- The system has to aid the workers of the Department of Transportation to create an itinerary.

    - The itinerary must be associated with a specific driver, vehicle, route & tracking device. Within it, there is also the departure time and arrival time, which are automatically computed when the trip starts and ends, respectively.
- Once an itinerary has been created, the system must send the trip information to the tracking device, and which promptly begins the communication of the vehicle's location.
- During the trip, or several trips, the system must be actively analyzing the events being transmitted by the tracking device. More specifically:
    - **Location**: When this event fires, the system will log it, and will calculate the actual route that the trolley is taking. Afterwards, the system will broadcast this location to everyone that is listening to the specific route. The system evaluates each coordinate to check if the trolley is currently in-route.
    - **Off-route:** This event is fired when the trolley is currently off-route and the driver did not specify that there was an obstacle. The system logs each off-route coordinate.
    - **Obstacle:** This event is fired when the driver specifies that a road obstacle may make them go off route. The system logs each off-route coordinate.
    - **Stop:** This event is fired when the trolley arrives at a route-defined stop. The tracking device listens to the amount of passengers that the driver subtracted from the passenger count, which will be encoded in the event.
    - **Trip End:** This event is fired when the trolley has reached the end of its route (either via geofencing or the driver/administration manually activating the event).
- Once the trip ends, the system must:
    - update the arrival time associated to the trip and the mileage of the associated vehicle,
    - gather the relevant information to generate a complete trip report,
    - deactivates the tracking device.
- Whenever the administration needs to create a monthly report, the system must gather all the trips taken in a certain month and generate a report that calculates important statistics like: mileage driven for each driver and vehicle, passenger count per route, etc.

C. **Preliminary Software Architecture**

- Upon first inspection, the requirements of this system all revolve around operations regarding the active trolleys on a specific day. Therefore, the module that is most important must center around the notion of the itineraries.
    - The trolley module will have an itinerary aggregate. This itinerary aggregate will store the information relevant to the trip: the associated driver, tracking device, vehicle, and route entities. It will also store a departure time and an arrival time.
    - A repository for itineraries will store all the active trips currently in circulation. The associated entities within the trip will also have repositories.

    - These repositories will have the control to query an external database so that any additional information that is needed can be accessed.
        - Specifically to the itinerary repository, it should also let the client query the location of the trip at any given moment.
    - An itinerary factory must also be implemented to facilitate the creation of the trip ticket. The interface of the trip factory must account for the entities currently being used in other active trips.
    - A special entity connected to each itinerary is the tracking device. This tracking device is responsible for handling events that are being emitted by the physical tracking device in the trolley.
- There is also the need to create a module based on the administration functionalities. This module will encapsulate the user login function, and the scheduling (creation, ending) of an itinerary.
- A route module encapsulates information about a specific route that trolley drivers must follow.