Computer On Wheels

Implemented Requirements

<In Part 1>

Vehicle control

Autonomous navigation: The system shall be capable of autonomously navigating from a starting point to a destination.

Throttle control: The system shall control the throttle to regulate vehicle speed within a range of 0 to 120 km/h, adjusting for road conditions and traffic regulations.

Steering control: The system shall control the vehicle's steering to maintain a maximum lateral deviation of 0.5 meters from the planned trajectory under normal conditions.

Path Planning

Route Calculation: The system shall calculate the most efficient route i.e. shortest path from the vehicle's current location to the driver-specified destination

Lane Assignment: The system shall assign appropriate lanes for the vehicle to travel in along the calculated route.

Waypoint Generation: The system shall generate waypoints along the calculated route to guide the vehicle towards the destination.

Trajectory Planning

Trajectory Generation: The system shall plan a smooth and optimal trajectory, balancing between minimum travel time and energy efficiency, while considering real-time traffic data and road conditions.

Sensor Integration

Inertial Measurement Unit Utilization: The system shall use an IMU to provide orientation and acceleration data at a frequency of 100 Hz.

Global Positioning System Utilization: The system shall use GPS to determine the vehicle's position.

Path Following

Path smoothing: The system shall apply path smoothing techniques to limit acceleration changes to within 0.3 m/s², ensuring a smooth ride for passengers.

Lateral Control: The system shall maintain a lateral deviation of no more than 0.5 meters from the planned path under normal driving conditions.

Longitudinal Control: The system shall maintain a longitudinal deviation of no more than 1 meter from the planned path under normal driving conditions.

Speed Control: The system shall control the speed to reach the destination

Waypoint Following: The system shall follow waypoints along the calculated waypoints to guide the vehicle towards the destination

Destination Arrival

Destination Approach: The system shall approach the driver-specified destination with a positional accuracy of within 1 meter, following the calculated trajectory and waypoints precisely.

Stop at Destination: The system shall bring the vehicle to a complete stop within 1 meter of the designated destination, ensuring deceleration rates do not exceed 2 m/s² for passenger safety and comfort.

User Input

Destination Setting: The driver shall be able to input the desired destination, triggering the route planning process

System Integration

ROS Integration: The system shall utilize the Robot Operating System (ROS) to facilitate communication and data exchange between different software components.

Simulation Environment: Development and testing of the system shall be conducted in a simulated environment (e.g., CARLA simulator) for thorough validation before real-world deployment.