

# Computer On Wheels

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Implemented Requirements

**<In Part>**

## *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/s<sup>2</sup>, 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/s<sup>2</sup> 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.