Core Software Requirements:

1. **MATLAB & Simulink:**
    - Essential for modeling, simulation, control system design, and algorithm development.
    - Key toolboxes: Automated Driving Toolbox, Robotics System Toolbox, Vehicle Dynamics Blockset, Sensor Fusion Toolbox.
2. **Python (with Libraries):**
    - For developing algorithms for machine learning, perception, and data analysis.
    - Key Libraries: **NumPy, Pandas, Matplotlib, Seaborn, OpenCV, TensorFlow, PyTorch, Scikit-learn, ROS (Robot Operating System)** libraries.
3. **ROS (Robot Operating System):**
    - A set of software frameworks for developing robot applications. It provides tools and libraries for communication between components (e.g., sensors, actuators, control).

- Tools: **rospy**, **rosbag** for data collection, **rviz** for visualization, and **roslaunch** for orchestrating multiple processes.

4. **Simulation Software:**

   - **Gazebo**: Open-source robotic simulation platform that allows for realistic robot simulation, including physics, sensors, and environments.
   - **CARLA**: Open-source autonomous driving simulator used for testing self-driving algorithms in realistic urban environments.
   - **Webots**: A robotics simulator used for designing and testing robots in simulated environments.
   - **VISSIM/SimulationX**: For traffic simulation and modeling of urban environments, especially in autonomous vehicle testing.

Path Planning Libraries:

- **OMPL (Open Motion Planning Library)**: A collection of sampling-based motion planning algorithms used to find paths for robots and autonomous vehicles.
- *A and Dijkstra's Algorithms**: Commonly used for grid-based path planning in robotics.

Control Systems:

- **Control System Toolbox (MATLAB)**: Provides functions for designing and analyzing control systems, including vehicle motion controllers and PID controllers.
- **Model Predictive Control (MPC)**: A popular method for autonomous vehicle trajectory planning and control.

State Estimation:

- **Kalman Filters (KF, EKF, UKF)**: Used for estimating the state of a vehicle from noisy sensor data.