Software Requirements for Autonomous Vehicles and Robotics

# 1. Functional Requirements

These define what the system should do:

## Perception

* Integration with sensors (LiDAR, radar, cameras, GPS, IMU)
* Object detection and classification
* Obstacle recognition and avoidance
* Environment mapping (SLAM)

## Localization & Mapping

* Real-time localization within a known or unknown environment
* Map generation and maintenance
* Sensor fusion for accurate positioning

## Planning

* Route planning (global path planning)
* Motion planning (local path planning)
* Behavior prediction of other agents (vehicles, pedestrians)

## Control

* Trajectory tracking
* Speed and steering control
* Braking and acceleration logic

## Communication

* V2V (vehicle-to-vehicle) and V2X (vehicle-to-everything) communication
* Real-time data sharing between modules

## Human-Machine Interface (HMI)

* Driver/passenger notifications
* Emergency intervention protocols
* Manual override capability

## Diagnostics & Fault Handling

* Real-time health monitoring
* Fail-safe and fallback mechanisms

# 2. Non-Functional Requirements

These define how well the system performs its tasks:

## Safety & Reliability

* Compliance with standards like ISO 26262 (functional safety)
* Redundancy in critical systems
* Predictable failure handling

## Real-Time Performance

* Low-latency processing for sensor data and decision making
* Deterministic execution of control tasks

## Scalability & Modularity

* Support for software updates and modular components
* Plug-and-play sensor compatibility

## Security

* Protection against cyber-attacks
* Secure communication