Adaptive Intelligence System Based Car Parking

**HAZARD ANALYSIS**

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**Background**

# Context

The industrialization and rapid population increase with slow pace city development has created issue of parking space and many related problems. We have dire need for intelligent, secure and efficient system which can guide in parking by searching for unoccupied parking facility. This is part of Intelligent Transportation Systems (ITS). Our goal is to build an AADL model for intelligence system-based car parking system and perform verification and validation techniques. Currently, used parking systems are not efficient as drivers park as per their will and no restrictions. Adaptive intelligence-based car parking system will not just manage operations of parking facility, but also different aspects related to parking. Human Errors are major cause of accidents which can be avoided/minimized through in-car technologies. This will lessen the burden of driver and enhance his car functions. Parking meters based on coins are inefficient as there is manpower involved. This smart parking system will monitor meter and report any violations of parking lot.

# Assumptions

* All the necessary systems and subsystems are working correctly in the vehicle.
* Vehicle control can read and send messages coming through sensor.

# Definitions, acronyms, and abbreviations

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| **Term** | **Definition** |
| AIS | Adaptive Intelligence System: System running inside vehicle that communicates with parking lot. |
| RADAR | Radio Detection and Ranging: System running inside Smart Parking system that communicates with the vehicle sensors |
| NAPA | Nearest Available Parking Lot Application: System that manages internal operations of parking facility. |
| ITS | Intelligent Transportation System: System that maintains steady system set by driver. |
| GPS | Global Positioning System: provides precise position data for the vehicle as it moves along. |

## ACCIDENTS

1. **A1**​: A serious injury or even death of driver and co-passengers.

## HAZARDS

1. **H1**: ​Sensor fails to report real-time information to driver. [​A1]. [SC4]
2. **H2**​: AIS fails to synchronize after every few seconds. ​[A1]. [SC2]
3. **H3**​: Communication issues/delay between vehicles and NAPA. ​ [A1]. [SC3]
4. **H4**​: Sensor doesn’t timely connect with RADAR.​ [​A1]. [SC4]
5. **H5**​: Monitor fails to give real-time information collected from sensor. ​​[A1]. [SC8]
6. **H6**​: ​ GPS fails to report exact location to NAPA. [​A1]. [SC6]
7. **H7**​: Subsystems fail to perform system check before vehicle start. [A1]. [SC7]
8. **H8**​: NAPA reports incorrect parking info to vehicle sensor. [A1]. [SC1]

# SAFETY REQUIREMENT

1. **SC1**​: Self-check must be performed for the subsystems.
2. **SC2**​: AIS must send alerts after every few seconds.
3. **SC3**​: Latency should be low to avoid any communication delays.
4. **SC4**​: Sensors should be in always on-state and working perfectly.
5. **SC5**​: Sensors should ensure they connect with RADAR without delay.
6. **SC6**​: GPS should be well calibrated and report exact location.
7. **SC7**​: AIS must be in control every time to shutdown/restart system during system failure.
8. **SC8**​: NAPA must provide real-time parking info to prevent any parking congestion.

## CONSTRAINTS

Since the system is operated in consumer vehicles, safety is of paramount importance. To minimize chances of any road accidents or parking congestions some constraints must be satisfied:

1. **C1**​: System must synchronize data after every few seconds to ensure real-time data and eliminate any old data. [H6]
2. **C2**: ​ If system hangs or stops to work correctly, it must power off the system and detect the failure. [H7]
3. **C3**​: System must maintain log of events for fault identification later when required. [H8]
4. **C4**​: GPS and NAPA should work perfectly to ensure correct information shared with the vehicle. [H4]
5. **C5**​: All critical hardware components in vehicle like GPS, sensors are in perfect condition and well tested before vehicle start. [H1]