# Case study: Layer wise responses/actions/activities for Autonomous Vehicles

1. **Autonomous Vehicles** Requirements - The vehicle should be able to

A. Autonomous vehicles will operate in concert with other connected vehicles,
   a. traffic management systems,
   b. roadside units and
   c. pedestrians on busy thoroughfares and at intersections.

B. Detect the presence of the obstacles and control the speed and direction accordingly

C. Give **lane-departure warning and and be able to do self-parking**

D. Send the route information to the central system for storage and to be made available to the supervisor to monitor the performance of the vehicle in real time

E. Data will be accessed by various other zonal people for R & D

F. The performance of the vehicle will be monitored and the vehicle will be tracked in real time to detect any unforeseen situation

G. The history of the vehicle performance need to be maintained and the abstract level information in the form of fuel used, time taken to cover different routes along with route information mapped to GPS, accidents taken place if any, etc will be sent to the R & D department situated in other city/country

H. The records of modification taken place to improve the performance of the vehicle also to be maintained at the central level

I. Keep a track of sensor failure over the period of time

| **Requirements** | **EDGE layer** | **FOG layer** | **CLOUD layer** |
|---|---|---|---|
| Traffic Management System | Response: Sense the signal from the traffic light.<br><br>Action: If the Signal is red then stop; yellow then ready to go and for the green, the vehicle is clear to proceed | | |
| Roadside Obstacles and pedestrians | Response: Use the camera to detect obstacles and pedestrians<br><br>Action: accordingly control speed and navigate the vehicle. | | |
| Lane Departure | Response: Use the | | |

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| Warning | stored route map to find out lane departure and junctions.<br><br>Action: Indicate using left/ right indicators and then change lanes safely | | |
| Self Parking | | Response: Once you are nearing to the destination Navigate according to the coordinates and send it to the controller to locate the parking slots.<br><br>Action: Using the sensors and camera find an empty parking slot and proceed to the parking safely. | |
| Monitoring Performance | Action: Fetch data from various sensors.<br><br>Response: Send the data from sensors to the fog level after processing | Action: Convert low-level sensor data to an abstract level to be presented to the observer for tracking purposes<br><br>Response: Send the abstract-level data to the cloud. And make the data ready to be sent to the cloud for DSS | Response: Analytics of the information will be performed.<br><br>Action: Information will be sent to zonal people for research and development. |
| Unforeseen Situation | Action: Detect any unforeseen situation based on the signals from the accelerometer and gyroscope.<br><br>Response: Send the signal to a centralized system and local alert | Action: Keep a record of the accident, route, date time and severity<br><br>Response: Send the information to a centralized system and generate an alert to the supervisor and | Action: Keep a record of the accident, route, date time and severity<br><br>Response: Send the information to a R &D and generate an alert for the higher ups |

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|---|---|---|---|
| | to switch to manual mode. | higher ups | |
| Sensor Failure | Action: switch to a backup plan after receiving an alert from the fog layer on detecting a failure of sensor<br><br>Response: Send a information of switched plan based on this event to the FOG | Action: Detect Sensor Failure by analyzing the trend and pattern of the sensor data.<br><br>Response: Send this response and info of switched plan to the cloud storage | Action: Keep a record of the sensor failure event along with timestamp and cause and effect maps<br><br>Response: Send the information to a R &D and generate an alert for the higher ups |
| Accident report generation | | Action: Analyze the unforeseen situation just before the crash<br><br>Response: A backup of critical parameters needs to be taken at regular intervals. | Action: keep a report of analysis done of the unforeseen situation just before the crash<br><br>Response: analyze a backup of critical parameters and use it for DSS and further improvement in the system. |