# System Requirements Specification for ADAM

Bla

## Feature List

#### Functional requirements:

Driving

1. Show a warning if the distance is below the average break distance (including human reaction and actual breaking time) (may require further calibration or knowledge of break effectiveness)

2. Inform with a warning if a lane departure is expected to happen within the next x(e.g. 5 ) seconds

3. Show which lane is about to be crossed

Traffic and flow information

4. Give an indication if the cars in front are about to break by detecting the brakelight

5. Detect and show speed signs (including city signs, end of speed limits) and show the detected speed limit

6. Detect priority in traffic by showing the direction which has priority

Dashcam

7. Record video footage in case of a major incident

8. Display last detected information such as speed, cars in front, detected signs and lanes

#### Non-functional requirements

1. The solution should run on a commodity Android device with at least 4 CPU cores and a GPU with OpenGL ES 2.x support, support OpenCV runtime, at least 512 MB RAM, back-facing camera with at least FullHD resolution, sustainable charging (run on power-source with battery charging)

2. The solution should run in almost real-time (no longer than the average humand reaction time) to detect objects/situations

3. The system shall not record any data and must withdraw video footage after processing

4. No car signs should be disclosed and any detected signs should be anonymoused while showing the captured video

5. The system shall reach a detection ratio of at least 50% for lanes, 75% for traffic signs, 50% for brakelight, 75% for lane departure

6. The solution requires a steady power connection to bridge longer driving sessions

## Use Cases

There are three main categories of Use Cases:

1. Mx: Monitoring Use Cases
2. Wx: Active Warning Use Cases
3. ???

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| --- | --- |
| Use Case ID | M1 |
| Name/Summary | Monitor Speed |
| Priority | high |
| Preconditions | Accelerometer data is available |
| Postconditions | Current speed of the vehicle is available for further calculations |
| Primary Actor | System |
| Secondary Actor(s) | - |
| Trigger | Periodic time interval |
| Main Scenario | 1. Measure the current speed of the vehicle |
| Extensions | - |
| Open Issues | - |

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| --- | --- |
| Use Case ID | M2 |
| Name/Summary | Detect lanes |
| Priority | high |
| Preconditions | Video data of street in front of the device(car?) is available |
| Postconditions | Lanes in front of the device are detected |
| Primary Actor | System |
| Secondary Actor(s) | - |
| Trigger | Periodic time interval |
| Main Scenario | 1. Detect all lanes in current video frame |
| Extensions | - |
| Open Issues | - |

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| --- | --- |
| Use Case ID | M3 |
| Name/Summary | Detect vehicles |
| Priority | high |
| Preconditions | Video data of street in front of the device(car?) is available |
| Postconditions | Verhicles and their metadata in front of the device are detected |
| Primary Actor | System |
| Secondary Actor(s) | - |
| Trigger | Periodic time interval |
| Main Scenario | 1. Detect all vehicles in current video frame 2. If vehicle has been detected in last (or further away) frame, treat as the same vehicle object 3. If vehicle is already known:    1. Determine the direction of the vehicle    2. Determine the speed and acceleration of the vehicle, especially if it is slowing down/braking    3. Determine the lane the vehicle is travelling on |
| Extensions | M4: In step 3.1 use Information from M4 |
| Open Issues | - |

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| --- | --- |
| Use Case ID | M4 |
| Name/Summary | Detect brake lights |
| Priority | high |
| Preconditions | Video data of street in front of the device(car?) is available |
| Postconditions | Braking lights of a vehicle in in front of the device are detected |
| Primary Actor | System |
| Secondary Actor(s) | - |
| Trigger | Periodic time interval |
| Main Scenario | 1. Detect all red lights connected to a vehicle object in current video frame |
| Extensions | - |
| Open Issues | - |

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| --- | --- |
| Use Case ID | M5 |
| Name/Summary | Detect street signs |
| Priority | high |
| Preconditions | Video data of street in front of the device(car?) is available |
| Postconditions | Street signs in front of the device are detected and recognised |
| Primary Actor | System |
| Secondary Actor(s) | - |
| Trigger | Periodic time interval |
| Main Scenario | 1. Detect all street sign in current video frame 2. If sign has been detected in last (or further away) frame, treat as the same street sign object 3. Try to match a detected street sign with sign database for symbol visualisation |
| Extensions | - |
| Open Issues | - |

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| --- | --- |
| Use Case ID | M6 |
| Name/Summary | Record video footage |
| Priority | high |
| Preconditions | Video data of street in front of the device(car?) is available |
| Postconditions | Video footage of the last x minutes is stored (x is a parameter corresponding to system disk space) |
| Primary Actor | System |
| Secondary Actor(s) | - |
| Trigger | Periodic time interval |
| Main Scenario | 1. Save latest video frames 2. Check for saved frames, that are too old and delete them |
| Extensions | M7: If option is activated the newly saved footage in step 1 has to be scanned for image material that has to be redacted before saving |
| Open Issues | - |

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| --- | --- |
| Use Case ID | M7 |
| Name/Summary | Redact video footage |
| Priority | low |
| Preconditions | New Video data is available and ready to be saved |
| Postconditions | New Video footage is redacted |
| Primary Actor | System |
| Secondary Actor(s) | - |
| Trigger | Periodic time interval |
| Main Scenario | 1. Redact all image material like car signs from current video footage |
| Extensions | - |
| Open Issues | - |

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| --- | --- |
| Use Case ID | W1 |
| Name/Summary | Warning on lane departure |
| Priority | high |
| Preconditions | Lanes have been detected for current video frame |
| Postconditions | Lane departure warning is issued to user |
| Primary Actor | System |
| Secondary Actor(s) | User |
| Trigger | Periodic time interval |
| Main Scenario | 1. Check if vehicle is in danger of leaving the lane 2. If there is a possible danger, issue warning to user interface |
| Extensions | M2: Use result of M2 in step 1 |
| Open Issues | - |

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| --- | --- |
| Use Case ID | W2 |
| Name/Summary | Warning on braking vehicles |
| Priority | high |
| Preconditions | Vehicles in front of the camera have been detected |
| Postconditions | Vehicle braking warning is issued to user |
| Primary Actor | System |
| Secondary Actor(s) | - |
| Trigger | Periodic time interval |
| Main Scenario | 1. Check if a vehicle is in front of the camera 2. Check if the vehicle is on the same lane 3. Check if the vehicle is in a brakeing state 4. Check if the distance to the braking vehicle is in a dangerous level 5. If all 1-4 are true, issue warning to user interface |
| Extensions | M1, M2, M3, M4: Use these for the results in step 1-4 |
| Open Issues | - |

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| Use Case ID | W3 |
| Name/Summary | Information on street signs |
| Priority | middle |
| Preconditions | - |
| Postconditions | User has been informed about any street signs detected |
| Primary Actor | User |
| Secondary Actor(s) | Video stream |
| Trigger | User starts system |
| Main Scenario | 1. User starts Application 2. User starts Recording 3. System shows record mode and incident button 4. (opt.) User marks incident 5. (opt.) Video footage is permanently saved and success is displayed 6. User stops Recording or quits Application |
| Extensions | - |
| Open Issues | - |

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| Use Case ID | W4 |
| Name/Summary | Get video footage |
| Priority | middle |
| Preconditions | - |
| Postconditions | If incident has been marked, video has been saved |
| Primary Actor | User |
| Secondary Actor(s) | Video Stream |
| Trigger | User starts system |
| Main Scenario | 1. User starts Application 2. User starts Recording 3. System shows record mode and incident button 4. (opt.) User marks incident 5. (opt.) Video footage is permanently saved and success is displayed 6. User stops Recording or quits Application |
| Extensions | 3a No Video stream available or no disk space  3b System displays record failure |
| Open Issues | - |