Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Exterior Lights Soft Switch

APIM Phoenix Domain Controller Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.1

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Revision History

Date	Version	Notes	
October 22, 2021	1.0	Initial Release	
December 16, 2021	1.1		
	981268/B-Overview		tmertiri: update content
	ELSS-CLD-REQ-456638/B-Soft Switch Client		tmertiri: no change. Add vsem ID
	ELSS-CLD-REQ-456639/B-Soft Switch Server		tmertiri: no change. Add vsem ID
	981269/B-Logical Signal Mapping		tmertiri:update signal name
	IIR-REQ-456640/B-Soft Switch Client Tx		tmertiri: update content
	MD-REQ-456658/B-LLightsRq		tmertiri:update req type. no content changestmertiri:update req type. no content changes
	MD-REQ-459617/B-LFogFrontRq		tmertiri:update req type. no content changes
	MD-REQ-459618/B-LFogRearRq		tmertiri:update req type. no content changes
	MD-REQ-466815/A-LDrvSpotRq		tmertiri:update req type. no content changes
	MD-REQ-466816/A-LPsngrSpotRq		tmertiri:update req type. no content changes
	IIR-REQ-456641/B-Soft Switch Client Rx		tmertiri: update content
	MD-REQ-456657/B-IgnSt		tmertiri:update req type. no content changes
	MD-REQ-456659/B-LLightSt		tmertiri: update content
	MD-REQ-459597/B-LFogFrontSt		tmertiri:update req type. no content changes
	MD-REQ-459598/B-LFogRearSt		tmertiri:update req type. no content changes
	MD-REQ-466817/A-LLeftSpotSt		mertiri: update contentiri: update content
	MD-REQ-466818/A-LRightSpotSt		tmertiri: update content
	MD-REQ-471459/A-LLowBeamSt		tmertiri: update content
	MD-REQ-472600/A-LParkLampSt		tmertiri: update content
	981265/B-General Requirements		tmertiri: update content
	ELSS-REQ-456698/B-Soft Switch Availability in Client		tmertiri: no change. Add vsem ID
	982890/B-Functional Requirements		tmertiri: update content
	982910/B-Low Beam		tmertiri: update content
	ELSS-REQ-456699/B-Faulty Request		tmertiri: update content
	ELSS-REQ-457939/B-ASIL Compliance		tmertiri: no change. Add vsem ID
	ELSS-REQ-456718/B-Light State Request		tmertiri: update content
	989731/B-Display Related Requirements		tmertiri:removed power realted req: 460657 and 460678
	ELSS-REQ-460657/B-Lighting Control Icon		tmertiri: no change. Add vsem ID
	ELSS-REQ-460677/B-Lighting Soft Switch Operation		tmertiri:removed missin or unknown states of ignition signal
	1011158/A-UseCases		tmertiri: update content
	ELSS-UC-REQ-470253/A-Activate Particular Lights		tmertiri: update content
	ELSS-UC-REQ-470254/A-Deactivate Lights		tmertiri: update content
	1011159/A-Diagrams		tmertiri: update content
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	ELSS-ACT-REQ-470197/A-Low Beam and Parking Operation		tmertiri: update content
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	ELSS-REQ-457938/B-Parking Lights Request		tmertiri: no change. Add vsem ID
	982913/B-Fog Lights		tmertiri: update content
	1006511/A-Requirements		tmertiri: update content
	ELSS-REQ-460637/B-Feature Change Request		tmertiri: no change. Add vsem ID
	ELSS-REQ-460638/B-Button Press Timing		tmertiri: no change. Add vsem ID
	ELSS-REQ-460639/B-Missing Signals		tmertiri: update requirement
	1006512/A-UseCases		tmertiri: update content
	ELSS-UC-REQ-466414/A-FogLights Activate		tmertiri: update content

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1007721/A-Activity Diagram	tmertiri: update content
ELSS-ACT-REQ-466824/A-SpotLights Interaction AD	tmertiri: update content
1007722/A-Sequence Diagram	tmertiri: update content
ELSS-SD-REQ-466825/A-SpotLights Interaction SD	tmertiri: update content
981267/B-Appendix: Reference Documents	tmertiri: update content

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1 Architectural Design

1.1 Overview

The intent of Soft Switch is to describe software based switch operation that controls various vehicle lights, such as low beam lights, parking, fog or spot lights. Each one of these is considered a separate feature, but signals to request the lights and the signal that indicates the type of light currently active is shared among the features, hence all the features are described in this SPSS. Common requirements between them are found in General requirements. Unique requirements that are applicable only to particular features are located in the respective functions. Parking Lights are ASIL B compliance features.

Each function is an independent feature/operation. They are enabled/disabled independently from unique configuration values. The requirements are valid and need to be executed if the functions are enabled or not valid and not to be executed if functions are disabled.

1.2 ELSS-CLD-REQ-456638/B-Soft Switch Client

Client provides a way for user input to interface with the feature. In this feature is also provides soft switch state too.

1.3 ELSS-CLD-REQ-456639/B-Soft Switch Server

Soft switch server takes controls the feature state. It takes as input client requests and decides to changes the lights states.

1.4 Logical Signal Mapping

The CAN signals mentioned throughout this document shall refer to the CAN signal's logical name. The logical names shall be mapped to their actual CAN signal names. Please use the table below to perform the mapping. The InfoCAN database file is the master file for the actual CAN signal names. Note: some CAN signals referenced throughout this document may use the logical name while some may use the actual CAN signal name.

Logical Name	CAN Signal Name
IgnSt	Ignition_Status
LLightSt	HeadLghtSwtch_D_Stat
LFogFrontSt	FogLghtFrontOn_B_Stat
LFogRearSt	FogLghtRearON_B_Stat
LLowBeamSt	Headlamploactv_b_stat
LLightsRq	HeadLghtCtl_D_RqMnu
LFogFrontRq	FogLghtFrontButtn_B_Rq
LFogRearRq	FogLghtRearButtn_B_Rq
LDrvSpotRq	DrvSpotLghtButtn_B_Rq
LPsngrSpotRq	PsngrSpotLghtButtn_B_Rq
LLeftSpotSt	SpotLghtLeft_D_Stat
LRightSpotSt	SpotLghtRight_D_Stat

1.5 IIR-REQ-456640/B-Soft Switch Client Tx

1.5.1 MD-REQ-456658/B-LLightsRq

LLightsRq: This signal is transmitted from client to request Low Beam light status change.

Signal Parameter	Parameter Description
0x0	Null State
0x1	Off
0x2	ParkLamp
0x3	AutoLamp
0x4	HeadLamp
0x5	NotUsed_1
0x6	NotUsed_2
0x7	Faulty

1.5.2 MD-REQ-459617/B-LFogFrontRq

LFogFrontRq: This signal is an indicator of Soft Switch button press state for the front fog lights transmitted from client to server.

Signal Parameter	Parameter Description
0x0	Not Pressed
0x1	Pressed

1.5.3 MD-REQ-459618/B-LFogRearRq

LFogRearRq: This signal is an indicator of Soft Switch button press state for the rear fog lights transmitted from client to server.

Signal Parameter	Parameter Description
0x0	Not Pressed
0x1	Pressed

1.5.4 MD-REQ-466815/A-LDrvSpotRq

LDrvSpotRq: This signal is sent from the client to the server. It is used to indicate button status for driver side spot light.

Signal Parameter	Parameter Description
0x0	Not Pressed
0x1	Pressed

1.5.5 MD-REQ-466816/A-LPsngrSpotRq

LPsngrSpotRq: This signal is sent from the client to the server. It is used to indicate button status for pasenger side spot light.

Signal Parameter	Parameter Description
0x0	Not Pressed
0x1	Pressed

1.6 IIR-REQ-456641/B-Soft Switch Client Rx

1.6.1 MD-REQ-456657/B-IgnSt

IgnSt: This signal is sent to client to indicate ignition state.

Signal Parameter	Parameter Description
0x0	Unknown
0x1	Off
0x2	Accessory

0x4	Run
0x8	Start
0xF	Invalid

1.6.2 MD-REQ-456659/B-LLightSt

LLightSt: This signal is received by the client. It provides the state of the soft switch by the server after filtering and other internal processes.

Signal Parameter	Parameter Description
0x0	Off
0x1	Parklamp
0x2	Headlamp
0x3	Autolamp

1.6.3 MD-REQ-459597/B-LFogFrontSt

LFogFrontSt: This signal provides the status of Front fog lights to the client.

Signal Parameter	Parameter Description
0x0	Off
0x1	On

1.6.4 MD-REQ-459598/B-LFogRearSt

LFogRearSt: This signal provides the status of Rear fog lights to the client.

Signal Parameter	Parameter Description
0x0	Off
0x1	On

1.6.5 MD-REQ-466817/A-LLeftSpotSt

LLeftSpotSt: This signal provides the left side of the vehicle spot lights status. Left side is when the user is inside vehicle, forward facing , their left side.

Parameter Value	Parameter Description
0x0	Off
0x1	On

1.6.6 MD-REQ-466818/A-LRightSpotSt

LRightSpotSt: This signal provides the right side of the vehicle spot lights status. Right side is when the user is inside vehicle, forward facing , their right side.

Parameter Value	Parameter Description
0x0	Off
0x1	On

1.6.7 MD-REQ-471459/A-LLowBeamSt

LLowBeamSt is sent by the server to indicate low beam light status.

Signal Parameter	Parameter Description
0x0	Off
0x1	On

1.6.8 MD-REQ-472600/A-LParkLampSt

LParkLampSt is sent from the server and it provides the Parklamps state.

Signal Parameter	Parameter Description
0x0	Off
0x1	On
0x2	Unknown
0x3	Invalid

2 General Requirements

2.1 ELSS-REQ-456698/B-Soft Switch Availability in Client

Soft Switch could have a diagnostics value that indicates if the feature is available or not. If the feature/function is not available, the function and its requirements are not to be executed by the client.

3 Functional Requirements

3.1 Low Beam

VIP/VMCU is involved in the execution of this function.

3.1.1 ELSS-REQ-456699/B-Faulty Request

Among the parameters that client request form Soft Switch server is Faulty.
This value is used from client to indicate various internal faults to the server. The list of DTC for which the client should transmit LLightsRq (Faulty) is the table below:

DTC 0x908E01 – Display General Electrical Failure
DTC 0x908E4A – Display Incorrect Component Failure
DTC 0x908E02 – Display General Signal Failure
DTC 0xC16200 – Lost Communication With Navigation Display Module No Sub Type Information
DTC 0x908E87 – Display Missing Message
DTC 0xF00041 – Control Module General Checksum Failure

3.1.2 ELSS-REQ-457939/B-ASIL Compliance

The operation is required to satisfy ASIL B compliance rating. Refer to Appendix for related documentation.

3.1.3 ELSS-REQ-456718/B-Light State Request

The client shall transmit the light type being requested by the user using signal LLightsRq for the applicable lights. The Client shall continuously transmit that request until the server provides the compatible light status feedback to the user. When received signal status matches to that requested, client shall request Null state.

3.1.4 Display Related Requirements

This feature execution needs some unique requirements and operation from Client HMI. While HMI spec could be a better place to document these requirements, due to the urgency of releasing the spec for this feature, those requirements are documented in SPSS. Subsequent releases, we could remove some of those requirements from SPSS to HMI spec.

3.1.4.1 ELSS-REQ-460657/B-Lighting Control Icon

When the Client display is ON, the Master Lighting Control icon on Client display shall be visible in any driving condition.

3.1.4.2 ELSS-REQ-460677/B-Lighting Soft Switch Operation

Below table provides some relations between ignition status, light switch and display state.

PDC Input		PDC Output signal	
Center Stack Display State	User Action	LLightsRq	Description
Power ON / init /wakeup	N/A	Null	No valid state until receive LLightSt
ON	None	Null	Send Null until a valid touch happens
ON	Touch	Off	Valid touch, send it until receive LLightSt = Off
ON	Touch	ParkLamp	Valid touch, send it until receive LLightSt = Parklamp
ON		HeadLamp	Valid touch, send it until receive LLightSt = Headlamp

	Touch		
ON	Touch	AutoLamp	Valid touch, send it until receive LLightSt = Autolamp
OFF	N/A	Null	No screen available
Defective (1)	N/A	Faulty	Not able to detect user request

3.1.5 UseCases

3.1.5.1 ELSS-UC-REQ-470253/A-Activate Particular Lights

Actors	User
Pre-conditions	Ignition is On
Scenario Description	Soft switch is showing. The user enables one for the lights, such as Parklamp or AutoLamp or Headlamp
Post-conditions	Selected lights will turn On.
List of Exception Use Cases	
Interfaces	Client HMI

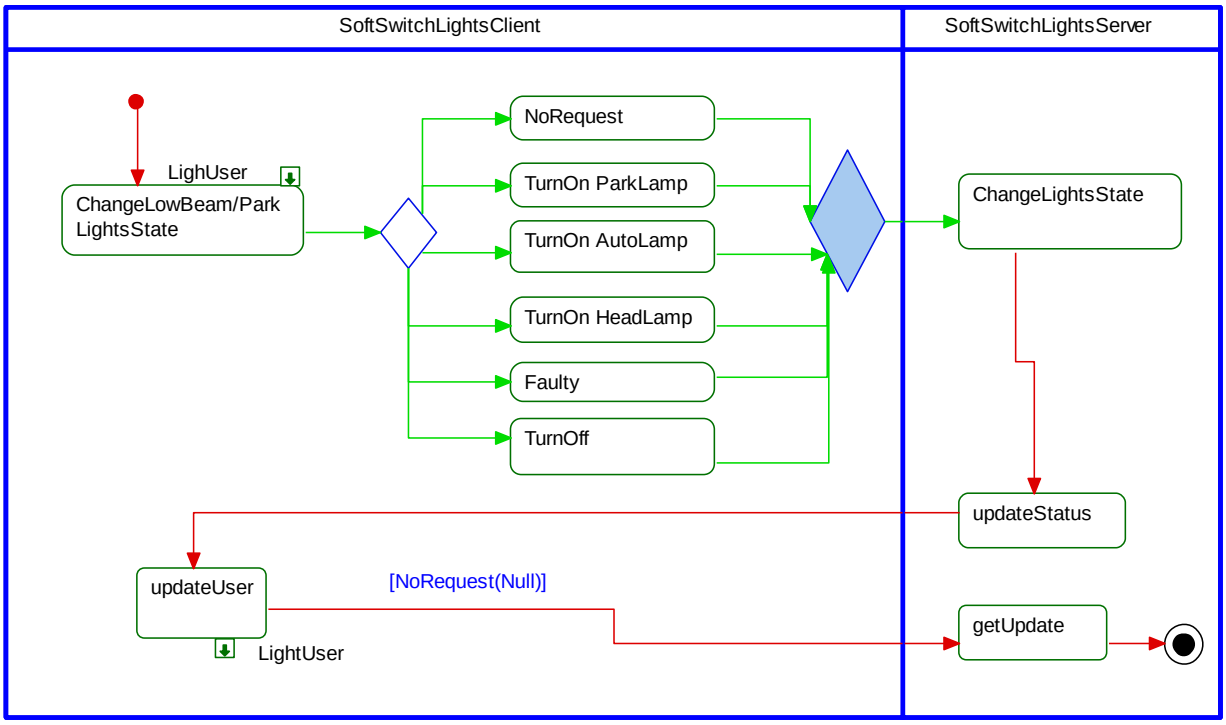
3.1.5.2 ELSS-UC-REQ-470254/A-Deactivate Lights

Actors	User
Pre-conditions	One of the lights (ParkLamp or AutoLamp or Headlamp) is On. Softswitch is showing On.
Scenario Description	User selects another light or lights Off.
Post-conditions	If Off selected, All lights are Off. If another light is selected , previous Light is Off and new light is On.
List of Exception Use Cases	
Interfaces	Client HMI

3.1.6 Diagrams

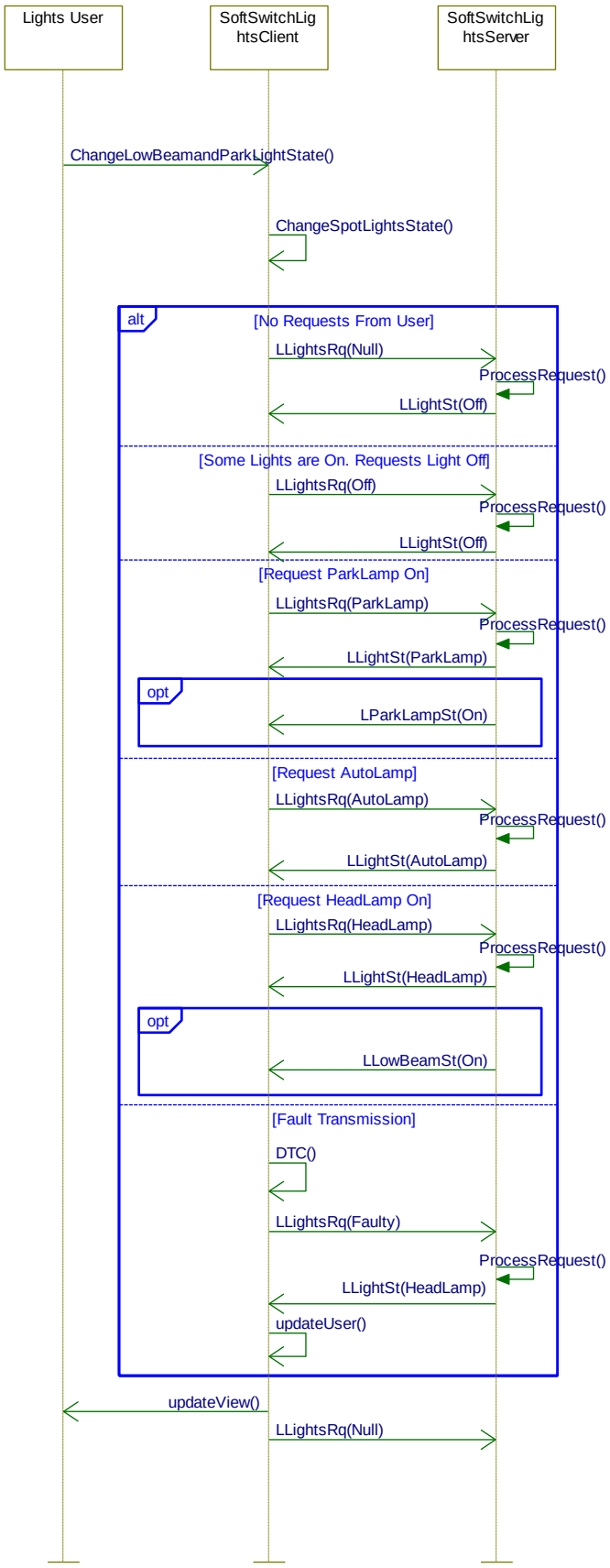
3.1.6.1 Activity Diagrams

3.1.6.1.1 ELSS-ACT-REQ-470197/A-Low Beam and Parking Operation



3.1.6.2 Sequence Diagrams

3.1.6.2.1 ELSS-SD-REQ-470198/A-Low Beam and Parking Operation


Lights User
SoftSwitchLightsClient
SoftSwitchLightsServer
ChangeLowBeamandParkLightState()
ChangeSpotLightsState()
alt
[No Requests From User]
LLightsRq(Null)
ProcessRequest()
LLightSt(Off)
[Some Lights are On. Requests Light Off]
LLightsRq(Off)
ProcessRequest()
LLightSt(Off)
[Request ParkLamp On]
LLightsRq(ParkLamp)
ProcessRequest()
LLightSt(ParkLamp)
opt
LParkLampSt(On)
[Request AutoLamp]
LLightsRq(AutoLamp)
ProcessRequest()
LLightSt(AutoLamp)
[Request HeadLamp On]
LLightsRq(HeadLamp)
ProcessRequest()
LLightSt(HeadLamp)
opt
LLowBeamSt(On)
[Fault Transmission]
DTC()
LLightsRq(Faulty)
ProcessRequest()
LLightSt(HeadLamp)
updateUser()
updateView()
LLightsRq(Null)

3.2 Parking Lights

VIP/VMCU is involved in the execution of this function.

3.2.1 ELSS-REQ-457937/B-Power Mode Operation

The Parking/ Position Feature shall be available for all ignition status including when IGNITION == OFF/ACC

3.2.2 ELSS-REQ-457938/B-Parking Lights Request

The client shall transmit the signal LLightsRq with the parameter 0x1 (Parklmap) once user presses the soft button. This parameter shall be continuously transmitted until vehicle turns Off or user makes another selection in Soft Button.

3.2.3 ELSS-REQ-456718/B-Light State Request

The client shall transmit the light type being requested by the user using signal LLightsRq for the applicable lights. The Client shall continuously transmit that request until the server provides the compatible light status feedback to the user. When received signal status matches to that requested, client shall request Null state.

3.2.4 UseCases

3.2.4.1 ELSS-UC-REQ-470253/A-Activate Particular Lights

Actors	User
Pre-conditions	Ignition is On
Scenario Description	Soft switch is showing. The user enables one for the lights, such as Parklamp or AutoLamp or Headlamp
Post-conditions	Selected lights will turn On.
List of Exception Use Cases	
Interfaces	Client HMI

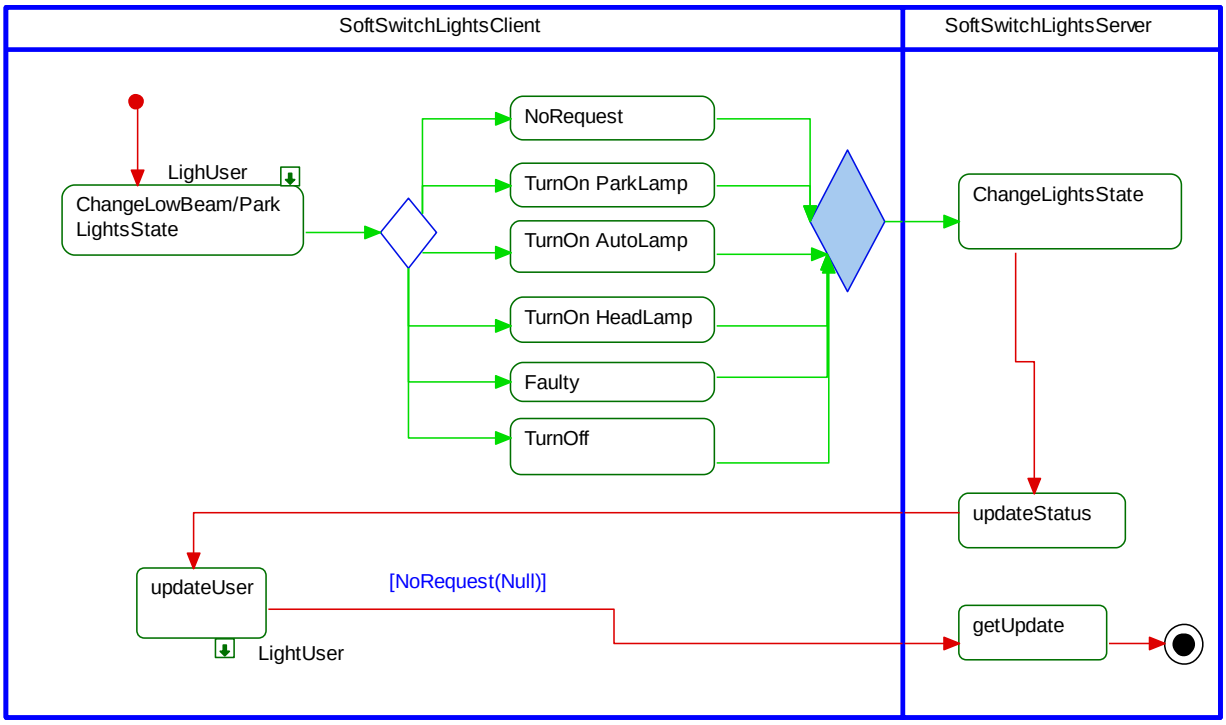
3.2.4.2 ELSS-UC-REQ-470254/A-Deactivate Lights

Actors	User
Pre-conditions	One of the lights (ParkLamp or AutoLamp or Headlamp) is On. Softswitch is showing On.
Scenario Description	User selects another light or lights Off.
Post-conditions	If Off selected, All lights are Off. If another light is selected , previous Light is Off and new light is On.
List of Exception Use Cases	
Interfaces	Client HMI

3.2.5 Diagrams

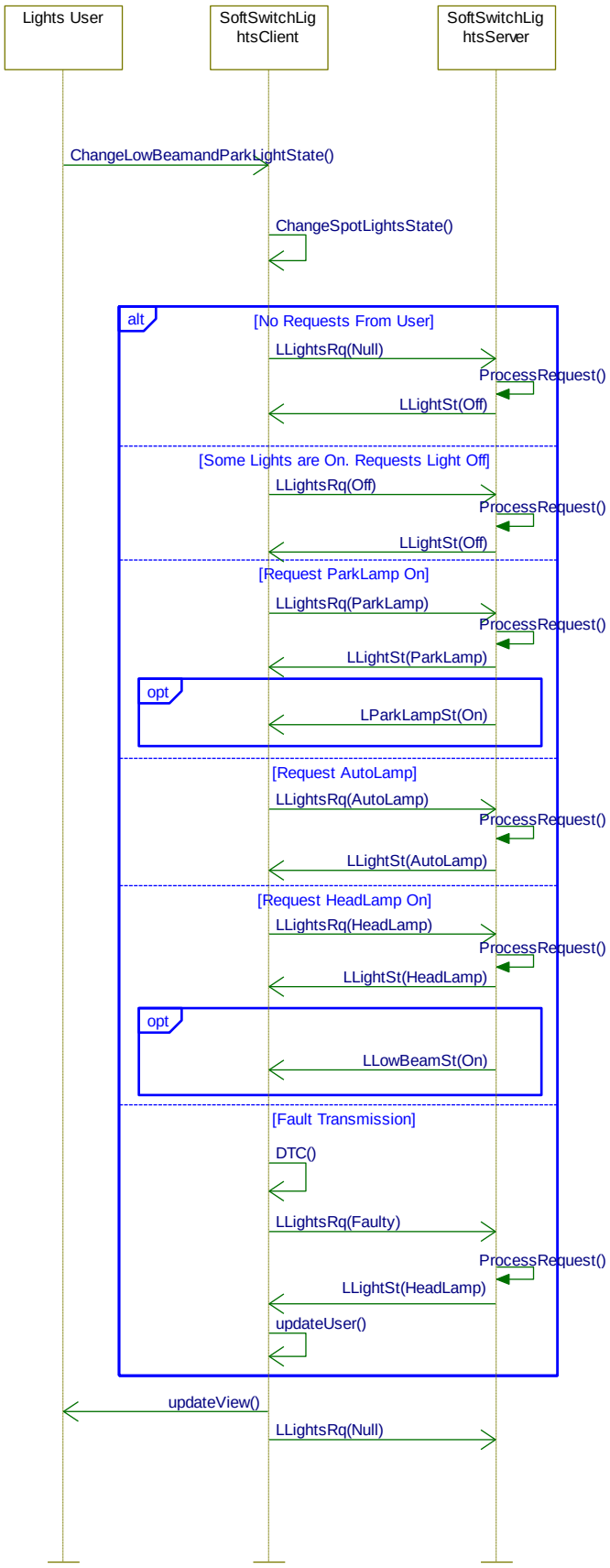
3.2.5.1 Activity Diagrams

3.2.5.1.1 ELSS-ACT-REQ-470197/A-Low Beam and Parking Operation



3.2.5.2 Sequence Diagrams

3.2.5.2.1 ELSS-SD-REQ-470198/A-Low Beam and Parking Operation


Lights User
SoftSwitchLightsClient
SoftSwitchLightsServer
ChangeLowBeamandParkLightState()
ChangeSpotLightsState()
alt
[No Requests From User]
LLightsRq(Null)
ProcessRequest()
LLightSt(Off)
[Some Lights are On. Requests Light Off]
LLightsRq(Off)
ProcessRequest()
LLightSt(Off)
[Request ParkLamp On]
LLightsRq(ParkLamp)
ProcessRequest()
LLightSt(ParkLamp)
opt
LParkLampSt(On)
[Request AutoLamp]
LLightsRq(AutoLamp)
ProcessRequest()
LLightSt(AutoLamp)
[Request HeadLamp On]
LLightsRq(HeadLamp)
ProcessRequest()
LLightSt(HeadLamp)
opt
LLowBeamSt(On)
[Fault Transmission]
DTC()
LLightsRq(Faulty)
ProcessRequest()
LLightSt(HeadLamp)
updateUser()
updateView()
LLightsRq(Null)

3.3 Fog Lights

GIP/CCPU is involved in the execution/development of this function.

3.3.1 Requirements

3.3.1.1 ELSS-REQ-460637/B-Feature Change Request

The client shall transmit user requests only when user presses the button. The transmitted request is button state, which is indicated as Pressed.

3.3.1.2 ELSS-REQ-460638/B-Button Press Timing

Client shall transmit the button press state as Pressed for a 100ms consecutive time length.

3.3.1.3 ELSS-REQ-460639/B-Missing Signals

If Fog Lights State signals go missing or aren't received by the client for a period of 5 sec, the client shall display the last state of the fog lights received.

3.3.2 UseCases

There are additional conditions that are required to be fulfilled for fog lights to turn On. Other lights need to be On, Market etc. The purpose of these usecases in this SPSS are to provide Client behavior scenario with relation to the lights, such as providing user request to turn them On or Off, not necessarily lights to the vehicle or internal lights operation and conditions.

3.3.2.1 ELSS-UC-REQ-466414/A-FogLights Activate

Actors	User
Pre-conditions	All fog lights are off Ignition is On.
Scenario Description	User enables fog lights (front or rear)
Post-conditions	Fog lights turn on.
List of Exception Use Cases	
Interfaces	Client HMI screen

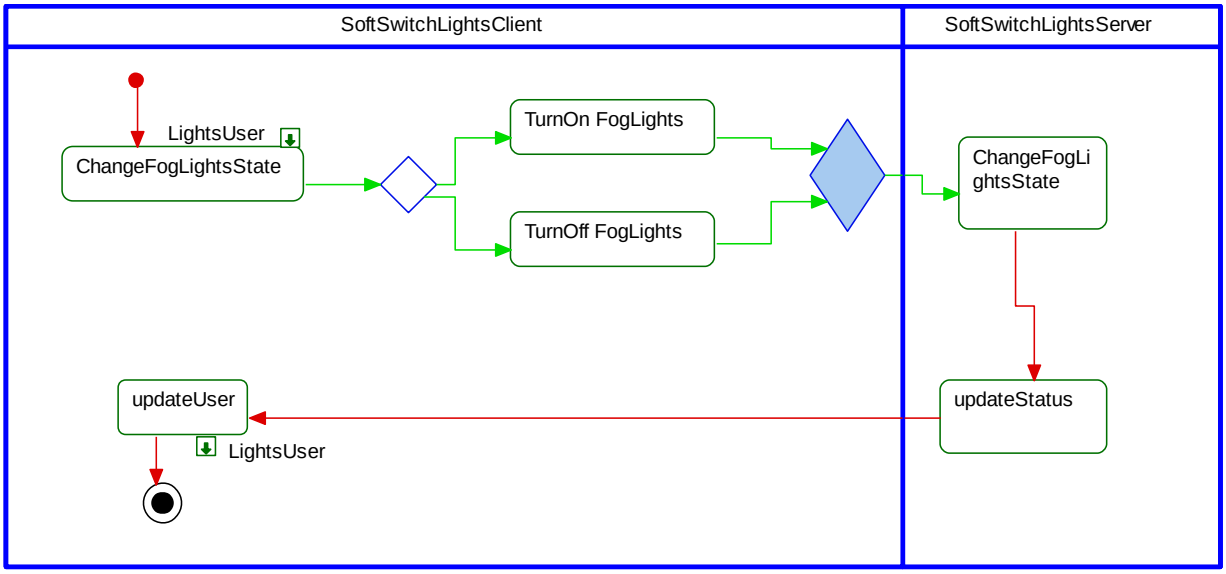
3.3.2.2 ELSS-UC-REQ-466415/A-FogLights Deactivate

Actors	User
Pre-conditions	Fog lights are On. Ignition is ON
Scenario Description	Driver turns the fog lights off.
Post-conditions	Fog lights turn off.
List of Exception Use Cases	
Interfaces	Client HMI

3.3.3 Diagrams

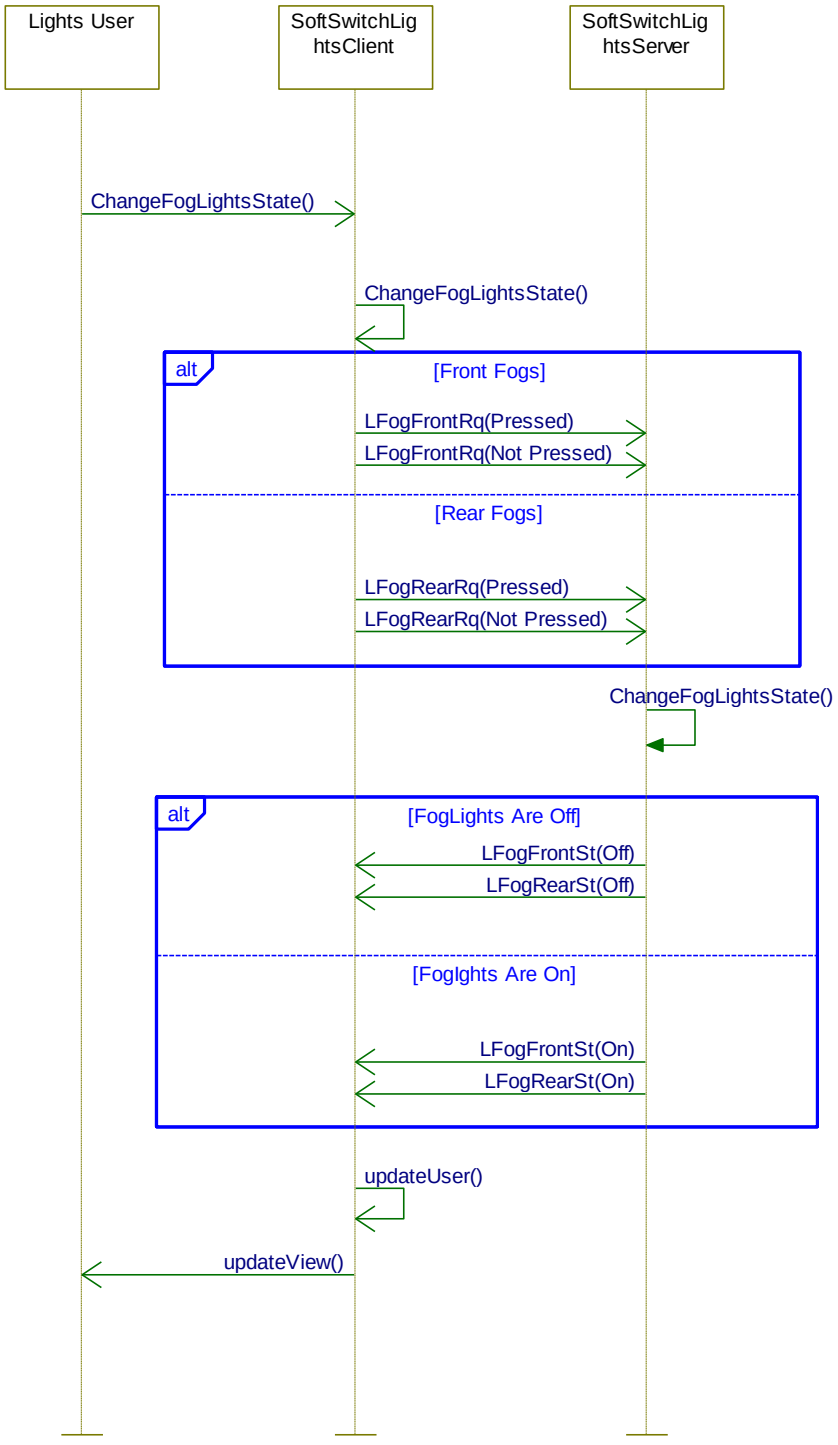
3.3.3.1 Activity Diagram

3.3.3.1.1 ELSS-ACT-REQ-466518/A-FogLights State Change AD



3.3.3.2 Sequence Diagram

3.3.3.2.1 ELSS-SD-REQ-466519/A-FogLights State Change SD



3.4 Spot Lights

GIP/CCPU is involved in the execution/development of this function.

3.4.1 Requirements

3.4.1.1 ELSS-REQ-466820/A-Press Event

Whenever a Press event is detected from the client, the client shall transmit that value in the bus for a consecutive 100ms timeframe.

3.4.1.2 ELSS-REQ-466821/A-Missing Signals

If signal LLeftSpotSt or LRightSpotSt go missing for longer than 5 seconds, client shall display last known state of the signal(s).

3.4.2 Use Cases

3.4.2.1 ELSS-UC-REQ-466822/A-Turn Spotlights On

Actors	User
Pre-conditions	Engine is Running or inAccessory. Spotlights are Off
Scenario Description	Driver requests driver side or passenger side (or both) spotlights on.
Post-conditions	Client forwards the requests to server. Server turns the requested spotlights on.
List of Exception Use Cases	
Interfaces	Client HMI

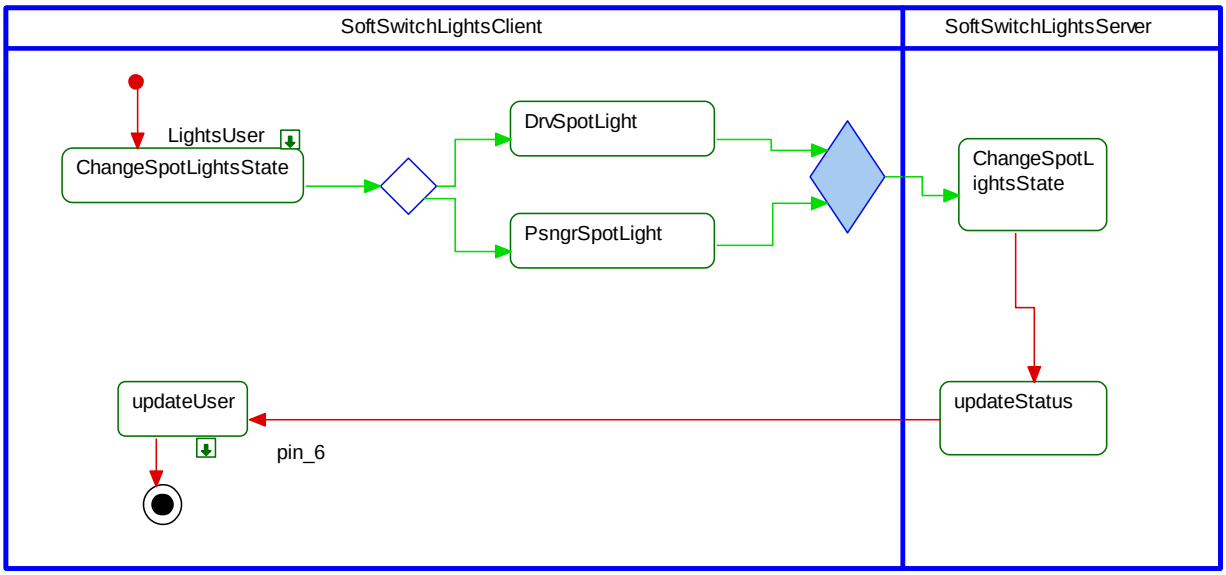
3.4.2.2 ELSS-UC-REQ-466823/A-Turn Spotlights Off

Actors	User
Pre-conditions	Engine is Running or in Accessory. Spotlights are On
Scenario Description	Driver requests driver side or passenger side (or both) Off.
Post-conditions	Client forwards the requests to server. Server turns the requested spotlights Off.
List of Exception Use Cases	
Interfaces	Client HMI

3.4.3 Diagrams

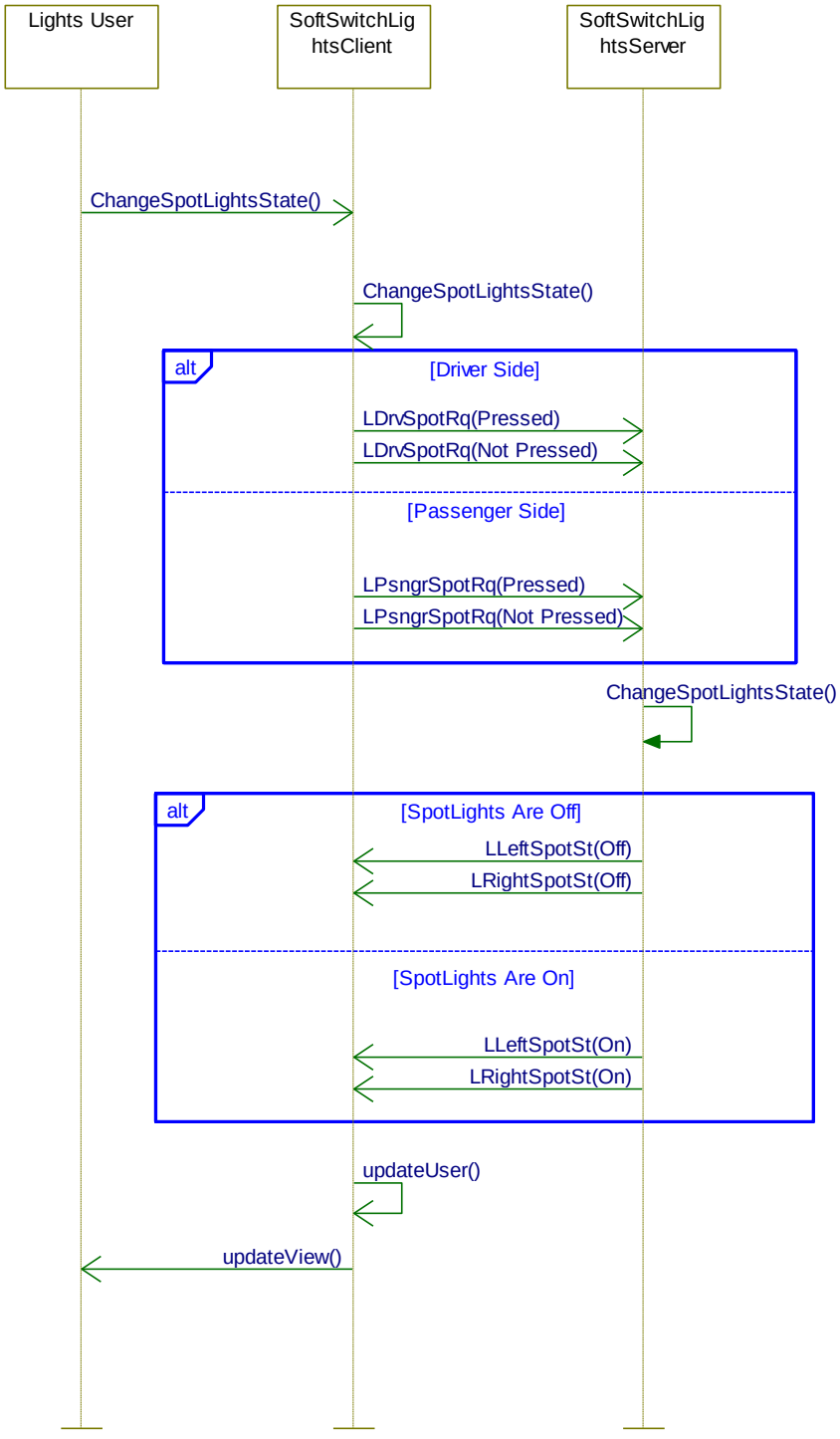
3.4.3.1 Activity Diagram

3.4.3.1.1 ELSS-ACT-REQ-466824/A-SpotLights Interaction AD



3.4.3.2 Sequence Diagram

3.4.3.2.1 ELSS-SD-REQ-466825/A-SpotLights Interaction SD



4 Appendix: Reference Documents

For ASIL B compliance refer to FFSD04. SRS specification.
Headlamp Power Mode SPSS