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**APA**

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# 需求概述/Requirement Overview

## 背景价值/Background Information

用户通过使用APA功能，配合简单的操作，能够实现自动倒车入库的功能。本文档定义了配置Local APA模块的车辆，APA在娱乐系统上的基本功能。系统需要根据标定判断当前车辆配置是否为Local APA。本文中所有图片以及涉及用户操作的描述均为示意，仅为帮助理解文字之用，不对界面和交互设计作任何指导与规定。

By using APA function in combination with simple operation, the user can realize the function of automatically reversing into garage. This document defines the vehicle with the Local APA module, the basic functions of APA on the entertainment system. The system needs to determine whether the current vehicle configuration is Local APA based on the calibration.All pictures in this document and the descriptions related to user operations are schematic. They aim to help understand the text only, but not provide any guidance or regulations for the interface and interaction design.

## 名词解释/Terminology

APA:自动泊车辅助系统（Automatic Parking Assistance）

APA: Automatic Parking Assistance

## 功能全景/Panorama of Functions

APA开启

泊入车位

泊出车位

车位选择

泊车过程

车位选择

找车位

APA ON

Park into the parking space

Exit the parking space

Select parking space

Parking

process

Select parking space

Search for parking space

# 需求列表/Requirement List

（细分并描述需求的主要功能模块，列出功能模块的优先级：1，2，3，1最低，3最高。）

(Subdivide and describe the main function modules of the requirements, list the priority of the function modules: 1, 2 and 3; 1 represents the lowest, 3 represents the highest.)

|  |  |  |
| --- | --- | --- |
| Subfeature | Description | Priority |
| 泊车准备/Parking Preparation |  | 3 |
| 泊车入库/Parking into Garage |  | 3 |
| 泊车过程/Parking Process |  | 3 |
| 离开车位/Leaving the Parking Space |  | 3 |
| 错误提示/Error Prompt |  | 3 |

# 需求描述/Requirement Description

APA自动泊车辅助系统可实现自动检测车位、自动泊车入库/出库等功能，辅助或完全代替驾驶员完成泊车任务。APA系统通过超声波雷达、摄像头等传感器对周围环境进行感知，获取车位及障碍物信息，再基于车位和障碍物信息来规划泊车入库/出库路径，控制车辆按照已规划路径驶入/驶出车位。

APA system can realize certain functions (detecting the parking space, automatically parking into garage/exiting the garage, etc.) to assist or completely replace the driver to park the car. APA system senses the surroundings through sensors such as ultrasonic radar and camera, obtains parking space and obstacle information, and then plans the route for parking into garage/exiting the garage based on parking space and obstacle information, and controls the vehicle to enter/exit the parking space according to the planned route.

根据自动化等级不同，APA系统有如下几种分类。本文档仅对APA2做描述。系统需要根据标定判断当前车辆的APA配置。

APA的整体功能由影像、APA版本和APA附加功能共同组成。APA附加功能有两种，一种是只有倒车入库，另一种是既有倒车入库也有离开车位。影像决定了APA在倒车入库或离开车位时，摄像头拍摄的画面，APA的版本决定了倒车入库或离开车位时系统对车辆的控制程度，APA附加功能决定了是否具有离开车位的功能。三者是没有必然联系的，可以任意搭配。

The overall function of APA consists of image, APA version, and APA add-on features. There are two types of APA add-on features, one is only provided with ‘Parking into Garage’, but the other one is provided with both ‘Parking into Garage’ and ‘Leaving the Parking Space’. The image determines the pictures taken by the APA camera, and the APA version determines the degree of control of the vehicle when the vehicle is parking into garage or leaving the parking space. The APA add-on features determine whether it has the function of leaving the parking space. There is no necessary correlation among the three functions, so they can be arbitrarily matched.

APA支持的影像有2种：~~没有影像、~~倒车影像、360°环视影像，~~其中360°环视影像可以供用户设置，决定显示哪个方向的画面。~~系统需要根据标定判断当前车辆影像配置信息。

APA supports two types of images: ~~no image,~~ reversing image and 360°panoramic image. ~~360°panoramic image can be set by the user to determine the images in which direction will be displayed.~~ The system should judge the current vehicle image configuration information according to the calibration.

针对配备360环视影像的车辆，APA中影像需要支持的显示鸟瞰图和默认视图。其中默认视图需要支持根据档位切换，D挡切换为前视图，R挡切换为后视图，P/N档维持当前视角。针对视图中的导引线，轮胎轨迹线，警示符等辅助信息的显示没有特殊要求，根据当前360影像当前状态进行显示即可。特别地，在APA模式下，影像不支持手动切换视角。

For vehicles equipped with 360 round view images, the images in APA need to support the display of aerial view and default view. Among them, the default view needs to be supported to switch according to the tap position, D block to the front view, R block to the back view, P/N block to maintain the current perspective. There is no special requirement for the display of auxiliary information such as guideline, tire track line and warning sign in the view. It can be displayed according to the current state of the current 360 image. In particular, in APA mode, images do not support manual view switching.

本文档涉及到的总线信号详细信息见表格“APA interface”。

Detailed information on the bus signals covered in this document can be found in table "APA interface".

## APA开关/APA Virtual Switch

VCS支持用户通过娱乐系统上的虚拟按键开启和取消APA。通常情况下，APA模块不会同时配备物理按键开关和虚拟按键开关，对于同一款车型这两种开关形式支持其中一种。当APA功能当前不可用时，系统需要通过总线信号获取功能状态，并通过系统界面告知用户当前无法开启APA。系统需要根据标定判断当前系统是否支持虚拟按键开启APA，若不支持需隐藏虚拟按键。

VCS allows users to turn APA on/off by using the virtual button on the entertainment system. Generally, APA modules are not equipped with both physical and virtual key switches, and one of the two switch forms is supported for the same model. When APA functions are currently unavailable, the system needs to obtain the functional state through the bus signal and inform the user that APA cannot be opened through the system interface. The system should determine whether the current system supports enabling APA with the virtual button according to the calibration. If not, the virtual button should be hidden.

## 泊车准备/Parking Preparation

用户通过按下对应的物理按键或虚拟按键来触发APA功能。系统需要根据标定判断当前车辆支持的是物理按键还是虚拟按键。APA功能生效阶段，APA的界面将持续占有系统界面，此时系统不再响应和提供娱乐系统的其他功能，如多媒体，导航，通知中心等。特别地，当APA界面被唤醒时，系统不再响应倒车影像（RVC）以及360环视功能本身的逻辑。一旦进入APA界面，应用逻辑均以APA为准，RVC以及360环视仅提供影像。

The user triggers the APA function by pressing the corresponding physical button or virtual button. The system should judge whether the current vehicle supports physical buttons or virtual buttons according to the calibration. When the APA function is in effect, the APA interface will continue to occupy the system interface. In this case, the system will no longer respond to and provide other functions of the entertainment system, such as multimedia, navigation, and notification center. In particular, when the APA interface is woken up, the system no longer responds to the logic of the reverse image (RVC) and the 360 view itself. Once entering the APA interface, the application logic is subject to APA, and the RVC and 360 view only provide images.

APA包括倒车入库和离开车位两部分，系统需要根据总线信号判断当前车辆是否支持离开车位功能，如不支持需隐藏对应功能。

The APA includes two parts: Reversing into Garage and Leaving the Parking Space. The system needs to judge whether the current vehicle supports “Leaving the Parking Space” function according to the bus signal. If not, the relevant function should be hidden.

### 离开车位/Leaving the Parking Space

离开车位功能仅支持平行车位的驶出。当用户选择泊出车位功能时，APA模块会对当前环境进行搜索，若不满足离开车位要求，会通过总线信号通知系统退出APA。当车辆满足离开车位要求时，用户需要通过系统选择离开车位类型。

“Leaving the Parking Space” function only supports exiting from parallel parking spaces. When the user selects “Leaving the Parking Space” function, the APA module will search the current environment. If the requirements for leaving the parking space are not met, the system will be notified to exit the APA through the bus signal. If the requirements are met, the user needs to choose the type for leaving the parking space through the system.

离开车位支持“从道路左侧的平行车位离开”和“从道路右侧的平行车位离开”两种车位类型。请参考下方示意图1

“Leaving the Parking Space” function supports two types of parking spaces: “Leaving from the parallel parking spaces on left” and “Leaving from the parallel parking spaces on right ”. Please refer to Figure 1 below

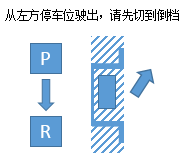
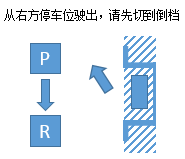


Figure 1

用户完成车位选择动作后，系统需要倒计时3s，在此期间用户可以选择其他车位类型并重新开始倒计时。系统需要在倒计时结束后通过总线信号通知APA模块当前用户选择，此后系统会进入泊车过程。

After the user completes the parking space selection, the system should count down for 3s, during which the user can select another parking space type and restart the countdown. The system needs to notify the APA module of the current user selection via the bus signal after the countdown, and then the system will enter the parking process.

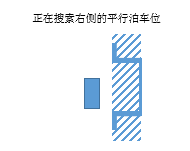
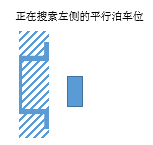
### 泊车入库/Parking into Garage

根据泊车位的类型（平行和垂直）以及泊车位的方位（左边和右边），共有四种泊车方式~~用户可以选择，分别是左边平行，右边平行，左边垂直，右边垂直~~。用户可以先选择泊车类型，再选择泊车方位。请参考示意图2。用户或系统选择不同的车位，系统会发送不同的消息至底层，从而实现车辆的APA功能。

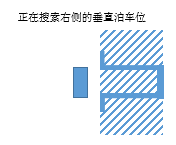
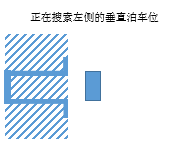
Depending on the type of parking spaces (parallel and perpendicular) and the orientation of the parking spaces (left and right), there are four parking modes available to the user, namely, parallel parking space on left, parallel parking space on right, perpendicular parking space on left, and perpendicular parking space on right. Please refer to Figure 2. The user or system selects different parking spaces, and the system sends different messages to the bottom layer to achieve the vehicle's APA function.

Searching for parallel parking space

Searching for perpendicular parking space



Searching for parallel parking space on left/right



Searching for perpendicular parking space on left/right

系统不限制类型和方位的选择顺序，即使已经选好的方位或者类型，只要在车辆找到车位之前，都可以随时更改。每次更改，底层都会反馈相应的消息给上层，帮助上层显示正确的画面或文字。

The system does not limit the selecting sequence of type and orientation. Even if certain orientation or type has been selected, it can be changed at any time before the vehicle finds the parking space. Each time the change is made, the bottom layer will feed back the relevant message to the upper layer to help the upper layer display the correct images or texts.

## 泊车入库-找车位/Parking into Garage - Searching for Parking Spaces

车辆必须处于一定速度（该值由APA模块通过标定决定）以下，才能找到车位，找到车位后，底层会通知上层，显示找到车位的界面，此后，选择车位类型和方位的按钮都不再可用。

The vehicle must be at a certain speed (this value is determined by the APA module based on the calibration) to find the parking space. After the parking space is found, the bottom layer will notify the upper layer to display the interface of the parking space. After that, the buttons for selecting the parking type and orientation are no longer available.

APA模块找到车位后会通过总线通知VCS。找到车位后，APA模块还会通知系统提示用户向前开；开到一定距离后，系统会根据总线信号输入提醒用户挂入R档。

After finding the parking space, the APA module will notify VCS via the bus. It will also inform the system to prompt the user to drive forward; after driving to a certain distance, the system will prompt the user to shift to Reverse gear according to the bus signal input.对于APA2，用户挂R档后，系统进入泊车过程。

For APA2, after the user shifts to R gear, the system enters the parking process

## 泊车过程/Parking Process

泊车过程包括泊入车位过程和泊出车位过程。当车辆进入泊车过程，系统需要显示RVC或360影像，并根据APA模块发送的总线信号显示对应的文字说明给用户。此时系统显示的影像是RVC还是360需要根据标定判断。针对只支持RVC的车型，在泊车过程中均显示倒车影像。图像显示比例，尺寸等参数以交互设计为准。

The parking process includes parking into/leaving the parking space. When the vehicle enters the parking process, the system needs to display the RVC or 360 image, and display the relevant text description to the user according to the bus signal sent by the APA module. At this time, whether the image displayed by the system is RVC or 360 needs to be judged according to the calibration. For models that only support RVC, reversing images are displayed during parking process. The image display scale, size and other parameters are subject to the interaction design.

泊车过程需要系统提供两类信息提示，一类为文字提醒，一类为进度显示。所有提示信息均根据总线接口由APA模块通知到VCS系统进行展示。其中进度显示仅在车辆进行倒车或前进的过程中进行展示。

The parking process requires two types of message prompts: one is text reminder and the other is progress display. All prompt messages are notified to the VCS system via APA module according to the bus interface. And the progress display is displayed only when the car is reversing or driving forward.

系统需要展示本次倒车/前进进度（并非整个入库过程的进度），并显示文字提示用户随时准备刹车或控制方向盘。倒车/前进进度会由底层信号随时通知上层。当本次倒车/前进结束，即进度为100%后，系统需要根据总线信号显示提示用户刹车、换倒车/前进档或入库结束。

The system needs to show the progress of reversing/driving forward (not the progress of the entire process of parking into a garage) and display the texts prompting the user to brake or control the steering wheel at any time. The progress of reversing/driving forward will be notified to the upper layer at any time by the bottom layer signal. When the reversing/driving forward process is over, that is, the progress is 100%, the system needs to prompt the user to brake or shift to R/D gear or prompt that the parking into garage process is over according to the bus signal display.

## 错误提示/Error Prompt

APA过程中，系统会收到由APA模块发出的错误信息，当系统收到错误信息时，需要显示给用户。当APA过程未完成时，APA被打断并退出的情况下，系统需要通过popup提示用户自动泊车辅助解除，并根据总线信号显示对应错误信息。具体提示信息参考表格”APA interface” ，具体文言提示内容以交互设计为准。

During the APA process, the system will receive an error message sent by the APA module. The error message received by the system should be displayed to the user. When the APA process is not completed, the APA is interrupted and exits, the system should prompt the user to automatically release the parking assistance through popup, and display the relevant error message according to the bus signal. Refer to the table "APA interface" for specific prompt message. The content of the text prompt is based on the interaction design.

## 性能相关/Function-related Requirements

对一般底层信号的响应，需要在50ms以内完成。

The response to the general bottom layer signal needs to be completed within 50ms.

切到入库影像，需要500ms以内完成。

Switching to “in garage” image should be completed within 500ms.

按键触发底层信号改变，需要在50ms内完成。

Changing the bottom layer signal by triggering the button should be completed within 50ms.

## 功能优先级/Function Priority

APA功能的优先级不~~应~~低于RVC/360，在RVC/360界面下按APA按钮会立刻进入APA界面（RVC/360会在档位离开R档后保留一段时间，这个时间内按下APA按钮会进入APA的界面）。APA功能R档下不生效，在R档下按APA按钮，或者当APA处在泊车准备状态时（本文第2、3章节描述的过程）挂R档，APA模块会报错并退出，系统需要显示错误信息，并且退出APA。

The priority of the APA function is not lower than RVC/360. Pressing the APA button in the RVC/360 interface will immediately enter the APA interface (RVC/360 will remain for a period of time after the gear shifts from R position. Pressing the APA button during this time will enter the APA interface). The APA function does not take effect under R gear. If pressing the APA button when the vehicle is in R gear, or engaging into R position when the APA is in the parking ready status (the process described in Sections 2 and 3 of this document), the APA module will report an error and exit. The system should display an error message and exit from APA module.

APA不抢占声音通道，在APA生效过程中，VR、蓝牙电话、media、TTS等对声音有要求的应用或服务仍然可用，只是无法显示画面以及接受触屏消息。

APA does not preempt the sound channel. When the APA is in effect, VR, Bluetooth phone, media, TTS and other applications or services that require sound are still available, but the screen cannot be displayed and the touch screen message cannot be received.

# 系统需求/System Requirements

## 账号相关/Account-related

（是否使用系统账号，是否有独立账号，是否账号打通，账号登陆推出功能情况说明等）

(Whether to use the system account, whether to have an independent account, whether the account is unified, account login & function introduction, etc.)

## 应用内设置/In-application Settings

（针对应用本身的设置项，如网络开关等，可选项）

(Optional settings for application itself, such as network switch.)

## 外部调用/External Call

（是否支持外部应用调用，三屏同步需要写，其他可选）

(Whether supporting external application calls; three-screen synchronization should be written; others are optional)

## 版本升级/Version Upgrade

（版本升级，独立升级还是随系统升级）

(Version upgrade, independent upgrade or upgrading with system)

## 相关CAN信号/Related CAN Signals



## 相关标定项/Related Calibration Items

在本文档描述的功能中，所有功能都不会受到互联的标定的影响。

All functions described in this document will not be affected by the interconnecting of the calibration.

|  |  |
| --- | --- |
| Cal name | Boolean/Enumeration Type Literals |
| P\_APA\_LEVEL | 0"Unknown";1"APA2";2 "APA2+";3"APA3";4"APA4";5"APA5";6"Reserved" |
| P\_APA\_VIRTUAL\_SWITCH | 0 "FALSE";1 "TRUE" |
| APA\_HighSpeed | 30 km/h |

**Revision Log**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Version** | **Date** | **Section** | **Description** | **Author** |
| 0.0.0.4 | Dec8.2020 | 3，3.1，3.2，3.3, 4.5 | 1. 增加描述，通常虚拟按键和物理按键只支持其中一种。   Add description. Generally, only one of the virtual key and physical key are supported.   1. 增加APA功能中需要显示哪些影响信息的定义。   Add a definition of what impact information needs to be displayed in APA functions.   1. 增加车位选择的描述与解释。   Increase the description and explanation of parking options.   1. 增加接口描述文档。   Add CAN interface description spec.   1. 在4.6节钟增加相关标定 | Wang Ziqi |
| 0.0.0.3 | Des19.2019 | 1.1，3，3.1，3.3 | Change the request from APA module.   1. Bilingual version. The document only for local APA 2. Remove the no camera case 3. APA virtual switch should let the user know whether can enable. 4. Remove choose one of two parking space feature. 5. Add APA virtual switch CAN message into interface spec. | Wang Ziqi |
| 0.0.0.2 | Aug26.2019 | All | 1. Add the bus signal list 2. Add the parking space selection function 3. Add APA virtual button | Wang Ziqi |
| 0.0.0.1 | May24.2018 | All | Create the Document | Wang Ziqi |