



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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**Multimedia systems and equipment for vehicles - Surround
view system - Part 1: General**

车辆多媒体系统和设备 环视系统 第1部分：总则

(English Translation)

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Foreword

This document was drafted in accordance with the rules provided in GB/T 1.1-2020 Directives for Standardization - Part 1: Rules for the Structure and Drafting of Standardizing Documents.

This document is Part 1 of GB/T 45715 Multimedia Systems and Equipment for Vehicles - Surround View System. GB/T 45715 has issued the following parts.

---Part 1: General;

---Part 2: Recording Methods of the Surround View System.

This document identically adopts IEC 63033-1:2022 Multimedia Systems and Equipment for Vehicles - Surround View System - Part 1: General.

Please be noted that certain content of this document may involve patents. The institution issuing this document does not undertake the responsibility of identifying these patents.

1 Scope

This document establishes a model for generating visual images around a surround view system.

2 Normative References

This document does not have normative references.

3.1 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1.1 Car

Any type of power-driven wheeled vehicle.

3.2 Abbreviations

The following abbreviations are applicable to this document.

AD. analogue-to-digital camera

ECU. camera electronic control unit

CAN. controller area network

DA. digital-to-analogue

GUI. graphical user interface 3D. three dimensional

4.1 Overview

The system model of the surround view system is shown in Figure 1. Cameras installed on the exterior of the vehicle capture visual images of the area surrounding the vehicle and project the visual data onto a 3D projection surface. The visual images can then be displayed as composite images. Images can be presented from various viewpoints depending on the shooting parameters. The number of cameras required on the vehicle, in addition to the car itself, varies depending on the size and shape of the vehicle, and it may exceed four. This model defines a four-camera system for general applications. The actual number of cameras used for each composite image will vary depending on the viewpoints. The installation positions and angles of the four cameras are calibrated in accordance with the data described in 4.2 and 4.3.

Information on display properties is available in Appendix D; information on system responsiveness is available in Appendix E.

4.2 Number of Cameras and Their Field of View

See Figure 2 for an example of the horizontal field of view of the cameras. The overlapping area and blind spot in the horizontal field of view vary depending on the number of cameras and their horizontal field of view. To obtain a better composite image, the overlapping area should be wider. The number of cameras and the horizontal field of view should be determined to ensure that there are no blind spots.

Figure 3 illustrates the vertical field of view and pitch angle ψ_{front} of the front camera and the vertical field of view and pitch angle ψ_{rear} of the rear camera. The variation in the vertical field of view blind spot depends on the camera's vertical field of view and pitch angle ψ . Appropriate vertical field of view and pitch angle ψ should be selected to ensure that no blind spots will be generated. See Appendix A.

4.3 Method for Projecting Visual Images onto a 3D Projection Surface

In accordance with the right-hand coordinate system, the length of the vehicle is the Y_{vehicle} axis, the width is the X_{vehicle} axis, and the height is the Z_{vehicle} axis. The projection surface of the camera video image is $Z_V = 0$, i.e., the road surface. The 3D projection surface used is shown in Figure 4. Figure 5 illustrates the process of projection onto the 3D projection surface. The 3D projection surface should ideally cover a 3D curved surface, as the polygonal model resembles a polyhedron. The coordinate P_V of a point on the 3D projection surface is converted into coordinate P_C based on the camera coordinate

system using the optical origin of the vehicle camera. This coordinate conversion is defined as.

MV C is the coordinate conversion matrix of the vehicle coordinate system, determined by the camera's installation position and angle. When the vehicle camera is positioned on PC to capture

4.4 Visualization of Projected Images from a Free Viewpoint

The 3D projection surface composed of a polygonal model can be visualized from any virtual viewpoint. The visualization of polygonal models uses 3D computer graphics technology. The texture image is an image updated by the vehicle camera at the system video rate. The surround view image is composed through the execution of polygon rendering; the texture coordinates are the image coordinates of the vehicle camera corresponding to the top of the polygon.

4.5 Free Viewpoint Functionality

The viewpoint, orientation, and field of view parameters of the virtual camera can be freely adjusted during polygon rendering. By altering parameters of the virtual camera, the vehicle's surrounding environment, and driving conditions, the viewpoint can be changed. By continuously changing these parameters, animated images between different viewpoints can be smoothly adjusted.

5.1 Camera

The camera lens should ideally be isotropic and have rotationally symmetric distortion characteristics along the optical axis. See Appendix B.