1 CONTENTS

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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THE CONCEPTUAL MODEL OF STANDARDIZATION FOR MULTIMEDIA CAR SYSTEMS AND EQUIPMENT

FOREWORD

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IEC TR 6XXXX, which is a technical report, has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
XX/XX/DTR	XX/XX/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

320 The committee has decided that the contents of this publication will remain unchanged until
321 the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data
322 related to the specific publication. At this date, the publication will be

323 • reconfirmed,
324 • withdrawn,
325 • replaced by a revised edition, or
326 • amended.

327

328 The National Committees are requested to note that for this publication the stability date
329 is ….

330 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE
331 DELETED AT THE PUBLICATION STAGE.

332

INTRODUCTION

This Technical Report is initiated by the study session 5 in AGS/TC 100 and made by stage 0 project, PT100-9. The study session 5 was formed to study car related issues of TC100, the study session 5 proposed stage 0 project, it was approved and assigned as PT100-9.

The equipment and systems under the scope of TC 100 are firstly used in residential domains such as in home, school, office, etc. And now these are used in mobile domains such as in car, train, airplane, ships and with individuals as movable, carryable or wearable device. These new domains require the different specification than the conventional residential domains.

PT100-9 focuses on the car domainr. At first, this TR clarifies the conceptual model of car related issues under the scope of TC100, and then the details are described to understand the standardization items of car related issues under the scope of TC 100.

THE CONCEPTUAL MODEL OF STANDARDIZATION FOR MULTIMEDIA CAR SYSTEMS AND EQUIPMENT

1 Scope

This Technical Report specifies the conceptual model of multimedia systems and equipment which are utilized for car, this model describes possible standardization items.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC/TR 61998 ed1.0 (1999), *Model and framework for standardization in multimedia equipment and systems*

IEC/TS 62045-1 ed1.0 (2006-12), *Multimedia security - Guideline for privacy protection of equipment and systems in and out of use - Part 1: General*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
car main system
main AV and multimedia system installed in car

3.2
working and functional mode
mode of various car's working and function

3.3
function and specification mode
mode of TC 100 system depending on working and functional mode

3.4 UX mirroring
UX mirroring is one of user-convenient functions provided by smart devices including a smart car, and provides users with personalized experience(UX) such as reorganizing or reordering user interfaces and relevant contents by sharing a user's personal preference and usage information in advance among them.

3.5 Picture navigation
Picture navigation is an infotainment service that allows users to find location with geotagged pictures, which contain latitude and longitude coordinates of the place where they are taken. The location can be set as a point of departure or destination.

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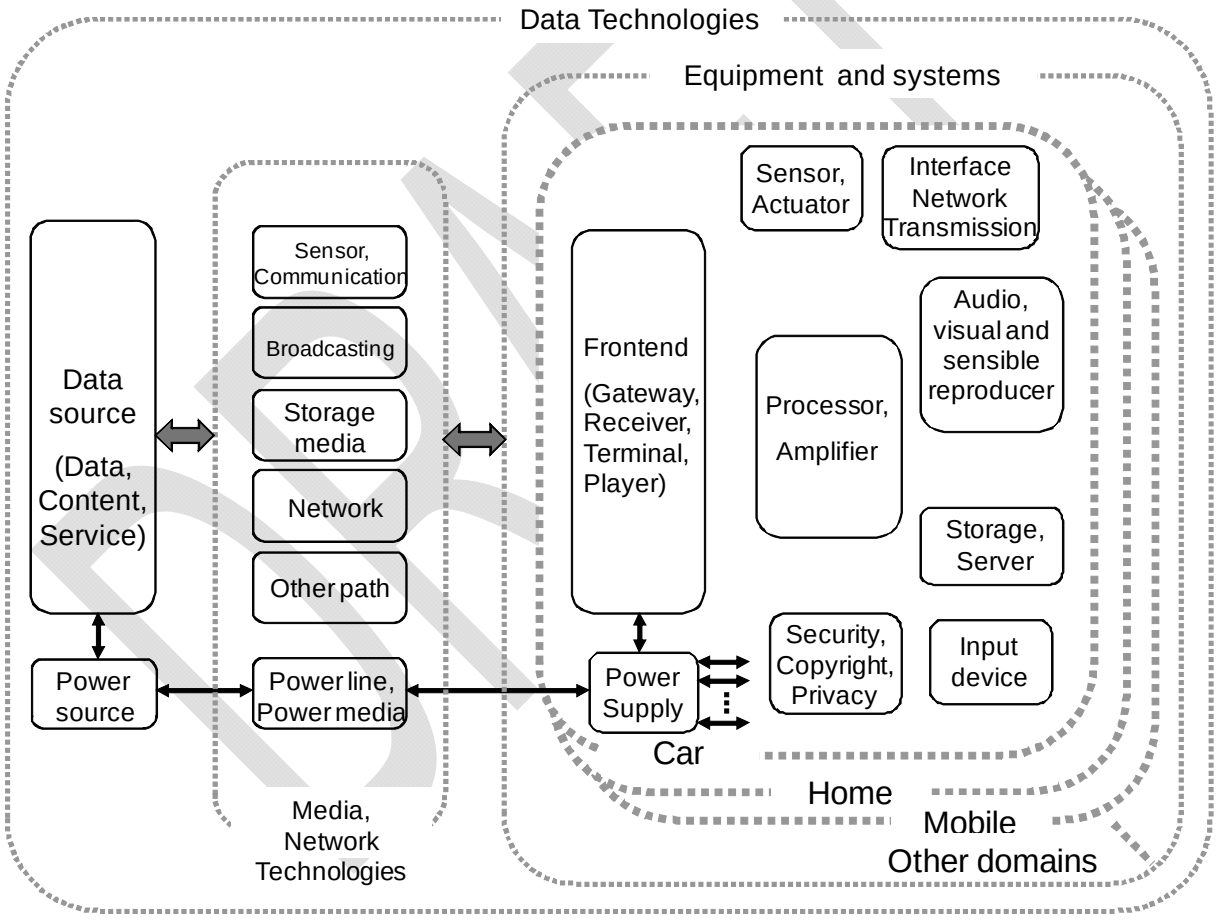
390 4 Overview of the car system

391 The TC100 system model from the point of data communication, it is described in Figure 1.
392 Whether the application area is car, home or any kind of domains, this model is applicable.
393 The TC 100 system model of car is basically uses this model as audio video and multimedia
394 systems and equipment, and infotainment system.



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396 **Figure 1 – TC100 system model by data communication**

397 The communication model between the system and user is described in Figure 2. This is TC
398 100 model and it is applied to car. The user is driver, passenger, pedestrian in car domain
399 and users in other domains.

400 The communication between TC 100 models is described in Figure 3. This communication is
401 between, TC 100 model via user and TC 100 model, TC 100 model via user and TC 100
402 model via use, and TC 100 model and TC 100 model.

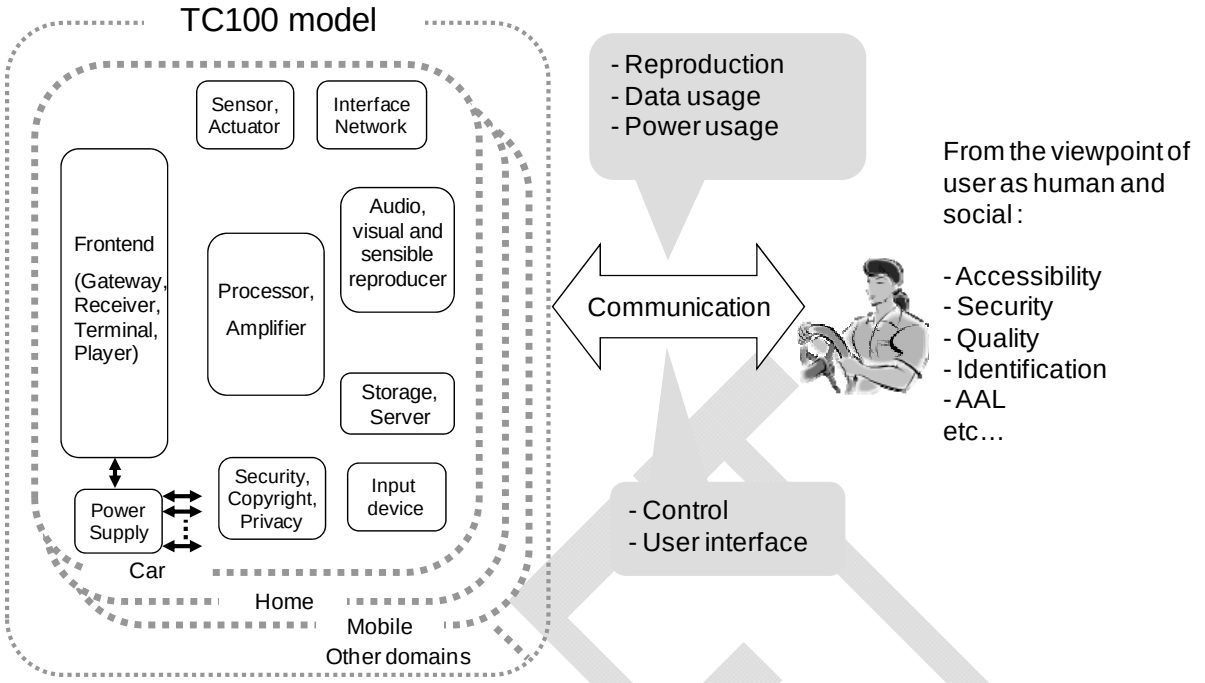


Figure 2 – User communication model

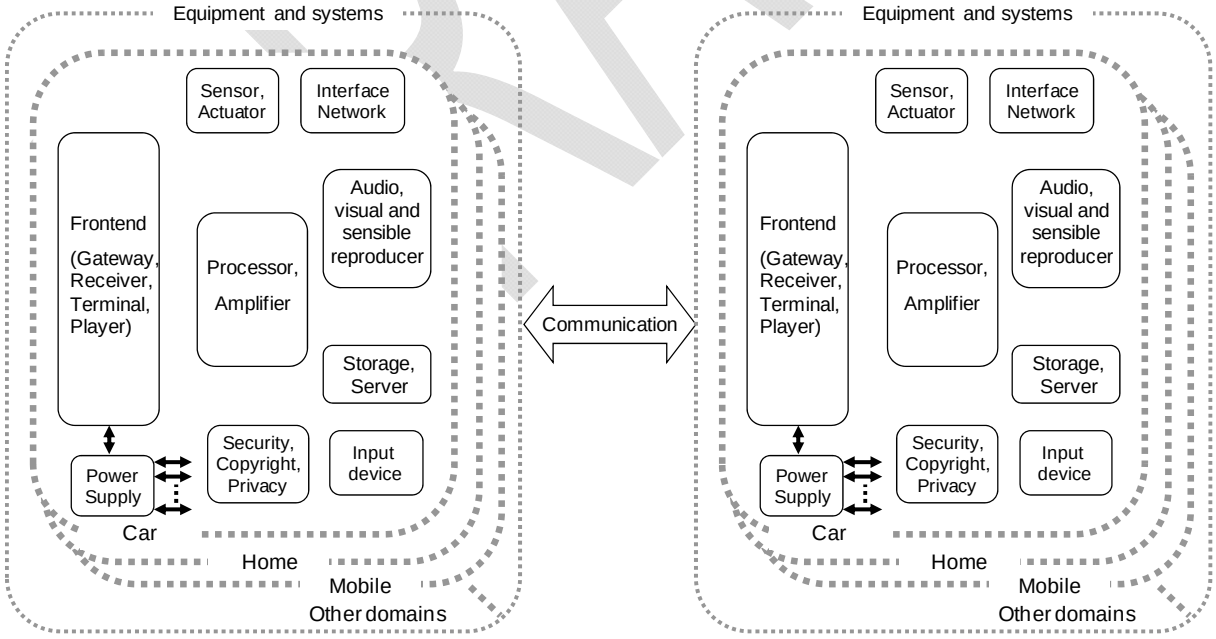
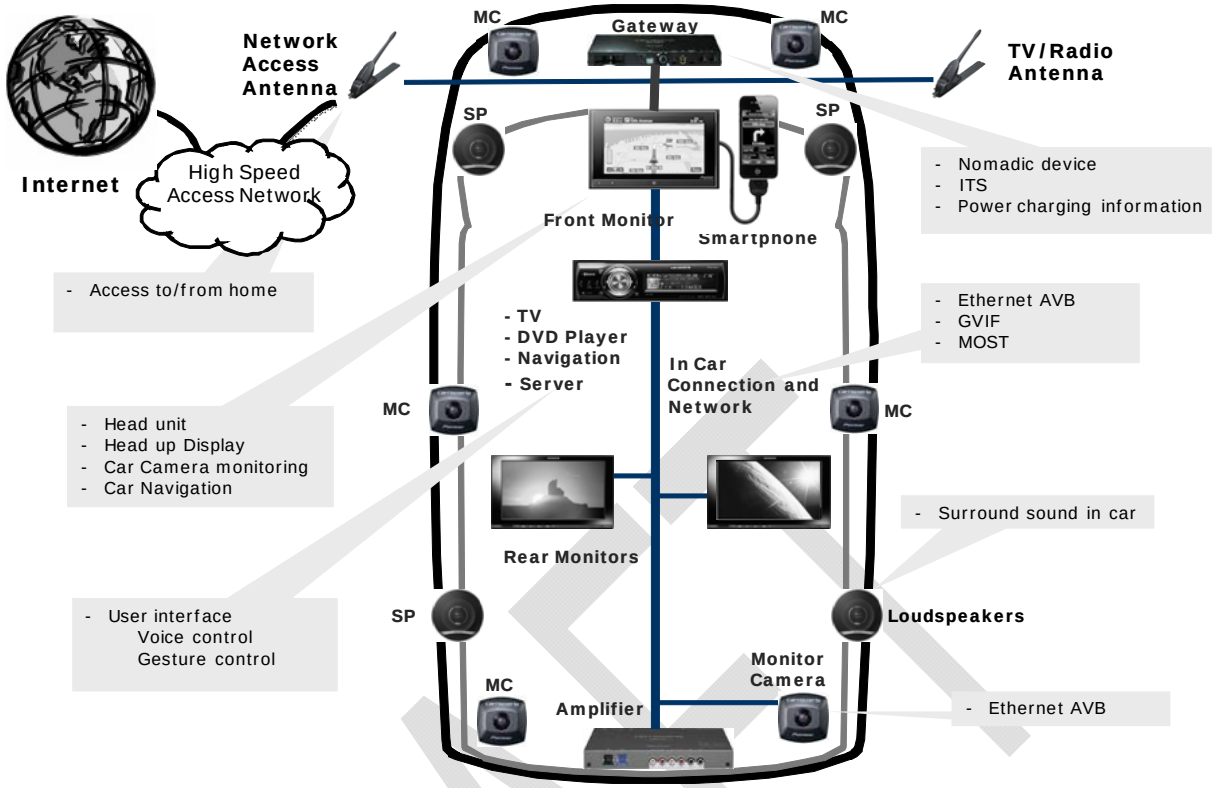


Figure 3 – Communication between TC100 models

For the car system model, more concrete model is described in Figure 4.



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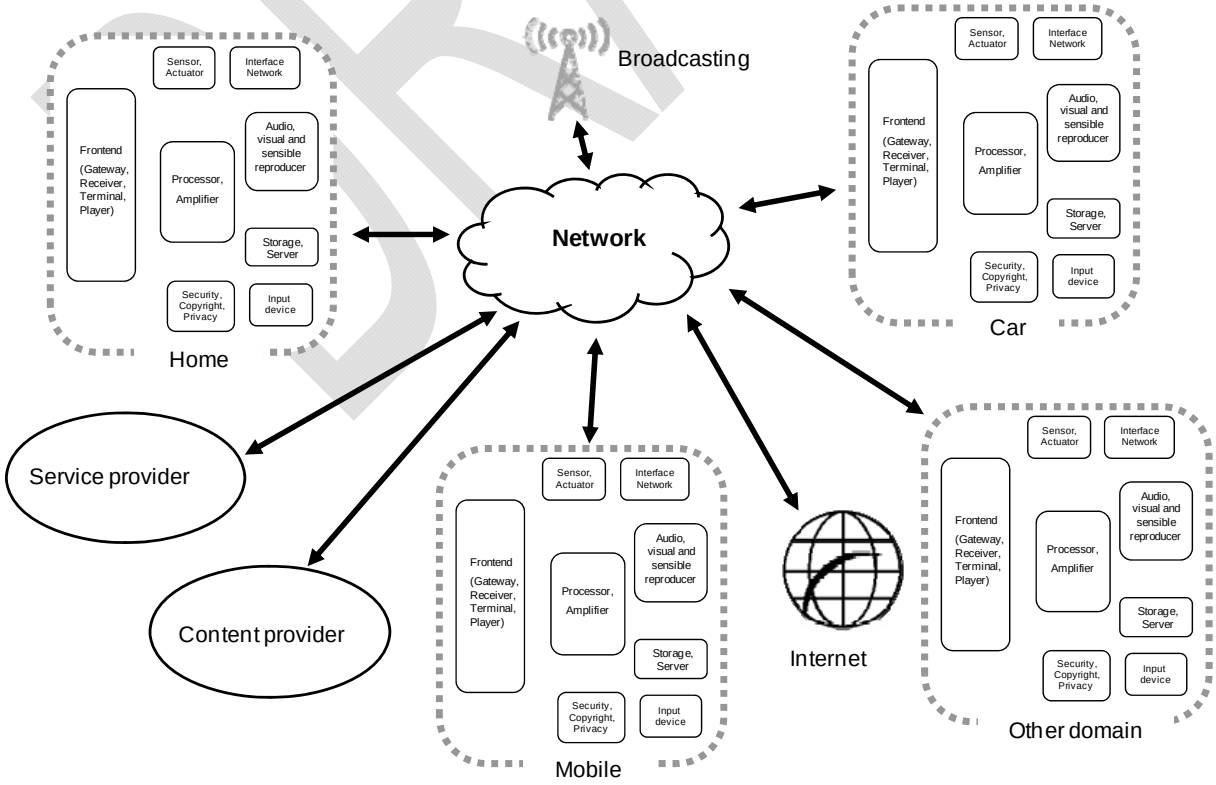
413 **Figure 4 – Car model**

414 The car system, the home system and the mobile system are related each other with network
415 communication and services, it is described in Figure 5.



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417 **Figure 5 – Networked systems**

5 Use case

5.1 General

As the one of TC100 system, the car system has the similar use case to the home system use case. The different aspect is that the car system is movable on road and land, and autonomous. The use case should take the following characteristics of car system into account;

- movable and autonomous, self energy supply,
- various working and functional modes of the car main system depending on the condition of car such as drive, cruise, stop, park and refuel or charge,
- human users are driver, passenger, pedestrian in and around car, and remote users from car,
- users remote form car are other human, non human such as TC100 model ~~and other~~ over the network.

The ~~W~~working and functional mode is particular to the car system, the car main system and each device have a specific function and specification depending on that mode. Each ~~A m~~mode has its function and specification relating to the condition of car. The mode will shifts to other modes depending on the condition of car.

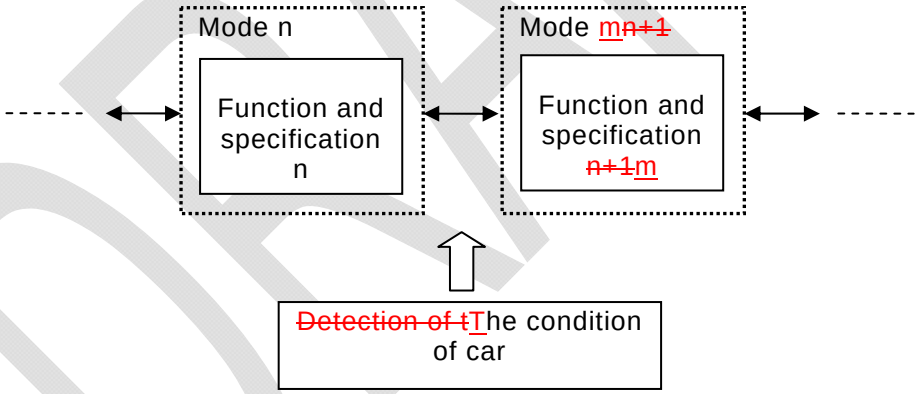

Figure 6 – Modes

For instance, using e-mail in each mode is done as follows,

– when car is stopping, all function of e-mail is available for driver,

– when car is driving, some restricted function is available for diver's safety, as text-to-speech to read e-mail, speech-to-text to send e-mail, or only e-mail notification on display device,

– when car is at rest, e-mail is stored and forwarded to other if necessary,

– when some urgent event is happed, alert e-mail is sent automatically.

Any other infotainment and services have the similar mode dependent function and specifications~~s~~.

5.2 Use experience ~~Smart start~~ system

5.2.1 General

Use experience system provides user integrated services and experiences. This system consists of mixture of other systems.

5.2.2 Smart start

Users can remotely control infotainment or audio visual system with a smart device before getting in a car, also if accessing to the CAN and car control system, user can adjust temperature inside a car, unlock (or lock) car doors, or start a car ~~with a smart device before getting in a car~~.

5.2.3 UX mirroring

Once a smart car is connected to the user's smart device via wireless communications such as Bluetooth or Wi-Fi, the user can choose to start UX mirroring service. Then a personalized menu screen is displayed on a display device of a smart car based on the usage pattern of the smart device. For example, icons for frequently used application appear bigger.

5.2.4 Data synchronization

Smart devices and a smart car can synchronize in real time various user data including navigation system setting, time schedule, and so on.

5.3 Infotainment system

~~5.2~~5.3.1 General

Infotainment system is adoption of any of information service that is online and offline, such as e-mail, web, social network, information services and any Internet services.

The function and specification of infotainment system has various mode depending on car working and functional mode and users. The mode will shift as it is required and needed by user or other.

5.3.2 Picture navigation

Navigation system of the a smart device or the a smart car can find a location with geotagged pictures which include contain latitude and longitude coordinates.

5.3.3 Car office system

5.3.3.1 Under-light office

Users make a list of tasks with the estimated time. Office system will let them implement tasks whose estimated time is short while they wait traffic signals.

5.3.4 Vehicle social network

Communication among cars can give users the opportunity to exchange traffic information such as vehicle speed, traffic accidents and congestion ahead. A smart car can gather (or get) such information by experience (or by other smart cars running on the opposite lane). This information can be visualized on a display device, or verbalized, or given in other optimized ways for users.

5.3.5 Panoramic vision

360-degree panoramic view around a smart car can be reconstructed from video images from cameras installed around a smart car, which helps users see blind spots easily and drive more safely.

5.3.6 OBD-based car maintenance service

On-board diagnostics (OBD) systems give users access to the status of various vehicle sub-systems through their smart device. Users can manage their cars on their own.

~~5.3~~5.4 Navigation system

~~5.3.1~~5.4.1 General

Navigation is a guidance system for user/driver to drive or live in the car, it is a useful or necessary information system. The information system consists of each information is ~~descried~~described as follows. Combination of any of this information provides the navigation system.

~~5.3.2~~5.4.2 Surrounding information

The surrounding information around car is visual, audio ~~and~~, atmospheres such as temperature, air pressure and geographical information of road and land.~~.~~

For instance, surround visual monitor provides the view around the car, it has the same various function and specification modes. This is not function~~al~~ as mirror dose but provides user visual information as infotainment.

Other sensors also provide surrounding information with the same various function and specification modes.

All of these information can be used for car navigation including auto driving support. –

~~5.3.3~~5.4.3 Geographical information

The position of car is one of factor of navigation, it is provided by GPS, gyrocompass, and network system.

~~5.3.4~~5.4.4 Drive information

This information is history and plan or foresee of car diving on the geographical map. User drive the car with this information or navigation system assists drive and driver. This has the same various function and specification modes.

~~5.3.5~~5.4.5 Car information

This information is condition and the status of car that is such as temperature, humidity, speed and fuel status of the car system. The atmosphere in the car is informed by TC 100 model but the information of the car system exists inside the car system. If the secure gateway to CAN allows assess, TC 100 model can get information.

This information can be monitored over network by other user.

~~5.3.6~~5.4.6 Event information

Event is various status change of car and effect on car from outside and inside such as change of acceleration, raining, turning on/off light. These are recognized by sensor or car control system, this information can be used to trigger shifting car working and functional mode.

~~5.4~~5.5 **Audio Visual entertainment system**

~~5.4.1~~5.5.1 **General**

This is the same as home system, in addition the function and specification mode is applied.

5.5.2 3D audio system

The inside of a car is suitable for 3D audio. This characteristic is applied to listen music and it can provide effective notification sound.

5.5.3 Emotional service

5.5.3.1 Emotion-based music streaming

A smart car can recommend users listening to a series of songs selected based on their emotion, which can be sensed by measuring heart rate or something from their wearable device.

5.6 Parking concierge system

When a smart car enters a parking lot where advanced beacon system providing indoor positioning function is equipped with, an application program on the smart car starts automatically and displays a map of the parking lot with empty parking slots highlighted on a display device in a smart car. After the user finishes parking, the application program stores the location and shares it with user's smart device.

5.7 Car monitoring system

Though users are away from their smart cars after parking, they can watch what is happening around their cars through their smart device connected to a black box installed in a smart car. Users can also get various types of alarm messages from their smart car.

5.8 Self-emergency call system

In the case that a user gets severely injured from a traffic accident, a smart car can make a self-emergency call for rescue. In order to do that, a smart car can sense the degree of collision and check the user's status.

6 Networked system

6.1 General

The car system is networked as described in Figure 5. With this networked system, the car system acts as an integrated system with other car system, home system, mobile system and network services.

6.2 Network inside of car

6.2.1 Car status information

The electric and electronic system of car has its own information, which is mainly information regarding car control and driving. These car information are important information for safety and security of the car, they must be secured from outside access of the car. Car information

is environment status information such as air condition and temperature, door status, glass status, and driving status information such as speed, tire status. These car status information may be accessible from outside if security and safety is guaranteed by such as secure gateway.

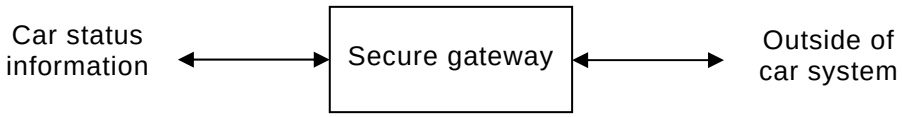

Figure 7 – Car status information

6.2.2 Infotainment system network

The network for infotainment system is used for various devices and equipment inside car. The network or interface is used for audio visual and information reproduction devices and it is also used for video, audio and other environment information of out side of car, inside of car and car itself, these information are networked or interfaced to the processor or any other devices.

For instance, sensors capture information regarding drive, e.g. view of car front, audio around car, acceleration information, and geographical information are networked. This information is monitored or recorded in car, also communicated to the network outside of car through gateway.

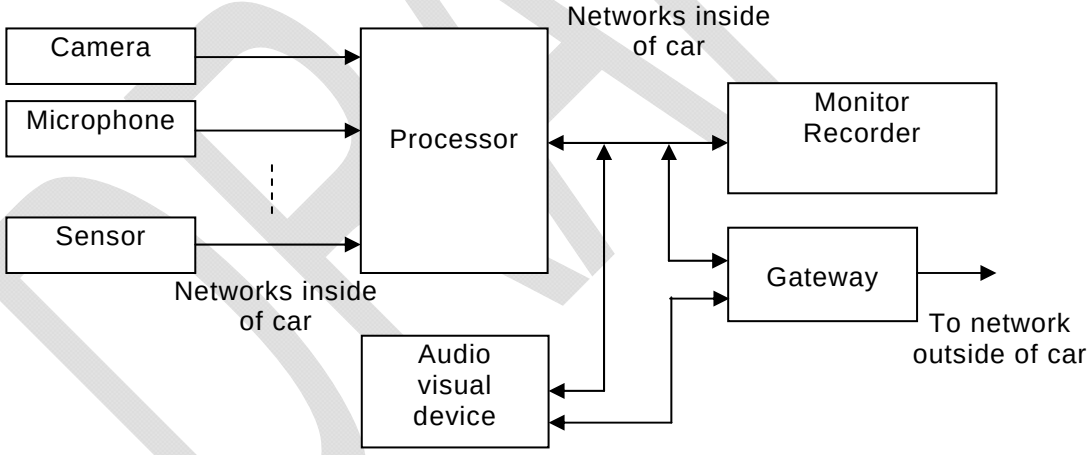

Figure 8 – Infotainment system network

The method of the network may be ether/LAN based network or any other networks, the network should have the ability to be applied to all kind of information and control inside car.

6.2.3 Network of devices

6.2.3.1 AV devices and smartphone

AV devices especially mobile devices and smartphone can be used inside car, these devices are connected to the car main system. Main device controls and uses these devices with more efficient controller and reproduction devices. The network and interface to the car main system may be dedicated one or any others existent one. The network used for smartphone is described in Annex A.

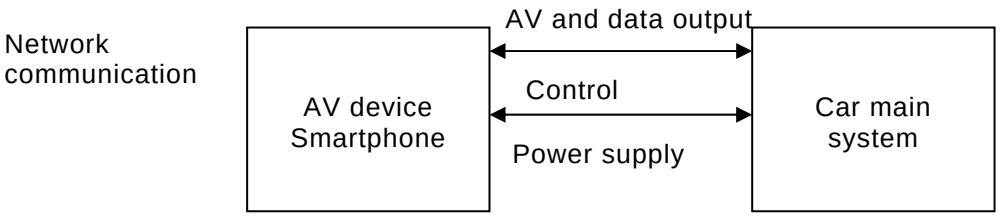

Figure 9 – AV devices

6.3 Network outside of car

6.3.1 General

The network may be IP based network, data model, format and protocol needs car specific specification.

6.3.2 Network between car and car

Car to car communication is done by peer-to-peer and client-server system. One car's system and equipment communicates with other cars' system and equipment. This means a user of a car uses mutually other car's AV&IT resources.

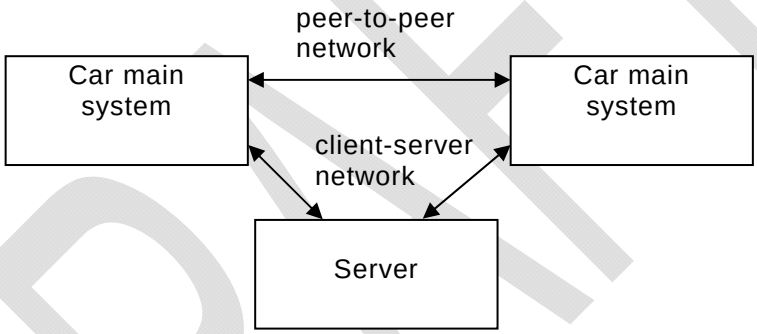

Figure 10 – Network between car and car

6.3.3 Network between car and home

Communication between car and home is done by peer-to-peer and client-server. Car's system and equipment communicates with system and equipment in home.

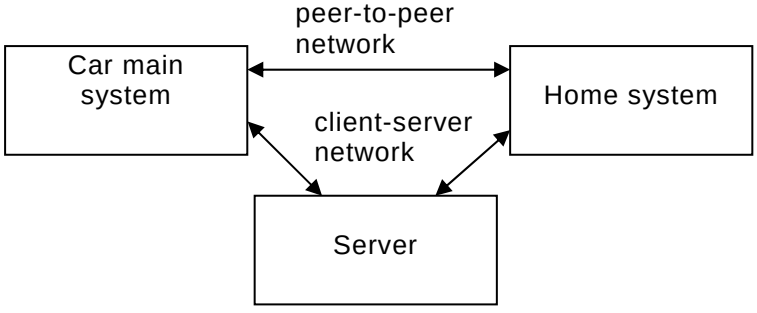

Figure 11 – Network between car and home

6.3.4 Network with cloud servers

Network with cloud is all other networks other than peer-to-peer networks. Any kind of services are applied to these networks, therefore there are many kind of data formats and protocols are applied. To use services among cars, the minimum compatibility should be considered.

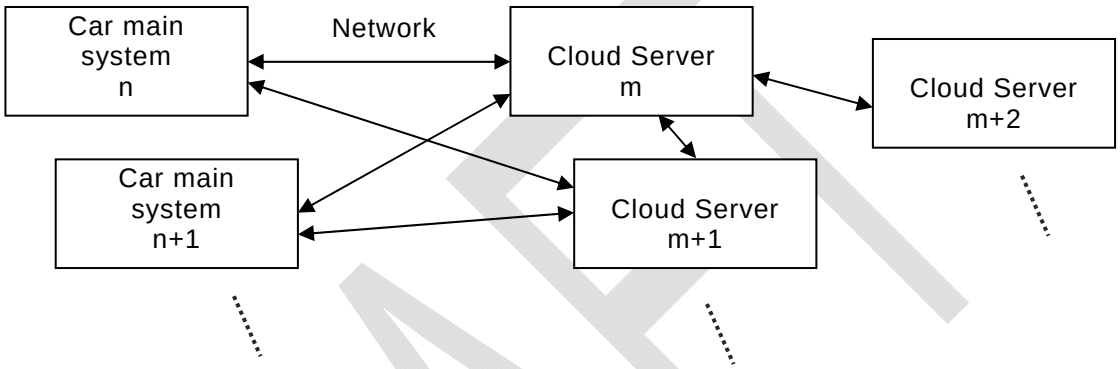

Figure 12 – Network with cloud

7 Elements

7.1 Device

7.1.1 Source

Source device provides audio video and information data of content. It is dedicated device for car or not dedicated device which is loaded in car. The both devices are under the environmental condition of car that is moving, under large range of circumstance parameters, and wireless communication.

Moving requires tolerance to vibration and acceleration, large range of circumstance parameters requires temperature range, humidity range and light range, and wireless communication means that communication is not stable.

7.1.2 Sink

Sink device receive content data and reproduce it. It is dedicated device for car or not dedicated device which is loaded in car.

The environmental conditions are the same as source deice, the requirement is the same.

7.1.3 Sensor

7.1.3.1 Camera and microphone

Audio and visual information are captured by camera and microphones for inside and outside of car.

7.1.3.2 Geographical sensor

Sensors can be used by car which is moving to obtain geographic information of circumstances, car itself and other cars and objects. They are radar, GPS, WiFi information, geomagnetic sensor, navigation information and signage information.

7.1.3.3 Circumstance sensor

Sensors capture information of moving car, they are temperature, air pressure, light, acceleration,

7.1.4 Output device

Audio visual reproduction devices and other reproduction device for human sense.

7.1.5 Car black box device

Car black box devices are necessary to record video around the car.

~~7.1.5~~7.1.6 Mobile device

Mobile, carryable and wearable device can be loaded in car.

Wearable device is very close to driver or passenger, it can be a human interfaec for multimedia car systems and equipment.

7.2 Network and interface

7.2.1 Inside of car

For multimedia car systems and equipment, all network and interface that are used for home system can be applicable.

The interface between car control system and multimedia car systems and equipment should have a gateway to ensure from interfere car control system. This means that necessary information of car control system can be transmitted to multimedia car systems and equipment but multimedia car systems and equipment cannot access to car control system.

7.2.2 Outside of car

For multimedia car systems and equipment, all network and interface that are used for home system can be applicable.

The gateway to outside of car is similar to home system. The security of gateway should to be more improved than home system, the path form outside to car control system should be strictly inhibited.

7.3 Information

7.3.1 File format

For multimedia car systems and equipment, all file formats that are used for home system can be applicable.

7.3.2 Metadata

For multimedia car systems and equipment, all file formats that are used for home system can be applicable. In addition car system specific metadata is specified. It is caused because of car nature that is movable and autonomous. Autonomous system senses the outside world and moves, metadata regarding that nature is specified.

7.4 User interface device

7.4.1 General

Users as driver, passenger and pedestrian communicate with car system with interface device.

7.4.2 Audio reproduction device

Loudspeaker is applied with optimization to the space of inside car, and to unbalanced listener position.

7.4.3 Video reproduction device

7.4.3.1 Monitor

Monitor used for visual content is the same as home and mobile system used.

7.4.3.2 HUD

Head up display is used especially for car, there are attached to car glass type and installed in car glass type.

7.4.3.3 Display installed in car body

Monitor can be a part of the car body, front glass can be a display and the car body inside and outside can be a display.

7.4.4 Input device

7.4.4.1 Voice or human recognition

Voice recognition is used in car. It should be considered that noisy environment and talker reorganization.

7.4.4.2 3D gesture

Gesture can be used in car as same as home or mobile system, it should be considered that it does not affect driver's operation of car.

7.4.5 Output device

7.4.5.1 Audio device

Audio device is used as audible interface to user.

7.4.5.2 Video device

Not monitor but used as visual interface to user.

7.4.5.3 Sensible device

Any sensible device can be used as interface to user.

7.4.6 Wearable device

Wearable devices are very close device to user, these can be used as user interface between car main system and user.

8 Measurement method

8.1 General

The method for car should consider circumstances of car for each measurement.

8.2 Audio video device

The method for audio video devices is the same as home system, in addition car circumstances such as vibration and acceleration, high and low temperature should be considered.

8.3 Sensor device

Any kind of source device should apply circumstances as audio video device.

8.3.1 Camera

Camera device need to be measured under the wide range of light and luminance conditions.

8.3.2 Other sensor

Other sensor devices need to be measured under the wide range of light and luminance conditions.

9 Content

9.1 General

Content used in car system is the same content as used in home system, in addition infotainment system needs car specific content in some cases.

9.2 Infotainment content

9.2.1 Map

Map content is specific for car system. Map content for car needs further information than the usual maps, they are information for car navigation and information of any kind of regional information including business issues such as signage. Also map is integrated with other infotainment information described in followings.

9.2.1.1 Map format

The format for map content for car should be made as high-functioning map. There are many kind of information regarding car map, electric map formats are defined by ISO and other SDOs but the map for infotainment of car need to be clarified.

9.2.2 Traffic and road information

This information is provided by other system than TC 100 system, for instance ITS and telematics are cases. However any services of Internet can be used for TC 100 system including such kind of information.

9.2.3 Drive information

Drive information is created by the car activities, such as view and sound information around car and event information. It is also created by other car.

9.2.4 Network service information

Content and information from network services are the same as used in home system, in addition car specific content and information is provided.

9.2.5 Car maintenance information

OBD-II system provides various vehicle information such as fuel economy, driving habits, diagnostic trouble codes and so on.

9.3 AV content

This is the same as home system.

10 Security

10.1 General

There are two aspect of security about car. One aspect of security is data security, data of content and information in multimedia car system and equipment should be secured, that data include copyright, intellectual property and privacy. In general, TC100 guideline's security criteria and IEC 62045-1 can be applied to make multimedia car system and equipment secure. IEC 62227 can be applied to ensure the copyright information. IEC 62443 can be applied to be secure network. Any DRM method and copy control information can be applied.

Another aspect of security regarding car is that car and drive system have a responsibility for user's safety, multimedia car system and equipment should not affect that safety. Multimedia car system and equipment may have a path to car and its drive system, data communication through that path should not affect car and drive system and should be secured. Also multimedia car system and equipment can affect driver of car, that should not affect driver's car operation.

10.2 Networked systems and equipment

Network inside and outside of the car is a path from outside of the car, these networks can be an intrusion path to the car and the drive system. This path is described in Figure 5, and also the paths described in Figure 1 as paths to data, content and service. This path should be secured.

Copyrighted content and private information are stored in the car system, the system connected to outside such as home or cloud, the network and the car system should be secured to prevent unauthorized access to the content and information.

The networked outside system can access to the multimedia car system through the network even to the car driving system, this may caused serious danger for user as driver, passenger and pedestrian. This access from outside should be prevented and the system should be made to be secure against these accesses.

10.3 None networked system and equipment

None networked system and equipment has no path from outside trough network, it has a path from outside through its hardware paths. IEC 62045-1 describes about that paths.

Copyrighted content and private information in none networked system and equipment should be secured from outside access.

None networked multimedia car system and equipment has a path from outside access, the access from outside should be prevented and the system should be made to be secure against these accesses.

11 Regulation

Regulation regarding car is settled in each region and country. TC 100 ~~standardaization~~standardisation does not enter to that regulation area.

However, outside of regulation can be a standardisation~~d~~ item. For instance, camera and monitor system as a mirror replacement~~d camera and monitor system~~ is recognized as the same as the legacy mirror in some regulation because it is recognized as a safety device. TC 100 can standardize items outside of safety.

Annex A
(informative)

Network for smartphone

Smartphone can be a main device of the car main system including navigation system. Also, smartphone can be a part of the car main system.

In case of the main device, all control and communication is done by smartphone, audio and video reproduction and control can be done by devices of the car main system. In case of a part of the car main system, the control is done by the car main system, the communication between smartphone and the car main system is done with interface and application such as web server application.

Figure A.1 shows the main device case, Figure A.2 shows the part of the car main system case.

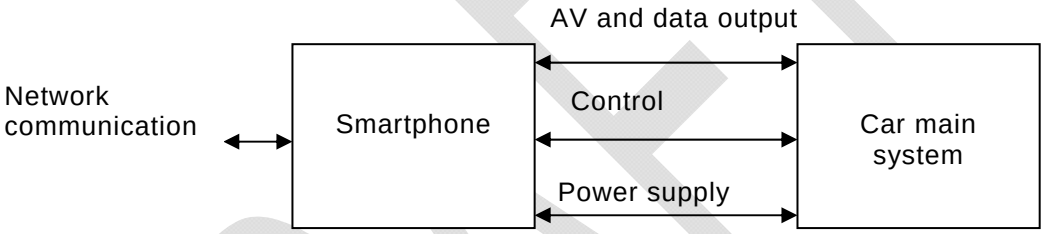

Figure A.1 – Main device case

The main device case, smartphone is functional centre, all network communication is done by smartphone. Control, interface and output are connected to the external device which has more efficient display, loudspeaker, microphone and user interface than smartphne has.

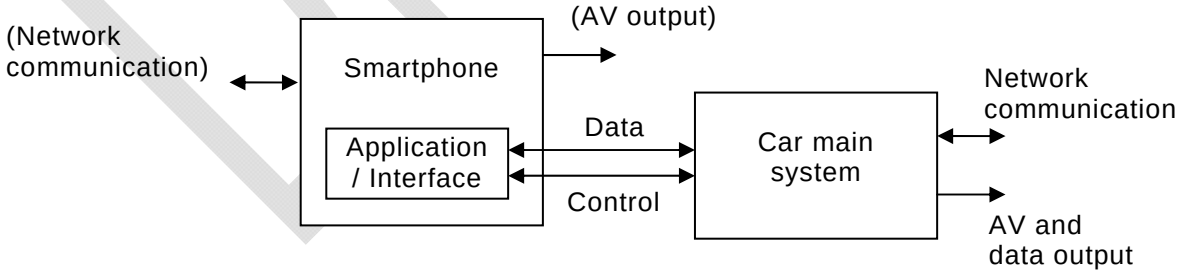

Figure A.2 – Part of the car main system case

In the part of the car system case, smartphone is a part of the car main system, the car main system uses and control smartphone with interface or application. Network communication is done by the car main device, or smartphone can do whole of communication or part of communication. Audio, video and data reproduction and control is done by the car main system.

Annex B
(informative)

IEC standard for security

Car multimedia systems and equipment should be secured for copyright, privacy and safety. Some IEC standards specify security issues as follows.

IEC 62045-1 ed1.0, *Multimedia security - Guideline for privacy protection of equipment and systems in and out of use - Part 1: General*

– This Technical Specification gives the guideline for methods for the protection of the user's privacy and access to content in consumer equipment and systems from outside except network access.

IEC 62227 ed1.0, *Multimedia home server systems - Digital rights permission code*

– This International Standard defines the permission code, a set of permission related information in short code form, the permission code is comprised of a common ID system to control and register the right of content.

IEC 62443 series, *Security for industrial process measurement and control - Network and system security*

– This series of International Standard, Technical Specification and Technical Report specifies secure method against cyber attack through network.

876 Bibliography

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