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**File structure for interactive mobile comic and
animation content**

Recommendation ITU-T T.621



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Recommendation ITU-T T.621

File structure for interactive mobile comic and animation content

Summary

Recommendation ITU-T T.621 defines an interactive mobile comic and animation file structure used for organization and storage of mobile animation contents. It consists of a header, a resource file list, an asset list, an index of all movies and a movie list that contains animation and interactive attributes. This Recommendation can be used as a guideline for creation, processing, transmission and play of mobile animation contents.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Animation, comic, file structure, interactive, mobile.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

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Recommendation ITU-T T.621

File structure for interactive mobile comic and animation content

1 Scope

This Recommendation defines an interactive mobile animation file structure used for organization and storage of mobile animation files.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is published regularly. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[IETF RFC 1321] IETF RFC 1321 (1992), *The MD5 Message-Digest Algorithm*.
<https://tools.ietf.org/html/rfc3174>

[ISO/IEC 16262] ISO/IEC 16262:2011, *Information technology – Programming languages, their environments and system software interfaces – ECMAScript language specification*. <https://www.iso.org/standard/55755.html>

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this recommendation

This Recommendation defines the following terms:

3.2.1 action: The changes caused by user behaviour that can be used as outputs of an action track.

3.2.2 animation object: An object that contains an asset and the information of its changes over time.

3.2.3 asset: A digital material used to make animations, including bitmaps, vector diagrams, texture, subtexture, sound or movie clips.

3.2.4 behaviour: User interactions that can be used as inputs of an action track.

3.2.5 movie clip: A container that can hold one or more animation objects.

3.2.6 subtexture: A part of texture that can be used independently. A subtexture contains information about its size and offset position in a texture.

3.2.7 texture: A bitmap image that can be applied to a surface in computer graphics.

3.2.8 track: A set of data that describes the changes of a single attribute in an animation object.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

GPS	Global Positioning System
ID	Identification
JSON	JavaScript Object Notation
MACF	Mobile Animation and Comic File Formats
MD5	Message-Digest Algorithm 5

5 Conventions

The file structure described in this Recommendation is called mobile animation and comic file formats (MACF).

6 Data types

The data types used in the animation file structure are listed as follows:

NUMBER	Numeric type. Double-precision floating-point data type.
BOOLEAN	Boolean type. The value is either true or false.
STRING	String type. The string length can be 0.
ARRAY	Array type. An array is a collection of data elements that are sorted in a certain order.
OBJECT	Object type. The object type contains the data type of the subfields.

7 File structure

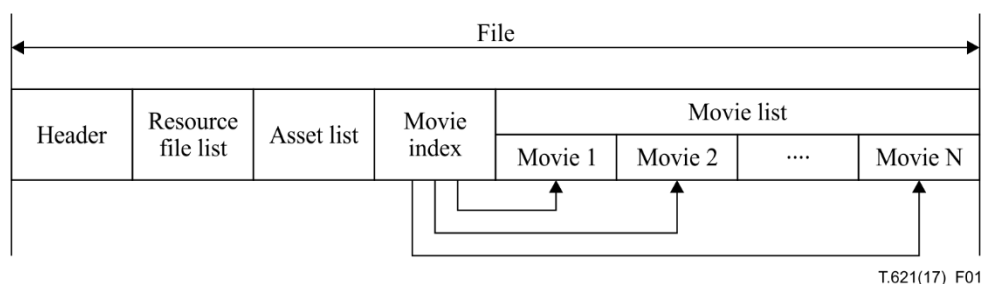
This clause defines file structure. Data in the file structure is carried in key/value pairs. The recommended file format is JavaScript object notation (JSON) that is defined in [ISO/IEC 16262].

7.1 File name extension

The recommended file name extension is mobile animation and comic file formats (MACF).

7.2 Basic file structure

A file consists of a header, a resource file list, the index to a movie in the asset list and one or more movie markers as shown in Figure 1.



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Figure 1 – Structure of the file body

7.3 Header

The header describes basic information about the file. Description attributes include, inter alia, file name, author, keywords and description.

The key of the header is "head" and the value is an object. Table 1 describes the structure of the head field.

Table 1 – Structure of header

Field	Type	Mandatory (Y/N)	Description
head	OBJECT	Y	The head field contains relevant information about the file content.

Table 2 describes the attributes of the header object.

Table 2 – Attributes of header object

Field	Type	Mandatory (Y/N)	Description
version	STRING	Y	Major version of the file in MACF format. Backward compatibility cannot be ensured if the major version changes.
subVersion	STRING	Y	Minor version of the file in the MACF format. Backward compatibility cannot be ensured if the minor version changes.
name	STRING	Y	Official name of the item corresponding to the file.
volumeCount	STRING	Y	Total number of episodes of the item corresponding to the file.
volume	STRING	Y	Current episode of the item corresponding to the file.
keyword	ARRAY	Y	Keywords of the item corresponding to the file, separated by comma (,).
language	STRING	Y	Language used in the item corresponding to the file, such as Chinese or English.
description	STRING	Y	Detailed description of the item corresponding to the file.
author	ARRAY	Y	Names and detailed description of the company and persons creating the file.
date	STRING	Y	Date when the file is created.
producer	ARRAY	Y	Names and detailed description of the company and persons producing the file.
produceDate	STRING	Y	Date when the file is produced.
publisher	ARRAY	Y	The name and detailed description of the company publishing the file.
publishDate	STRING	Y	Date when the file is published.
copyright	STRING	Y	Copyright statement of the file.

7.4 Resource file list

The resource file list is an array that contains all asset data required in a movie. The key of the resource file list is "files" and the value is an array. Each item in the array is an object. The resource file object contains the file data, including the path and data of the file. Generally, data is in a binary format. Following this standard, binary data is converted into string data in Base64 mode. Hash data is a string obtained by converting the binary data of the resource file by using the MD5 algorithm. The hash string is used to verify the data integrity of the resource file. Table 3 describes the structure of the resource file list and Table 4 describes the relevant attributes.

There is no limitation for supported resource file types in this Recommendation.

Table 3 – Structure of resource file list

Field	Value type	Mandatory (Y/N)	Description
files	Array	Y	All resource file data used in the movie as described in Table 4.

Table 4 – Attributes of a single resource file

Field	Value type	Mandatory (Y/N)	Description
id	STRING	Y	Unique identifier of the resource file.
path	STRING	Y	The path of the resource file.
data	STRING	Y	Binary data of the resource file in the form of a string
hash	STRING	Y	Hash string obtained by converting the binary data using the MD5 algorithm to verify data integrity.

7.5 Asset list

The asset list is an array that contains all assets required in the movie. Assets are packaged resource file data. The key of the asset list is the "assets" field and the value is an array that contains all assets. Table 5 describes the structure of the asset list.

Table 5 – Data structure of asset list (file information)

Field	Value type	Mandatory (Y/N)	Description
assets	Array	Y	All asset data used in the movie. Table 6 describes the structure of each item in the array.

Table 6 describes the structure of a single asset.

Table 6 – Data structure of one asset

Field	Value type	Mandatory (Y/N)	Description
id	STRING	Y	Unique identifier.
type	STRING	Y	Asset type. Different types of assets have different attributes.
fileId	ARRAY	Y	Unique identifier of the resource file used by the current asset.
asset attribute	–	Y	The attribute list varies with the asset type. Tables 7, 8, 9, 10, 11 and 12 define the asset attributes for different asset types.

7.5.1 Asset type

There are four types of asset: picture, texture, sound and movie clip.

7.5.2 Picture attributes

Pictures contain a number of attributes, some of which are mandatory and some which are not. If an attribute is not set, the default value prevails. All optional attributes have default values.

A mask is a graphic. If the mask attribute of a picture is not null, the picture will be displayed in the area of the mask graphic and will not be displayed outside the area thereof. A mask is represented in an array that contains the coordinates of multiple points. A mask indicates a graphic formed by connecting all points. For example, mask:[0,0,100,0,100,100,0,100] indicates a square with a width and height of 100.

Table 7 describes the complete list of attributes of a picture.

Table 7 – Picture attributes

Field	Value type	Mandatory (Y/N)	Description
width	NUMBER	Y	Width of the picture, in pixels.
height	NUMBER	Y	Height of the picture, in pixels.
pivotX	NUMBER	N	X coordinate of the pivot. The default value is half of the width.
pivotY	NUMBER	N	Y coordinate of the pivot. The default value is half of the height.
mask	ARRAY	N	A mask, indicating the shape of the mask layer of the picture. It is represented in a series of points. The default value is null.
zOrder	NUMBER	Y	The layer of the picture. A lower-layer picture will be covered by an upper-layer picture.
path	ARRAY	N	The path, described in a Bezier curve. The default value is null.
x	NUMBER	N	X coordinate of the picture. The default value is 0.
y	NUMBER	N	Y coordinate of the picture. The default value is 0.

Table 7 – Picture attributes

Field	Value type	Mandatory (Y/N)	Description
scaleX	NUMBER	N	Scale of the picture in the X direction. The default value is 1.
scaleY	NUMBER	N	Scale of the picture in the Y direction. The default value is 1.
rotation	NUMBER	N	Rotation angle of the picture. The default value is 0.
skewX	NUMBER	N	Skew of the picture in the X direction. The rotation angle of a picture can be represented by the skew in the X and Y directions. Therefore, the skew attributes and the rotation angle are mutually exclusive. The default value is 0.
skewY	NUMBER	N	Skew of the picture in the Y direction. The default value is 0.
blend	STRING	N	Blend mode of the picture with lower-layer pictures. The default value is normal.
visible	BOOL	N	Whether the picture is visible or not. The default value is true.
alpha	NUMBER	N	The range of Alpha value is 0-1. The value 0 indicates full transparency and the value 1 indicates opacity. The default value is 1.

7.5.3 Texture attributes

The texture refers to a picture that is composed of multiple smaller pictures arranged in a certain manner. Each small picture is a subtexture. A texture consists of one or more subtextures. If a subtexture is surrounded by many transparent areas, these areas can be cut when forming a texture to save space. Figure 2 shows the meaning of each attribute of a subtexture. The key of a texture is "subTexture" and the value is an array. Each item in the array is an attribute of the subtexture.

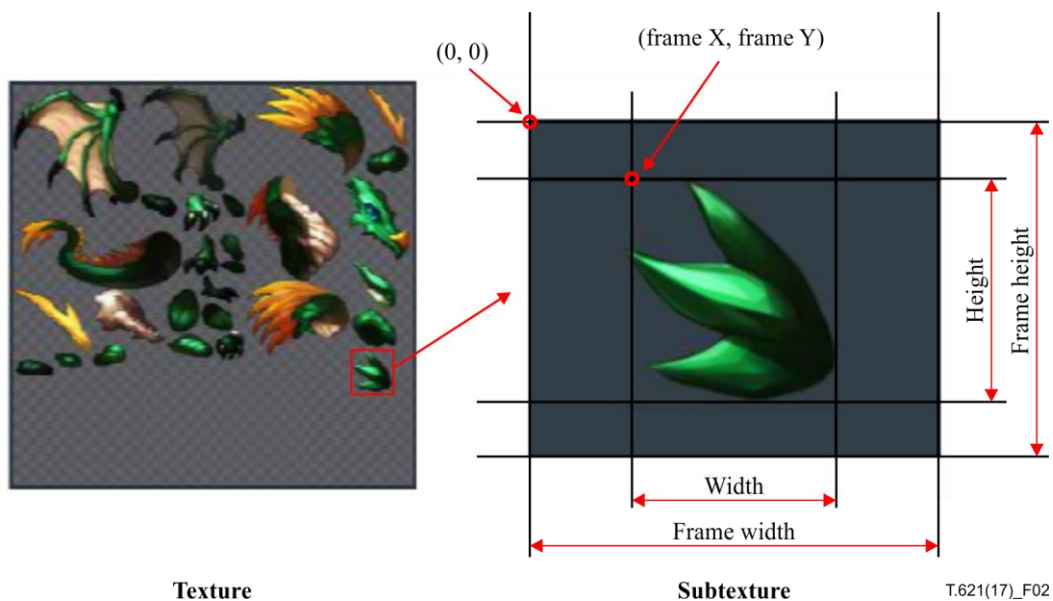


Figure 2 – Texture and subtexture

Table 8 describes the structure of a texture and Table 9 describes the attributes of a subtexture.

Table 8 – Texture structure

Field	Value type	Mandatory (Y/N)	Description
subTexture	ARRAY	Y	A subtexture represents a picture contained in a texture. For details about the attributes of a subtexture, see Table 9.

Table 9 – Subtexture attributes

Field	Value type	Mandatory (Y/N)	Description
name	STRING	Y	Subtexture name.
height	NUMBER	Y	Height of the subtexture with transparent areas removed.
width	NUMBER	Y	Width of the subtexture with transparent areas removed.
X	NUMBER	Y	Position of the subtexture in the X direction of the larger picture.
Y	NUMBER	Y	Position of the subtexture in the Y direction of the larger picture.
frameX	NUMBER	N	Offset of X with transparent areas added to the subtexture.
frameY	NUMBER	N	Offset of Y with transparent areas added to the subtexture.
frameHeight	NUMBER	N	Height of the subtexture with transparent areas added.
frameWidth	NUMBER	N	Width of the subtexture with transparent areas added.

7.5.4 Sound attributes

The sound attributes include play and volume. The play attribute indicates the number of times played and the value 0 indicates a cyclical play mode. The volume attribute indicates the volume. The sound attributes are usually used together with the track. Table 10 describes the sound attributes.

Table 10 – Sound attributes

Field	Value type	Mandatory (Y/N)	Description
play	NUMBER	N	Number of times the sound is played. The value 0 indicates a cyclical play mode.
volume	NUMBER	N	Volume. The value range is 0-100. The value 0 indicates no sound and the value 100 indicates the maximum sound.

7.5.5 Movie clip attributes

A picture or sound plus a track together form an animation object. One or multiple animation objects form a movie clip. A movie clip may contain nothing, which is referred to as a blank movie clip. A track is the data of an attribute that changes over time. Not all attributes have a track. Table 27 lists the attributes of a track.

A movie clip is an animation object as well as a container of multiple animation objects.

Table 11 describes the attributes of a movie clip.

Table 11 – Movie clip attributes

Field	Value type	Mandatory (Y/N)	Description
children	ARRAY		All animation objects contained in the movie clip.
pivotX	NUMBER	N	X coordinate of the pivot. The default value is half of the width.
pivotY	NUMBER	N	Y coordinate of the pivot. The default value is half of the height.
mask	ARRAY	N	A mask, indicating the shape of the mask layer of the picture. It is represented by a series of points. The default value is null.
zOrder	NUMBER	Y	The layer of the picture. A lower-layer picture will be covered by an upper-layer picture.
path	ARRAY	N	The path, described in a Bezier curve. The default value is null.
x	NUMBER	N	x coordinate of the picture. The default value is 0.
y	NUMBER	N	y coordinate of the picture. The default value is 0.
scaleX	NUMBER	N	Scale of the picture in the X direction. The default value is 1.
scaleY	NUMBER	N	Scale of the picture in the Y direction. The default value is 1.
rotation	NUMBER	N	Rotation angle of the picture. The default value is 0.
skewX	NUMBER	N	Skew of the picture in the X direction. The rotation angle of a picture can be represented by the skew in the X and Y directions. Therefore, the skew attributes and the rotation angle are mutually exclusive. The default value is 0.
skewY	NUMBER	N	Skew of the picture in the Y direction. The default value is 0.
blend	STRING	N	Blend mode of the picture with lower-layer pictures. The default value is normal.
visible	BOOL	N	Whether the picture is visible or not. The default value is true.
alpha	NUMBER	N	The range of the Alpha value is 0-1. The value 0 indicates full transparency and the value 1 indicates opacity. The default value is 1.

Table 11 – Movie clip attributes

Field	Value type	Mandatory (Y/N)	Description
tracks	OBJECT	Y	Track data, which is an object. The object contains one or multiple attributes. Not all attributes have a track. Table 27 lists the attributes of a track. For details about the structure of a track, see Table 13.
actionTracks	ARRAY	N	Action track data. An action track describes the changes that occur according to user interactions. Table I.1 lists different types of user interactions. Changes caused by user interactions are called actions. Table II.1 lists different types of actions. Table 15 describes the structure of an action track.

Table 12 describes the attributes of an animation object.

Table 12 – Animation object attributes

Field	Value type	Mandatory (Y/N)	Description
assetId	STRING	Y	Unique asset identifier. The data of an asset can be located by the asset ID. The asset type can be acquired based on the asset data.
name	STRING	N	Name of the subtexture if the asset is a texture.
attribute list	–	Y	Different types of assets have different attributes. For details about the attributes of each type of asset, see Table 27.
tracks	OBJECT	Y	Track data, which is an object. The object contains one or multiple attributes. Not all attributes have a track. Table 27 lists the attributes of a track. For details about the structure of a track, see Table 13.
actionTracks	ARRAY	N	Action track data. An action track describes the changes that occur according to user interactions. Table I.1 lists different types of user interactions. Changes caused by user interactions are called actions. Table II.1 lists different types of actions.

Table 13 describes the structure of a track.

Table 13 – Track structure

Field	Value type	Mandatory (Y/N)	Description
attribute name	ARRAY	Y	The attribute name varies according to the type of the animation object. For details about attributes that can have a track, see Table 27. The attribute name is the key and the value is an array. Each item in the array is a key frame. A key frame defines the value of an attribute at a specific time point.

Table 14 describes the attributes of a key frame.

Table 14 – Attributes of a key frame

Field	Value type	Mandatory (Y/N)	Description
time	NUMBER	Y	Time position of the current key frame.
value	NUMBER	Y	Value of the attribute corresponding to the current key frame.
curve	ARRAY	N	Interpolation curve data from the current key frame to the next key frame. The default value is null. The value null indicates that the curve is a broken line, on which the attribute changes instantaneously.

Table 15 describes the attributes of an action track.

Table 15 – Attributes of an action track

Field	Value type	Mandatory (Y/N)	Description
condition	STRING	Y	Type of condition that triggers an action.
value	ARRAY	Y	Value of condition that triggers an action.
action	STRING	Y	Type of triggered action.
params	ARRAY	Y	Action parameter.

7.6 Movie index

A file may contain the data of one or multiple movies. A movie index is an array. Each item in the array contains ID, storage address and duration of a movie, excluding the actual movie data. The movie index and movie data are stored separately to implement the function of playing the movie while downloading.

A movie contains a stage. All animation objects of the movie are presented on this stage. See Figure 3.

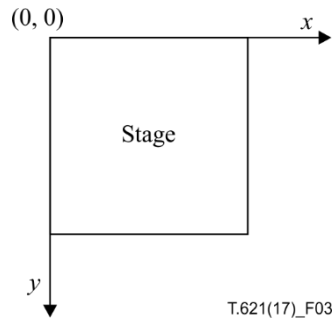


Figure 3 – Stage coordinates

Table 16 describes the structure of a movie index array.

Table 16 – Movie index array

Field	Value type	Mandatory (Y/N)	Description
movieIndex	ARRAY	Y	Array of movie indices listed based on the play order. Table 17 describes the structure of a single movie index.

Table 17 describes the movie index attributes.

Table 17 – Movie index attributes

Field	Value type	Mandatory (Y/N)	Description
movieId	STRING	Y	Unique identifier of the movie.
address	NUMBER	Y	Physical offset of the content in the file.
totaltime	NUMBER	Y	Duration of the movie.
size	NUMBER	Y	Physical size of the movie in the file.

7.7 Movie list

A movie is a special type of movie clip. Therefore, a movie has all the attributes and structures of a movie clip. The differences lie in that the attributes and track data of a movie are stored separately and track data is stored as segments based on the order of time. In this way, movies can be played while downloading.

A movie list stores all movie data. Table 18 describes the structure of a movie list. Each item in a movie list indicates a movie.

Table 18 – Movie list structure

Field	Value type	Mandatory (Y/N)	Description
movies	ARRAY	Y	Array of movies listed based on the play order.

Table 19 describes the movie attributes.

Table 19 – Movie attributes

Field	Value type	Mandatory (Y/N)	Description
id	STRING	Y	Unique identifier of the movie.
movieClipIndex	NUMBER	Y	Index information about all movie clips of the movie. Table 21 describes the structure of a movie clip index.
movieClips	ARRAY	Y	Information about all movie clips of the movie.
stream	ARRAY	Y	Track data of all movie clips of the movie, described as segments.

7.7.1 Movie clip index

A movie clip index is a data record that contains the index information of all movie clips. A movie clip index contains the ID, address, size and life attributes of the movie clip. The life attribute indicates the lifespan of a movie clip and is actually a miniature of the track of the movie clip. The value of the life attribute is an array, which contains the appearance and disappearance time of a movie clip on the stage. For example, life: [0,100,400,500] indicates that a movie clip appears at 0 s and disappears at 100 s, then reappears at 400 s and disappears at 500 s.

Table 20 describes the structure of a movie clip index array.

Table 20 – Movie clip index array structure

Field	Value type	Mandatory (Y/N)	Description
movieClipIndex	ARRAY	Y	Index information about all movie clips of the movie.

Table 21 describes the structure of a movie clip index.

Table 21 – Movie clip index structure

Field	Value type	Mandatory (Y/N)	Description
mcId	STRING	Y	Unique identifier of the movie clip.
address	NUMBER	Y	Physical offset of the content in the file.
size	NUMBER	Y	Content length.
life	ARRAY	Y	Lifespan of the movie clip.

7.7.2 Movie clip array

A movie clip array contains all movie clip attributes in the movie. The track information will be presented in the movie stream. Table 22 describes the attributes of a movie clip array.

Table 22 – Movie clip array structure

Field	Value type	Mandatory (Y/N)	Description
movieClips	ARRAY	Y	Information about all movie clips in a movie. A movie clip contains all other attributes except the track.

Table 23 describes the attributes of a movie clip.

Table 23 – Movie clip attributes

Field	Value type	Mandatory (Y/N)	Description
id	STRING	Y	Unique identifier of the movie clip.
objects	ARRAY	Y	Different types have different attributes. For details, see Table 12.

7.7.3 Movie stream array

Table 24 describes the structure of a movie stream array.

Table 24 – Movie stream array structure

Field	Value type	Mandatory (Y/N)	Description
stream	ARRAY	Y	Track information presented in segments.

Table 25 describes the attributes of a movie stream.

Table 25 – Movie stream attributes

Field	Value type	Mandatory (Y/N)	Description
timeStamp	STRING	Y	Time period of the movie stream.
timelines	ARRAY	Y	Track data of the movie stream.

7.7.4 Track

Table 26 describes the structure of the track of a movie stream.

Table 26 – Movie stream track structure

Field	Value type	Mandatory (Y/N)	Description
mcId	STRING	Y	Unique identifier of the movie clip.
tracks	ARRAY	Y	Track data of the movie clip. Different types of movie clips have different track data. For details, see Table 27.

Table 27 describes the attributes of a track.

Table 27 – Track attributes

Asset type	Attribute
Image, MovieClip	x
	y
	scaleX
	scaleY
	Rotation
	skewX
	skewY
	path
	zOrder
	visible
	alpha
	event
Sound	play
	volume

Appendix I

Behaviour list

(This appendix does not form an integral part of this Recommendation.)

Table I.1 contains user inputs that can trigger interaction events in mobile.

Table I.1 – Behaviour list

Field name	Field description	Data type	Value description
light_intensity	Light intensity	NUMBER	The value range is 0–100. The value 0 indicates complete darkness and 100 indicates the highest light intensity.
rotation	Rotation change of mobile phone	ARRAY	The value is an array of six items. Each value in the array is a number. The six values are described as follows: <ul style="list-style-type: none"> – Start angle for turnover forwards or backwards. – End angle for turnover forwards or backwards. – Start angle for turnover leftwards or rightwards. – End angle for turnover leftwards or rightwards. – Start angle for horizontal rotation. – End angle for horizontal rotation.
direction	Direction change	NUMBER	North-oriented clockwise offset. Unit: radians.
location	Location detection	ARRAY	The value is an array of 5 items. The 5 values are described as follows: <ul style="list-style-type: none"> – Integral part of the longitude returned by GPS. – Decimal part of the longitude returned by GPS. – Integral part of the latitude returned by GPS. – Decimal part of the latitude returned by GPS. – The longitude and latitude are determined based on the pivot, in meters.
air_pressure	Air pressure	NUMBER	Unit: hectopascal (hPa).
temperature	Temperature detection	NUMBER	Unit: °C.
accelerator	Displacement acceleration	NUMBER	Unit: m/s ² .
angle_accelerator	Angle acceleration	NUMBER	Unit: rad/s ² .
gesture	Gesture	NUMBER	1: leftwards. 2: rightwards. 3: downwards. 4: upwards. 5: long press. 6: tap.

Appendix II

Action list

(This appendix does not form an integral part of this Recommendation.)

Table II.1 contains animation actions triggered by user inputs in mobile.

Table II.1 – Action list

Action type name	Action type value	Data type	Action description
link	Link	STRING	Destination link address.
gotoAndPlay	Jump to a time point and continue to play	STRING	Jump to a time point and continue to play.
gotoAndStop	Jump to a time point and stop playing	STRING	Jump to a time point and stop playing.
gotoMovie	Jump to a movie and play it	STRING	Jump to a movie and play it.
playSound/ stopSound	Pause/play sound	STRING	Pause/play sound.
vibrate	Vibration	ARRAY	The value is an array of two items. The first value in the array indicates the number of times the vibration occurs, which is mutually exclusive to the vibration duration. The second value in the array indicates the vibration duration, which is mutually exclusive to the number of times the vibration occurs.

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