Valentia Kinect Service

Web Client Protocol

CERTIFICATE

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Revision History

Name	Date	Reason For Changes	Version
Valentia Technologies	12/1/2012	Initial draft	001

Contents

1   Introduction

This protocol is used to send the image, depth and skeleton related data extracted from Kinect device to the web client connected through web sockets via HTML 5 supporting browsers e.g. Google Chrome, Safari etc. Each *Protocol Data Unit* (PDU) begins with its identifier. *Table 1* shows PDUs and their respective identifiers.

PDU Name	Identifier
Color Image	1
Depth Image	2
Skeleton Data	3
Authentication Request	4
Authentication Reply	5

Table 1

2   PDU Structure

A detailed account of each PDU and its structure is given in the following sections. Please note that the tag <LF> is Line Feed character, in most programming languages it is represented as '\n'.

2.1   Color Image

Color Image PDU is used to send the colored video data generated by the Kinect device. Each PDU will contain a single frame of the video data i.e. if Kinect device generated 30 frames per seconds then this PDU will be sent 30 times in one second for each frame. *Table 2* displays the segment details of Color Image PDU. Each segment will be separated from the other by <LF> character.

Segment No.	PDU Segment Name	Segment Value
1	PDU Type	Color Image (Value : 1) (Ref : Table 1)
2	Kinect Device Name	String containing the name of Kinect device
3	Resolution	Value can be 640x480 or 320x240 or any other resolution on which Kinect device is generating Color Image.
4	Image data as base 64 string.	Color Image data as base 64 string e.g. data:image/jpeg;base64,/9j/4AAQSkZJRg….

Table 2

Following is the sample data of this PDU.

1<LF>Test Kinect Device<LF>320,240<LF>data:image/jpeg;base64,/9j/4AAQSkZJRg<LF>

2.2   Depth Image

Depth Image PDU is used to send the depth data of the object in front of the Kinect device. This PDU contains data of both the distance of each pixel of object and the image created based on the depth of pixels. *Table 3* displays segment details of this PDU. Each segment will be separated from the other by <LF>.

Segment No.	PDU Segment Name	Segment Value
1	PDU Type	Depth Image (Value : 2) (Ref : Table 1)
2	Kinect Device Name	String containing the name of Kinect device
3	Resolution	This will be the resolution of the image created based on each pixel's depth data. Value can be 640,480 or 320,240 or any other resolution.
4	Image data as base 64 string.	Depth Image data as base 64 string e.g. data:image/jpeg;base64,/9j/4AAQSkZJRg
5	Bytes Per Pixel	This will be number of bytes to represent each pixel in Depth Byte Data (7th segment). This default value will be 2.
6	Resolution of Depth Bytes Data	The resolution of the Depth Byte Data. It will either be 80x60 or 320x240
7	Depth Byte Data.	Byte array of the Depth bytes. Length of byte will be calculated based on 5th and 6th segment value. E.g. if 5th segment has value 2 and 6th segment has value 80x60 then Length will be 9600(2 x 80 x 60 = 9600).

Table 3

Following is sample data of this PDU.

2<LF>Test Kinect Device<LF>320,240<LF>data:image/jpeg;base64,/9j/4AAQSkZJRg...<LF>2<LF>80,60<LF>1,2,3,4,5,6 ... <LF>

2.3   Skeleton Data

Skeleton Data PDU is used to send skeleton data tracked by the Kinect device. Kinect device can track more than one skeleton at a time. Each skeleton will be having fixed 20 joints. Kinect service may send data of all 20 joints simultaneously or a specific number of joints data at a time depending on the configurations. *Table 4* shows the details of joints data.

Joint ID	Joint Name
0	Hip Center
1	Spine
2	Shoulder Center
3	Head
4	Shoulder Left
5	Elbow Left
6	Wrist Left
7	Hand Left
8	Shoulder Right
9	Elbow Right
10	Wrist Right
11	Hand Right
12	Hip Left
13	Knee Left
14	Ankle Left
15	Foot Left
16	Hip Right
17	Knee Right
18	Ankle Right
19	Foot Right

Table 4

Figure 1 shows an illustration of Skeleton Data with joints identification.
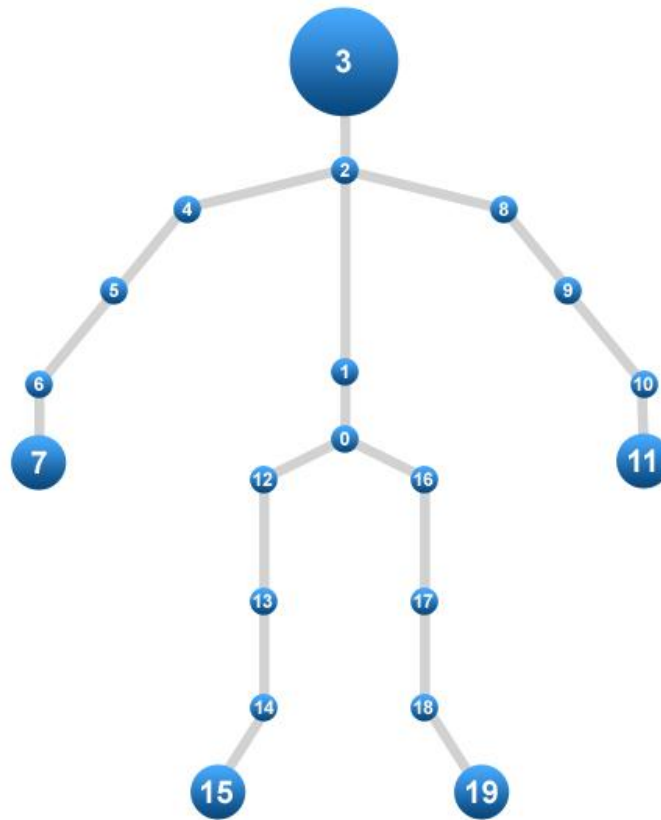

Figure 1

Table 5 displays the segment details of Skeleton Data PDU. Each segment will be separated from the other by <LF>.

Segment No.	PDU Segment Name	Segment Value
1	PDU Type	Skeleton Data (Value : 3) (Ref : Table 1)
2	Kinect Device Name	String containing the name of Kinect device
3	Resolution	This will be the resolution of the joints points. Value can be 640x480 or 320x240 or any other resolution.
4	Number of Skeletons	This will be numeric value indicating the number of skeletons in this PDU.
5	Skeletons Data Array	This will be an array of Skeleton Data structure. The length of the array will be the value of the 4th

segment. Each item of Skeleton Data array will be containing the joints information of single skeleton, quality, ID etc. Please note that dollar ($) is used to separate each information with other in single Skeleton Data item in array, and <LF> is used to separate a Skeleton Data item form other in array. The structure of Skeleton Data array is shown below:

Info. Num.	Information Name
1	Tracking ID (numeric value)
2	User ID (numeric value)
3	Quality (numeric value)
4	No. Of Joints (numeric value)
5	Joints Info Array

Single item Joint Info array will hold the information of each joint. Value of 4th info of the Skeleton Data Item will be the length of this array. Dollar ($) sign is used to separate each item of this array from others and comma sign (,) is used to separate sub parts of a single item. Each part of an item of this array will have the structure shown below..

Joint ID	W	X	Y	Z	Rx	Ry

Table 5

Following is sample data of PDU.

3<LF>Kinect Device Name<LF>320,240<LF>1<LF>

1$0$0$20$0, 1, 0.21, 0.35, 0.26, 245, 185$1, 1, 0.21, 0.15, 0.28, 158, 96$2, 1, 0.21, 0.39, 0.46, 330, 120$ ... 20, 1, 0.21, 0.39, 0.46, 330, 120<LF>

2.4   Authentication Request

This PDU is sent by the web client to pass the credentials to server. When the server receives this PDU it validates the credentials. Upon successful validation, the web client will be allowed to maintain its connection with the server; otherwise the connection will be closed. *Table 6* displays the structure of the PDU.

Segment No.	PDU Segment Name	Segment Value
1	PDU Type	Authentication Request (Value : 4) (Ref : Table 1)
2	Login	Login name string
3	Password	Password string

Table 6

The character placing in Login and Password string should be changed as follow.
- Total length of string should be multiple of 4 characters. If not, then an appropriate number of space(s)(ASCII code : 32) should be added at the end of string to make total length multiple of 4.
- Divide string into set of 4 characters.
- Replace the 1st character of each set with 3rd character.
- Replace the 2nd character of each set with 1st character.
- Replace the 3rd character of each set with 4th character.
- Replace the 4th character of each set with 2nd character.

Following is sample data of this PDU, suppose test123 is login and password.

```
4<LF>stte31 2<LF> stte31 2
```

2.5   Authentication Reply

This PDU is sent by the server to web client in reply of Authentication Request PDU. *Table 7* shows the structure of this PDU.

Segment No.	PDU Segment Name	Segment Value
1	PDU Type	Authentication Reply (Value : 5) (Ref : Table 1)
2	Authenticated	String value True or False.
3	Reason	String containing reason if authentication failed.

Table 7

If Authentication Request PDU is validated successfully at the server, the server will send this PDU with Authenticated segment having value True, else value will be False. Web client should close the connection if value is False.

Following is sample data of this PDU

5<LF>True<LF>

5<LF>False<LF>Login or password is invalid.

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