

# VIS.TRACK

Interface and protocol details

26.10.2009

# **VIS TRACK**

**... ANALYSE YOUR TEAM!**

## Table of Contents

1. Introduction
2. System Architecture
3. Protocol Details
  - 3.1. Tracking Data
  - 3.2. Coordinate System
  - 3.3. Samples
  - 3.4. Requests

## 1. Introduction

VIS.TRACK is a unique video based real time tracking system for players, referees and ball with high accuracy and easy operating functions.

This document describes the system architecture and protocol details in order to provide tracking data.

## 2. System Architecture

The VIS.TRACK system consists of two cameras, a computer unit and an operating interface (monitor, mouse, keyboard). All tracking data which are gathered during a match are available at the data interface. In order to use the position data, each recipient has to be connected to VIS.TRACK and has to care about the underlying data protocol which is described in section 3. Due to multicast streaming of tracking data, several recipients can be provided with data at the same time.

Each application that needs to connect to VIS.TRACK has to create three sockets with the following settings:

- ▮ TCP-socket (listening server, port **4301**): direct connection to VIS.TRACK receiving requested data
- ▮ UDP-receiving-socket (ip **224.64.4.3**, port **4300**): multicast connection to VIS.TRACK receiving tracking data
- ▮ UDP-sending-socket (ip **224.64.4.3**, port **4300**): multicast connection to VIS.TRACK sending requests

For the UDP-sockets the following options have to be set:

- ▮ SO\_REUSEADDR has to be TRUE
- ▮ IP\_MULTICAST\_LOOP should be FALSE
- ▮ UDP-receiving-socket has to join the multicast group

During the match each connected application receives current tracking data frame by frame on the UDP-receiving-socket. In case of lost frames, requests can be delivered to VIS.TRACK using the UDP-sending-socket. After that the TCP connection is confirmed by VIS.TRACK and the requested data can be received on the TCP-socket.

	<b>X</b>	X-coordinate of the player's position (4 decimal places)
	<b>Y</b>	Y-coordinate of the player's position (4 decimal places)
	<b>Speed</b>	Current speed of the player in m/sec (2 decimal places)
	<b>;</b>	Delimiter of player
	<p>Team 1 is the home team and includes 11 players. According to their position in the Team1-category, each player has a unique ID. Starting with ID 0 for the first player, up to 10 for the last player of the home team. If the player is not tracked, only the delimiter is delivered. In case of a red card the position is -10.0000,-10.0000 and the speed is set to 0.00.</p> <p>Structure: <i>JerseyNumber,X,Y,Speed;</i></p>	
<b>Team 2 (ID 11-21)</b>		Description
	<b>JerseyNumber</b>	Number on player's jersey
	<b>X</b>	X-coordinate of the player's position (4 decimal places)
	<b>Y</b>	Y-coordinate of the player's position (4 decimal places)
	<b>Speed</b>	Current speed of the player in m/sec (2 decimal places)
	<b>;</b>	Delimiter of player
	<p>Team 2 is the away team and includes 11 players. According to their position in the Team2-category, each player has a unique ID. Starting with ID 11 for the first player, up to 21 for the last player of the away team. If the player is not tracked, only the delimiter is delivered. In case of a red card the position is -10.0000,-10.0000 and the speed is set to 0.00.</p> <p>Structure: <i>JerseyNumber,X,Y,Speed;</i></p>	
<b>Referees (ID 22-24)</b>		Description
	<b>X</b>	X-coordinate of referee's position (4 decimal places)
	<b>Y</b>	Y-coordinate of referee's position (4 decimal places)
	<b>Speed</b>	Current speed of referee in

### 3. Protocol Details

#### 3.1 Tracking Data

VIS.TRACK determines the position of each player and the ball 25 times per second. For each frame a message is composed by the following structure:

*Frame#Team1#Team2#Referees#Ball#AdditionalInfo*

Category	Description	
Frame		Description
	FrameNumber	Relative number of frames. The FrameNumber is incremented with each frame. Each section starts with FrameNumber 0.
	Minute	Current minute. If Section is 0 Minute is set to 0.
	Section	Number of current section  π First half: 1 π Second half: 2 π First overtime: 3 π Second overtime: 4 π Else: 0  Section shows the current section of each frame. When the game has not started yet or is already finished or is interrupted, the Section is 0.
	;	Delimiter of frame.
	Structure: <i>FrameNumber,Minute,Section;</i>	
Team 1 (ID 0-10)		Description
	JerseyNumber	Number on player's jersey

		m/sec (2 decimal places)
	;	Delimiter of referee
	<p>In this category the first referee is the main referee with ID 22. The two linesmen have the IDs 23 and 24. If the referee is not tracked, only the delimiter is delivered.</p> <p>Structure: <i>X,Y,Speed;</i></p>	
<b>Ball</b>		Description
	<b>X</b>	X-coordinate of the ballposition (4 decimal places)
	<b>Y</b>	Y-coordinate of the ballposition (4 decimal places)
	<b>Z</b>	Z-coordinate of the ballposition in cm
	<b>Speed</b>	Current speed of the ball (2 decimal places)
	<b>Flag</b>	Current status of the ball
	<b>Possession</b>	Possession indicates the ID of the player, who is in possession of the ball (no possession: -1).
	;	Delimiter of ball
	Structure: <i>X,Y,Z,Speed,Flag,Possession;</i>	
<b>AdditionalInfo</b>		Description
	<b>PlayerInit</b>	<p>Structure: <i>1,ID,from,to;</i></p> <p>Message when a player was reinitialized. Player "ID" has to be interpolated within the range [from;to].</p> <p>Example: 1,13.0,100.0,710.0;</p>
	<b>PlayerSwap</b>	<p>Structure: <i>2,ID1,ID2,from,to;</i></p> <p>Two players "ID1" and "ID2" have to be swapped including all their data, frame by frame within the range [from;to].</p> <p>Example: 2,4.0,5.0,100.0,710.0;</p>

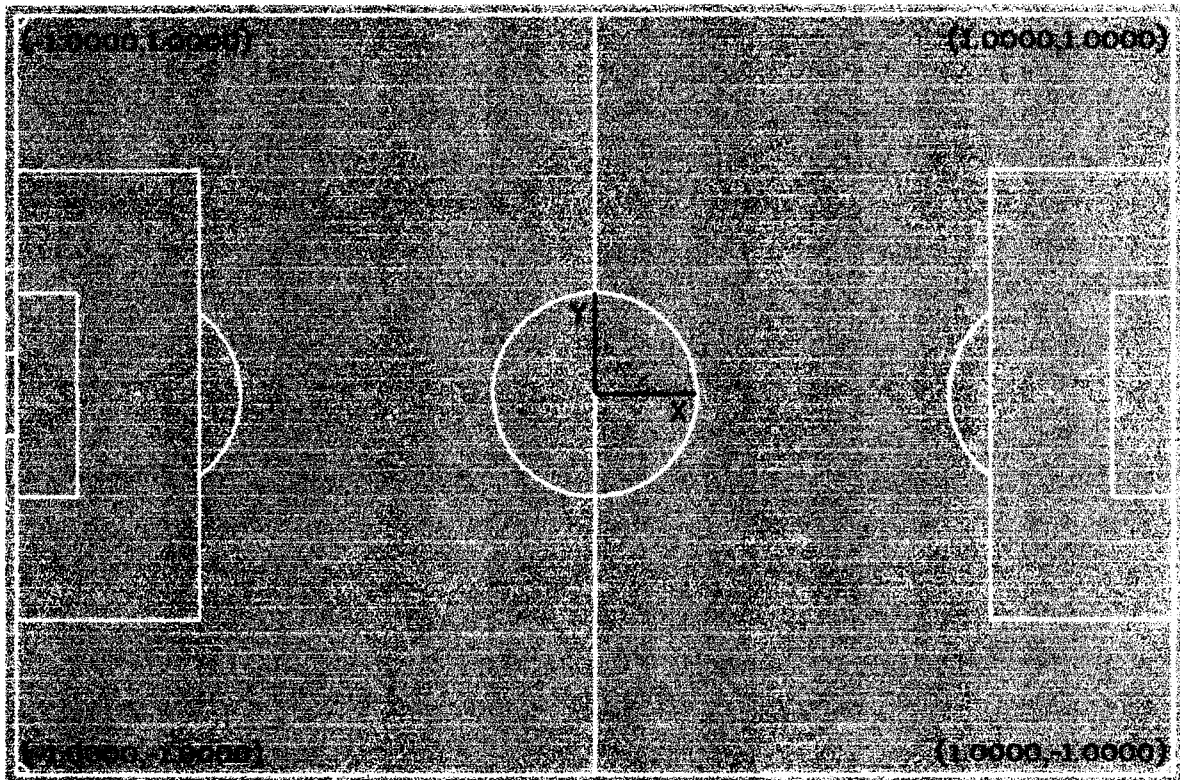
	<b>BallDistance</b>	<p>Structure: <i>3,Distance;</i></p> <p>Distance between ball and goal at freekicks in meters (1 decimal place).</p> <p>Example: 3,23.8;</p>
	<b>PitchSize</b>	<p>Structure: <i>4,X-distance,Y-distance;</i></p> <p>The information about the size of the pitch in meters is provided within the first frame (1 decimal place).</p> <p>Example: 4,105.0,68.0;</p>

### 3.2 Coordinate System

VIS.TRACK provides position data in relative coordinates.

- π Origin of the coordinate system is the center of the pitch
- π X-range: -1.0000 .... 1.0000 running parallel to the sidelines
- π Y-range: -1.0000 .... 1.0000 running parallel to the endlines
- π Values can be smaller than -1 and greater than 1





### 3.3 Samples

2263,2,1;#11,0.8534,-0.1709,2.59;2,0.2431,-0.9600,1.98;3,0.4148,-0.6447,5.39;4,0.4514,-  
0.1982,4.69;13,0.2622,0.2198,1.66;6,0.0878,-0.3046,2.43;7,-0.2224,-0.4681,1.72;8,0.0529,-  
0.6984,3.70;9,-0.0345,0.1992,0.69;15,-0.0169,-0.9324,1.63;11,-0.2984,-0.3758,1.15;#22,-  
0.8223,-0.0946,1.14;2,-0.2694,0.0378,0.81;4,-0.3179,-0.3640,1.60;5,-0.3197,-0.5387,2.10;  
6,-0.0449,-0.9088,1.84;7,-0.1251,-0.4614,0.93;8,0.0383,-0.7146,3.49;9,0.0953,-0.7388,  
5.54;10,0.2260,-0.9406,3.87;11,0.0487,0.1480,1.96;13,0.2616,-0.5773,2.50;#-0.0426,-  
0.4121,1.28;0.3843,-1.0211,2.97;;#0.3400,-0.6991,11,0.00,0,0;#

2264,2,1;#11,0.8524,-0.1745,2.66;2,0.2439,-0.9583,1.97;3,0.4191,-0.6456,5.42;4,0.4546,-  
0.1962,4.69;13,0.2628,0.2217,1.70;6,0.0891,-0.3041,2.39;7,-0.2223,-0.4696,0.169;8,  
0.0547,-0.6956,3.68;9,-0.0345,0.2000,0.67;15,-0.0170,-0.9301,1.66;11,-0.2974,-0.3755,  
1.16;#22,-0.8216,-0.0938,1.15;2,-0.2686,0.0401,0.85;4,-0.3164,-0.3614,1.68;5,-0.3178,-  
0.5378,2.16;6,-0.0443,-0.9074,1.81;7,-0.1250,-0.4600,0.95;8,0.0398,-0.7120,3.45;9,  
0.0965,-0.7315,5.61;10,0.2278,-0.9384,3.83;11,0.0493,0.1469,1.94;13,0.2628,-0.5741,  
2.54;#-0.0413,-0.4114,1.32;0.3871,-1.0203,3.02;;#0.3458,-0.6827,11,0.00,0,0;#2,7,0,9,0,  
1289,0,2263,0;