

# Web-Based Sign Language Synthesis and Animation for On-line Assistive Technologies

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## 1 Introduction

- New client-server framework for sign language synthesis
- Incorporating up-to-date 3D computer graphics for the Internet
- Central administration of the system
- Easy use, allows signing avatar to be more accessible for the target users

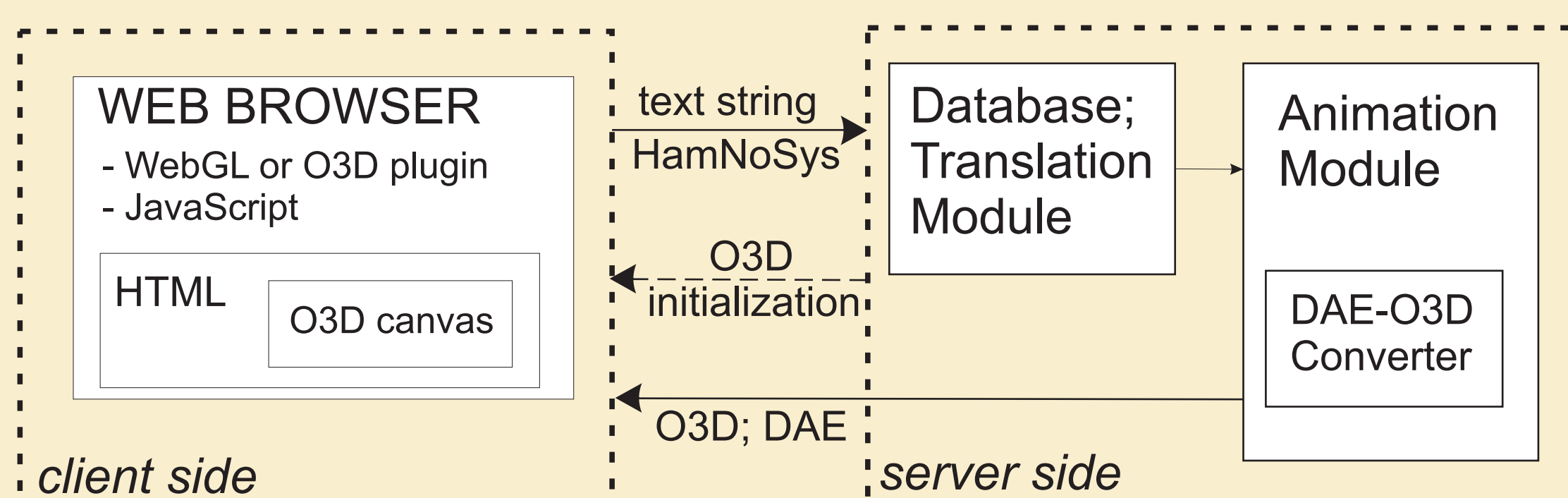
## 2 System Overview

### Features of the framework:

- Minimum requirements for installing additional software on the end user's computer;
- Effective data transfer across the network;
- Rapid response of the system and fluent animation of the 3D model

### Server side:

- Receives requests from all clients;
- Shares all services (conversion, animation, ...) and generates adequate responses;
- Current implementation incorporates: animation module; database for word-byword transliteration; cache of processed requests; and data converter.



Rendering method and graphic data formats are based on Google O3D technology (<http://code.google.com/p/o3d/>)

- Enables usage of signing avatars in interactive 3D applications
- Open-source Java Script (API)
- Majority of common web browsers are supported (Windows, Macintosh, Linux or Android platforms)
- Standalone JavaScript library uses WebGL standard (or Google O3D plugin when WebGL is not available)

### WebGL standard:

- Designed for the `<canvas>` HTML element
- Provide 3D computer graphics API using hardware accelerated graphics
- Released as version 1.0 on March 3, 2011
- Managed by the non-profit Khronos Group

### Supported desktop browsers:

- **Mozilla Firefox** - on all platforms that have a capable graphics card with updated drivers since version 4.0
- **Google Chrome** - on all platforms that have a capable graphics card with updated drivers since version 9
- **Safari** - Safari 5.1 installed on Mac OS X Lion has support, but is disabled by default
- **Opera** - has been implemented by Opera in the latest Opera 12 pre-release snapshots.
- **Internet Explorer** - Microsoft has not announced any plans to officially support; the Chrome Frame and IEWebGL plugins provide options to add support

### Animation module:

**Problem:** different representation of the 3D model and the rendering method in comparison with the off-line version

**Input:** one or more signs in the HamNoSys notation (manual component)

- Conversion process using HamNoSys parser [KRN08]
- New use of Collada; XML schema allowing full description of the signing avatar

**Output:** DAE data file

- Include the model involving animation; easy conversion to o3d

## 3 Examples of Usage

This screenshot shows a webpage with a 3D signing avatar. Annotations highlight:
 

- 3D interactive; rotate and zoom:** A callout points to the avatar, indicating its interactive capabilities.
- Common webpage:** A callout points to the text content of the page.
- Data for the signed utterance (HamNoSys):** A callout points to a code block containing HamNoSys notation: `<iframe width="250" height="300" style="float:left" src="http://sign.zcu.cz/avatar/show?unicode_hamnosys=%EE%83%A9%EE%80%84%EE%80%8D%83%86%EE%82%89%EE%82%BD%EE%83%A3&width=170&height=220">`
- Additional control (timeline; speed):** A callout points to a control interface for the avatar.

This screenshot shows the 'Sign Editor' interface within a browser. It features a 3D signing avatar on the right and a control panel on the left for editing the sign. A callout points to the avatar with the text 'Sign Editor in the Internet browser'.

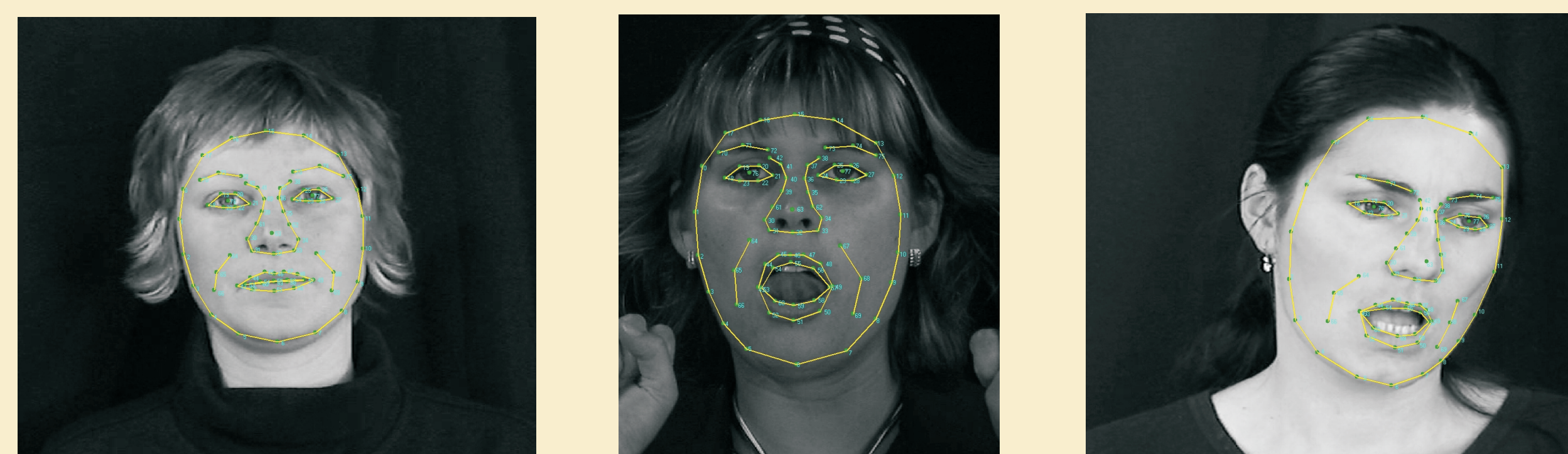
## 4 Current Research

### Morph controller:

- Per-vertex animation using blend shapes (the morph targets)
- Typical examples of morph targets used in facial animation is a smiling mouth, a closed eye, and a raised eyebrow

+ No constrained by skeletons; very powerfull and detailed

- More labour-intensive and large number of morph targets increase data



- PCA can be applied on the data measured at the face of a signing speaker (ASM, AAM);
- If we consider each of the principal components such as one morph target;
- Then it is identical with the interpolation used by the morph controller.

## 5 Summary

- 3D interactive rendering of the signing avatar in real time;
- Supported by the recent web browsers without any installation of additional software;
- End users can more easily receive prearranged on-line contents containing both standard webpages and the 3D signing avatar;
- Experimental implementation for Czech Sign Language (<http://signs.zcu.cz/>);
- Optionally can be saved by the end user as "3D sign utterance" for other communication or educational purposes;
- Additional modules can be incorporated into the server side (translation, control, ...);
- New mobile applications can be considered in the future (FireFox 5.0 on Android)