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Voice User Interface On The Web

Human Computer Interaction

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How to create a VUI on the Web?

- Three (main) steps, typically:
  - Speech Recognition
  - Text manipulation (e.g., Natural Language Processing)
  - Speech Synthesis
- We are going to start from a simple application to reach a quite complex scenario
  - by using HTML5, JS, and PHP
- Reminder: we are interested in creating an **interactive prototype**, at the end

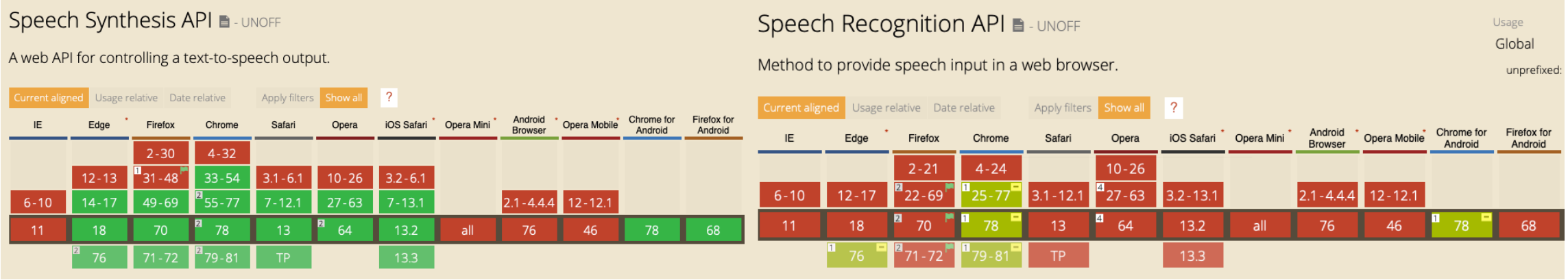
Weather Web App

A VUI for "chatting" about the weather

Base implementation at
https://github.com/polito-hci-2019/vui-example

Speech Recognition and Synthesis

- Web Speech API
  - currently a draft, experimental, unofficial HTML5 API (!)
  - https://wicg.github.io/speech-api/
- Covers both speech recognition and synthesis
  - different degrees of support by browsers



Web Speech API: Speech Recognition

- Accessed via the **SpeechRecognition** interface
  - provides the ability to recognize voice from an audio input
  - normally via the device's default speech recognition service
- Generally, the interface's constructor is used to create a new **SpeechRecognition** object
- The **SpeechGrammar** interface can be used to represent a particular set of grammar that your app should recognize
  - Grammar is defined using JSpeech Grammar Format (JSGF)

Speech Recognition: A Minimal Example

```
const recognition = new window.SpeechRecognition();
recognition.onresult = (event) => {
       const speechToText = event.results[0][0].transcript;
}
recognition.start();
```

- This will ask the user to allow the page to have access to the microphone
- Then, the user can start talking and when she/he stops, the `onresult` event handle will be fired, making the results of the speech capture available as a JavaScript object
- The `onresult` event handler returns a `SpeechRecognitionEvent` with a property results which is a two-dimensional array
- The first object of this matrix is the transcript, i.e., the recognized speech in text format

https://developer.mozilla.org/en-US/docs/Web/API/SpeechRecognition

Web Speech API: Speech Synthesis

- Accessed via the **SpeechSynthesis** interface
  - a text-to-speech component that allows web applications to read out their textual content
  - normally via the device's default speech synthesizer
- Different voice types are represented by **SpeechSynthesisVoice** objects
- Different parts of text to be spoken are represented by

  SpeechSynthesisUtterance objects
  - you can get these utterances spoken with the SpeechSynthesis.**speak()** method

Speech Synthesis: A Minimal Example

```
var synth = window.speechSynthesis;
var utterThis = new SpeechSynthesisUtterance("say this!");
synth.speak(utterThis);
```

- This will create some utterances from a given text
- … and reproduce the text (with a default voice, personalizable) through the device's speakers

https://developer.mozilla.org/en-US/docs/Web/API/SpeechSynthesis

Weather Web App

Let's code: integrating the Web Speech APIs…

Conversational Platforms

- Natural language understanding platforms
  - for developers, mainly
  - typically cloud-based
- To design and integrate voice user interfaces into mobile apps, web applications, devices, …
- Focus on simplicity and abstraction
  - no knowledge of NLP required

Conversational Platforms

- Two main families:
  1. Extension of a product
     - they need an existing product (software and/or hardware) to work
     - e.g., Actions on Google or Skills for Amazon Echo
  2. Standalone services
     - a series of facilities to create a wide range of conversational interfaces in one platform, *typically* integrated in "suites" of cloud services
     - e.g., Dialogflow, IBM Watson, wit.ai, …

wit.ai

- "Natural Language for Developers"
  - https://wit.ai/
- California-based startup, founded in 2013, acquired by Facebook in 2015
- Free to use
- Allow the creation and validations of commands, i.e., "annotated" sentences
- Multiple languages support
  - English, Dutch, Italian, Chinese, …
- Four SDKs
  - Node.js, Python, Ruby, and Go

Snips

snips

- "Create a Private by Design voice assistant that runs on the edge"
  - https://snips.ai
- France-based startup, founded in 2013, acquired by Sonos in 2019
- Run on the edge, not in the cloud
  - Raspbian, Android, iOS, macOS, and most Linux flavors
  - the setup of the NLP component is online
- Free for makers and for building prototypes
- 6 fully supported languages, mostly uses Node.js

DialogFlow

- "Build natural and rich conversational experiences"
  - https://dialogflow.com
- California-based startup, founded in 2010, acquired by Google in 2016
  - previously known as api.ai
- Free to use for simple usage
- One-click integration with several services
  - Telegram, Facebook Messenger, Cortana, Google Assistant, …
- Multiple languages support
  - English, Dutch, Italian, Chinese, …
- REST API and various (official) SDKs
  - Java, C#, Python, PHP, Go, and Node.js

DialogFlow: Definitions

- Each application (an agent) will have different **entities** and **intents**
- Intent
  - a mapping between what a user says and what action should be taken by the agent
- Typically, an intent is composed by:
  - What a user says
  - An action
  - A response
- Different out-of-the-box intents can be enabled on DialogFlow

DialogFlow: Definitions

- Entities
  - represent *concepts*
  - serve for extracting parameter values from natural language inputs
  - should be created only for concepts that require actionable data
- Many pre-existing entities are available on the platform

Weather Web App

Let's code: setting up a DialogFlow agent and integrating it in code…

DialogFlow: Fulfillment

- Often, you need more than "static" responses
  - you can use **fulfillment** to connect an external service to your Dialogflow agent
  - for example, if I want to know the weather in Turin, I need to get information from a real weather forecast service
- *Each* intent has a setting to enable fulfillment
  - if an intent without fulfillment enabled is matched, Dialogflow uses the static response you defined for the intent
  - otherwise, it will call the external service via **Webhook**

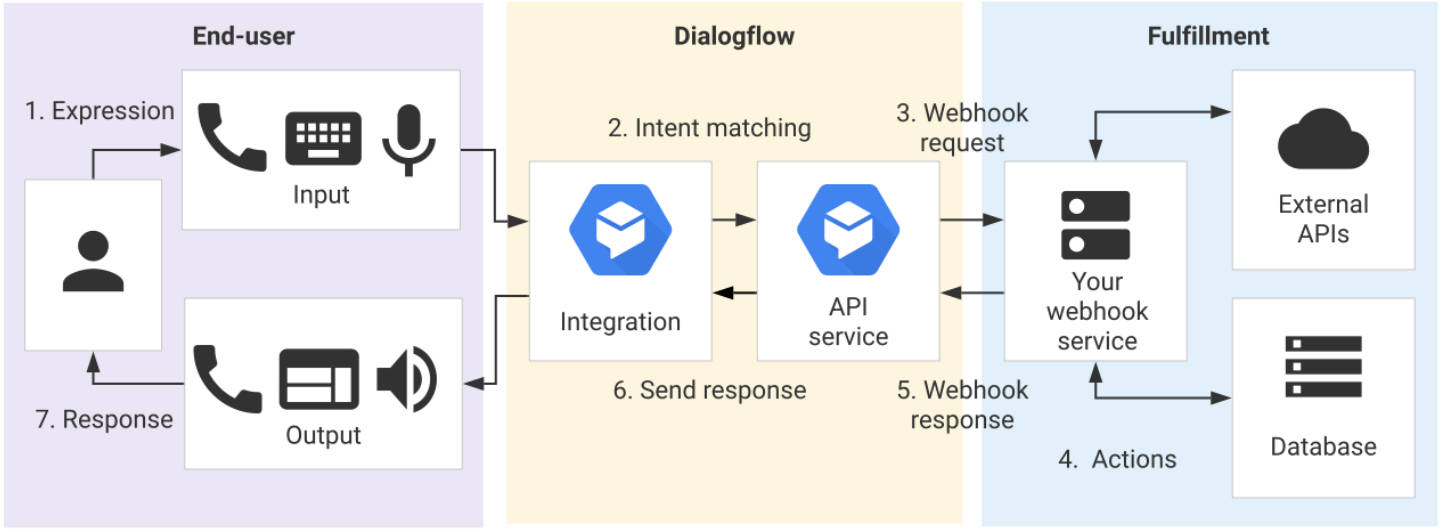
Webhook

- An HTTP callback
- An HTTP POST that occurs when something happens
  - a simple event-notification via HTTP POST
- A web application implementing Webhooks will POST a message to a URL when certain things happen
- They are a way to receive valuable information *when it happens*
  - rather than continually polling for that data and receiving nothing valuable most of the time

Webhook integration in Dialogflow

- A method to pass information
  - from a matched intent
  - into a web service
- and get a result from it

Officially supported via REST APIs, Node.js SDK, and on Firebase



Weather Web App

Last step: adding a Webhook…

References

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