Emotive Driver Advisory System (EDAS)

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Outline

• Introduction
• Background and Ford SYNC
• Emotive Driver Advisory System
  – Emotive Spoken Dialogue System
  – Avatar as an Advanced Automotive HMI
    – Cloud-based Infotainment
• Marketing & Business Impact
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Ford Motor Company

- Global automotive industry leader based in Dearborn, MI.
- Manufactures and distributes automobiles in 200 markets across six continents.
Ford Brands 2010
Ford Technology

Ford SYNC

MyFord Touch
Ford Research & Advanced Engineering

Manufacturing, Vehicles Design & Safety Research Lab

- Information Services & Connectivity
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The Challenge

Aibo

Emotive Driver Advisory System (EDAS)
Emotions in Engineering

- **Affective (Kansei) Engineering**
  - a method for translating feelings and impressions into product parameters

- **Affective Computing**
  - design of systems and devices that can recognize and/or simulate human emotions
Emotive Driver Advisory System

- Natural Interface
- Personalization
- Customization
- Context-Awareness
- Adaptable Interaction and Intelligence
- Seamless Integration of Vehicle Infotainment and Cloud-based Services
Ford SYNC

(CAN & USB)  (Bluetooth)  www.syncmyride.com
SYNC Services

- Standard Services
  - ✔ 911 Assist
  - ✔ Vehicle Health Report

- Subscription Services
  - ✔ Traffic
  - ✔ Directions
  - ✔ Business Search, News, Sports, Weather
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EDAS Overview

Spoken Dialog System
- Input Manager
- Dialog Manager
- Speech Recognition
- Semantic Interpretation

Emotive Response Generator
- Driving Conditions
- Driver State

Task Manager

Data Manager

Vehicle CAN BUS

Vehicle Apps
- Safety
- Performance
- Convenience

Driver State & Driving Conditions Analyzer

3rd party Web services
- Traffic/Weather Alerts
- Refueling Advice
- Speed Limit Changes
- Maintenance Concerns
- Personalized Infotainment
- Location-Based Notes
- Social Networking

App Services

Vehicle Portal

Server Speech Portal

Home/Office

Customization
- Preferences
- Learning
- Collaborative Filtering

User/Vehicle Profile

Video

Display NAV Audio

Buttons

Voice

Emotive Text-to-Speech

Emotive Response

Research and Advanced Engineering

Ford
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Spoken Dialogue System (SDS)

- Conversational
- Communication does not need to be hierarchical / menu driven
- Supports Open Mic / Push-to-Talk
- Multimodal (speech and/or button based interaction)
- Context aware & emotive dialogue
Emotion Recognition of Driver

Ways to detect emotions:

– Facial expressions: captured by camera
– Voice: input through microphone
– Biometrics: steering wheel, heart monitor
– Vehicle operating pattern: aggressiveness, workload

Emotion Vector

boredom 0.0000
happiness 0.0000
surprised 0.0005
hotanger 0.0000
sadness 1.0000
Emotive Conversational Dialog

Key Word Dialogue Interface

- **Speech Recognition:** converts recognized key word to text
- **Dialogue Manager**
- **Output Manager**

Conversational Dialogue Interface

- **Speech Recognition:** acoustic + language models
- **Input manager:** Semantic interpretation
- **Dialogue Manager**
- **Output Manager**

Keywords:
- Emotive Conversational Dialog
- Key Word Dialogue Interface
- Conversational Dialogue Interface
- Speech Recognition
- Dialogue Manager
- Output Manager
- Natural phrase
- Acoustic + language models
- Semantic interpretation
- Emotions
Emotion-based dialogue strategy

Using Driver’s Emotions to Modify Responses

Driver sends request: Monitor Fuel Economy

If Mood = bad & Performance = bad
Your hard acceleration is negatively affecting your gas mileage.

Check Driver’s mood

If Mood = good & Performance = bad
The way you’re driving right now is hurting your fuel economy. Please ease up on the pedal.
Dialogue Interface Architecture

Driver's emotional state

Speech Recognition
[Nuance speech recognition engine + Language Model built using Regulus]

Input Manager
[Semantic interpretation, built using Regulus]

Interpretation
[Determines system responses, e.g. send keywords to EDAS or navigate existing query result]

Output Manager
sends emotional tag
sends key words in text file
sends xml file in special format

Query Result Storage

Spoken Dialogue System (SDS)

Output message

CereProc text to speech

EDAS system queries the web

Driver speaks into microphone
Speech Signal

Output Manager
Actions to be performed

Query Result Storage

Sentiment recognition software

Speech Signal

Driver's emotional state

Sentiment recognition software
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Motivation for Avatar

- **Universal Multivariate Gage** (Chernoff Face)
- Reference Point of Vehicle Intelligence
- Agent of Customization
- Emotive Supplement to Text-to-Speech
- More natural interface
EDAS Prototype 2005
Avatars

Customizable Avatars, Voices, Names, & Background Scene
Jackie

EDAS
Emotive Driver Advisory System
Research & Advanced Engineering
Ford Motor Company
Toby Shouting

EDAS
Emotive Driver Advisory System
Research & Advanced Engineering
Ford Motor Company

Ford
Research and
Advanced Engineering
Output Responses from Avatar

- Request
- Driver Emotions
- Task Status
- Facial expressions
  - Tone of Voice
  - Emotive TTS
Emotion Recognition & Emotive Feedback

Hey Jackie

Playful

Serious

Formal

Emotion Recognition

Research and Advanced Engineering
Example clinic results

**Question 1:** If the avatar is human, what is the minimum you like it to appear?

**Answers Sorted By:**

- Age Group
- Gender
- Single or Not
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Benefits of Integration of Vehicle Infotainment and Cloud-based Services

- Enable on-demand, personalized infotainment services
- Access to real-time information
- Enable continuum of personalized information and entertainment services between on-vehicle and off-vehicle activities
- Utilize power of social network collaborative filtering in recommendation services
- Outsource Computing Power to Remote Server
- Simplify maintenance and upgrade of infotainment applications
Examples of EDAS Services

• POIs
• News
• Music
• Refueling advice
POIs & News

• POIs
  – Facilitates Social Network Collaborative Filtering – based Recommendations
  – Allow consolidation of relevant information scattered throughout the internet for enhanced decision analysis and support

• News
  – Personalized Interactive News Radio
  – Support Continuum of Personalized Information Services between in-vehicle and off-vehicle environment
POI & NEWS Services DEMO
Personalized Music Radio

Existing In-Vehicle Music Services

Private Collection

Broadcast

Personalized Music Radio

It's a new kind of radio - stations that play only music you like
Internet Personalized Music Services
Pandora Music Radio

• Creates custom stations based on artists or individual songs

• Learns preferences by analyzing the musical qualities of songs listener like and dislike

• Plays Music that matches personal preferences using AI and song genome database for song selection
EDAS Pandora Player
Intelligent Refueling Gauge

• Given a set of routes over a time period
  – When to buy gas
  – Where to buy gas
  – How much gas to buy

I recommend that you stop today at the Sunoco station because gas prices will be going up tomorrow.
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EDAS at CES & NAIAS 2009

01:19 January 10th, 2009

CES: Ford turns hip with Eva

Posted by: Anupreeta Das
Tags: Mediafile, Autos, Big 3 auto, cars, CES, Ford, Microsoft, Sync

Ford CEO Alan Mulally unveiled new features of its voice-command activated in-car system Sync yesterday at the Consumer Electronics Show in Las Vegas, highlighting its connectivity with a driver’s other devices, including cell phones and personal computers.

Mulally then showed off a futuristic dashboard featuring an electronic personal assistant, Eva (for Emotive Voice Activation). In a small video clip of how it could all work, the Eva avatar engaged the driver in conversation and performed tasks like scheduling appointments. It’s the next generation of Ford’s Human Machine Interface (HMI) strategy, Mulally said.
EDAS Media Coverage

EMOTIVE TEXT-TO-SPEECH SYSTEM AND METHOD

EMOTIVE TEXT-TO-SPEECH SYSTEM AND METHOD

Inventors: Gavrikov, Oleg Yurievitch; MacNeille, Perry Robinson; Klampfl, Eric; Theisen, Kacie Alane; Flev, Dimitar Petrov; Chen, Yifan; Tomshai, Rosavaraj
Assignee: Ford Global Technologies, LLC
Abstract: Text: Information about a device may be emotionally conveyed to a user of the device. Input indicative of an operating state of the device may be received. The input may be transformed into data representing a simulated emotional state. Data representing an avatar that expresses the simulated emotional state may be generated and displayed. A query from the user regarding the simulated emotional state expressed by the avatar may be received. The query may be responded to.

Publication Date: Mar 5, 2009
Application Filed: Nov 5, 2008
International Classifications: C10L

Nav. System Responds To Human Emotions

By Erin Van Lun, March 21 2009 in Business News
Posted in Intelligence, Emotion, Comprehension, Appearance, Speech synthesis (TTS), Market, Patents

Nav system that simulates emotion when reading out directions and detects the emotion of the driver.

Ford has filed a patent called "Emotive Text-to-Speech System and Method" describing a system that can not only simulate emotion when reading out directions and describing traffic problems, but could also detect the emotion of the driver and interact with the driver in ways designed to, oh, soothe a little road rage. The avatar is said to "appear to become frustrated" if the driver is a lead-foot, and may say "your driving is hurting my fuel efficiency." Or, if a driver is going too fast, the dash-bound assistant could turn blue, ask what's wrong, and suggest a more direct route to their destination.

Don't tell ME how to drive! - Next-gen Ford navigation system could have "emotions"

by Dan Roth - RSS feed on Mar 13th 2009 at 3:58PM

SUNDAY, MARCH 8, 2009

Ford Patent App Hints Next Gen Navi Systems Won't Talk to You if You're Angry
On March 5, 2009 the PTO published a patent application assigned to Ford Global Technologies entitled 'Emotive Text To Speech System and Method'. The app can be viewed here.
SYNC Pandora

2011 Ford Fiesta Rocks Out With Voice Control For Pandora

By Bengt Halvorson
Deputy Editor
April 19th, 2010

606 Views
5 Comments

SYNC API

Music Genome
Project Database

Pandora Server

User Profile
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Vehicle Design
Active Safety
P/T Controls
Vehicle Design
Systems Analytics
P/T Controls
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P/T Controls
Active Safety
IT
V&B Control
P/T Controls
P/T Controls
Systems Analytics
Vehicle Design