Modelling Contexts in Cross-Cultural Communication Environments

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Tekes

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3. CeACCC-prototype
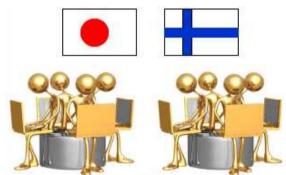4. Usage examples
5. Conclusion

Basic Concepts

- In the near future, cultural computing will have several important applications in our knowledge societies in the fields such as business, environment, health care, education and research.

- Culture can be considered as one example of context and cultural computing as a subset of context computing

- Context-sensitive applications have to adapt not only to the device, the connection state and the user environment but also to the user's situation at hand.

- Many context models model only the physical environment, i.e. location, identity, and time

- We propose a two-level context model that includes a generic level and an application domain specific level.

- The focus of our context modelling is on users' situations at hand in cross-cultural communication environments.

Approaches to Context Modelling

- Context definitions can be divided as follows (Coppola *et al,* 2009)
  - **Extensional definitions** present the context through a list of possible context dimensions and their associated values (e.g. location, proximity to other people, devices, time)
  - **Intensional definitions** present the concept of context more formally. Despite being theoretically satisfying, extensional definitions seem to be more useful in practical applications.
- Context modelling approaches can also be classified by the scheme of data structures which are used to exchange contextual information (Strang and Linnhoff-Popien 2004, Shimizu 1995, etc)
  - Key-Value Models, Markup Scheme Models
  - Graphical Models, Object-Oriented Models
  - Logic Based Models, Ontology Based Models
  - SECI/Shared Context Model
- A complete and comprehensive model for contexts is still missing.
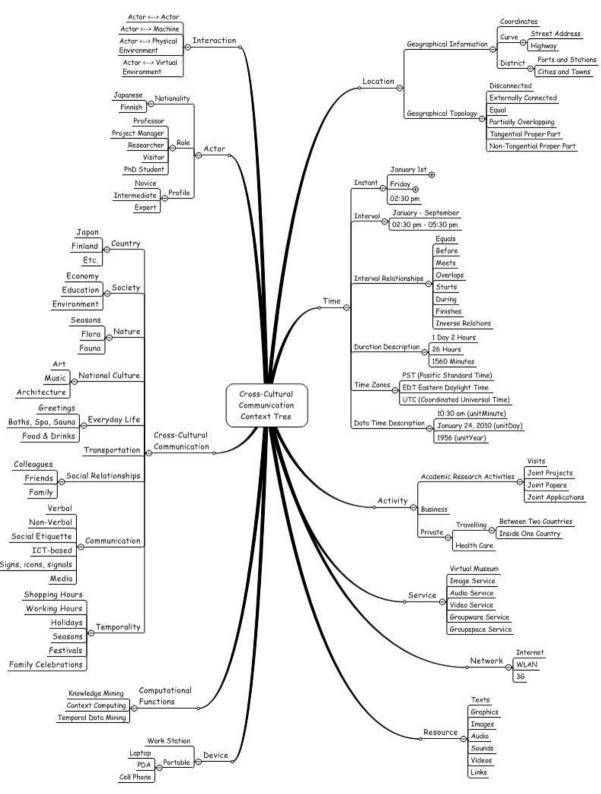
Context as a Situation at User's Hand

- Our (working) definition: context is a situation at user's hand.
  - The key triplet in our context research is *(cross-cultural communication environment, user/actor, situation)*
  - Based on the context definition classifications, our approach is extensional and (lightweight-)ontology-based

- The focus in our study is on modelling cross-cultural communication contexts, i.e. situations at user's hand in cross-cultural environments.
  - These environments can be physical, virtual or hybrid.

- The context ontology is illustrated by a context tree – a hierarchical structure containing both generic and application domain specific contexts. Each context may contain attributes and subcontexts.
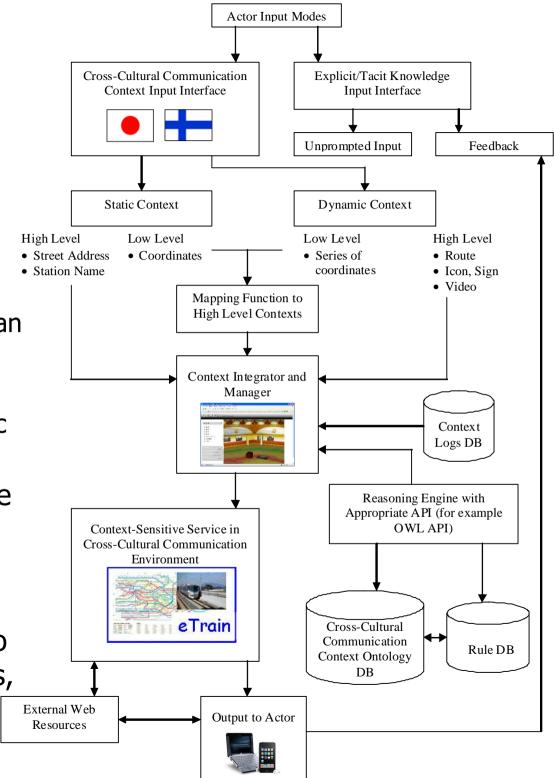
Context Tree

- Generic contexts include:
  Actor, Interaction, Location, Activity, Service, Network, Resource, Device

- Cross-cultural communication -domain specific contexts include: *Country, Society, Nature, Everyday life, Social Relationships, National culture, Transportation, Communication*

- The ontology is implemented as OWL using Protégé editor.

Information Flow Architecture

- A generic model for information flow and processing architecture for cross-cultural communication environments is outlined

- The system has two main input modes:
  - The explicit/tacit knowledge input mode can be used to store actor's own experiences
  - By means of the situation/task-specific interface the actor inputs static or dynamic contexts.

- The situation the actor has at hand can be mapped to a context ontology and transformed to reasoning and decisions

- The output can be knowledge explaining how to act in certain situation; it may also activate searching and delivering contents, or more advanced data mining functions.

Actor Input Modes

Cross-Cultural Communication Context Input Interface

Explicit/Tacit Knowledge Input Interface

Unprompted Input

Feedback

Static Context

High Level
- Street Address
- Station Name

Low Level
- Coordinates

Dynamic Context

Low Level
- Series of coordinates

High Level
- Route
- Icon, Sign
- Video

Mapping Function to High Level Contexts

Context Integrator and Manager

Context Logs DB

Reasoning Engine with Appropriate API (for example OWL API)

Context-Sensitive Service in Cross-Cultural Communication Environment

eTrain

Cross-Cultural Communication Context Ontology DB

Rule DB

External Web Resources

Output to Actor

Contextual electronic Assistant for Cross-Cultural Communication (TrainCAT)
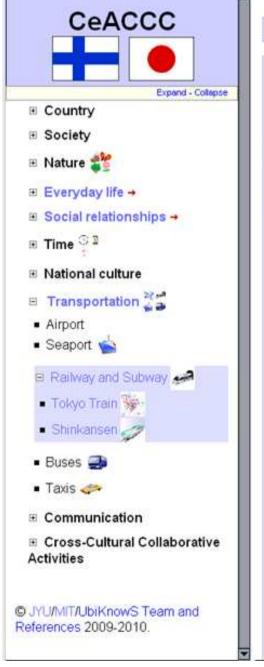
- CeACCC is a demo application that partially implements the context flow architecture

- The goal of the CeACCC is to support the user/actor in cross-cultural situations (e.g. research, meetings, travelling – transportation is used as a specific example)

- Technically, a faceted classification -based content management -like system.

  - Contexts are modelled as facets in a tree structure

  - Content items are instructions or helper applications (e.g. applets) attached to one or more contexts

  - Includes also guided tours - views to predefined scenarios in a given context

  - Future work includes keyword or natural language search, situation recognition based on image data, and dynamic context processing

- Implemented as a www application, planned to be used in mobile environment

CeACCC - Overview

CeACCC

Expand - Collapse

⊞ **Country**

⊞ **Society**

⊞ **Nature**

⊞ **Everyday life** →

⊞ **Social relationships** →

⊞ **Time**

⊞ **National culture**

⊟ **Transportation**
- Airport
- Seaport

  ⊟ Railway and Subway
  - Tokyo Train
  - Shinkansen

- Buses
- Taxis

⊞ **Communication**

⊞ **Cross-Cultural Collaborative Activities**

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Search

| Free Browsing | Guided Tours | Img Recognition | Charts | Options | Help |

Current Context: Top > Transportation > Railway and Subway

Subcontexts: [Tokyo Train - Shinkansen]

| Content Items | Guided Tours |

- Practical Information on travelling by train

Practical Information on travelling by train
show/hide

How to buy a ticket?
How to find the right platform?
Approaching the gate
Queueing
Safety gate
In the train
Changing train
At the destination station
General advice

How to buy a ticket?

You can buy a ticket either at a ticket counter or from an automated ticket machine. At the counter, tell the sales person where you are travelling to and they'll tell you the price. Pay for the ticket and head towards the platforms.

Buying a ticket from a machine is a bit more difficult. First of all, you should look at the Tokyo train map and see which colour coded line is **the last** one you will use to get to your destination. Most maps have the station names in Roman letters, too. Different companies have their own ticket machines; choose the one of the same colour as the last line you will use.

On the wall there is a map with station names and fares associated with them. Check the fare to your destination station. Insert money into the machine and push the button for the correct fare. The machine will give you the ticket and the change.

CeACCC - Functionality

- Context Tree containing categories of situations for free browsing
  - Content items contained in contexts can be browsed with navigation to super- and subcontext, and related items
- Guided tours
  - Predefined views to specific contexts that have fixed ordering and additional content.
- Helper applications, can be attached to content items
  - Imported content from external web sites (e.g. world time)
  - GridChart – Visualization component for clickable and zoomable content in given categories (e.g. train maps)
  - KeyGraph, graph visualization component based on TouchGraph LinkBrowser for browsing graph data (e.g. social relationships)
  - Situation recognition component, can be used to identify icons and other image data submitted by user for dynamic context search

Guided Tour Example

- Collection of most common scenarios/situations (e.g how to get from airport to hotel)

- Includes both icons and textual links

- Detailed, step by step instructions with additional options and functionality (e.g. search by fastest or cheapest route)

- Detail level can be profiled based on used expertise or cultural orientation.

In the stations, there are several Exit Gates. Each gate has a letter and a number for identification. It is very important to identify the right gate to go out from the station.

The green sign is one of the three icons used in Tokyo to indicate subway (Icon title: Toei Subway), Station name, line symbol (=E), and station number (=28).

Fastest route

	Station	Line	Travel time (2h 12min)	Fare (2,100 Yen)
	Tsukuba			
	Tsukuba	Tsukuba Express	52 min	1,150 Yen
	Akihabara			
	Akihabara	JR-Keihin Tohoku line	15 min	
	Shinagawa			
	Shinagawa	JR-Tokaido line	26 min	300 Yen
	Totsuka			
	Totsuka	Yokohama Subway-Blue line	11 min	300 Yen
	Enoshima			

Situation Recognition Example

1. When encountering an unknown sign or symbol in the train station, the actor can take a picture of it with her/his mobile device, and use CeACCC's image recognition feature to help interpret the sign or symbol.

2. The actor submits the image by her/his mobile device to the CeACCC pictorial database. The actor can also give additional information in order to help the interpretation of the content of the image. The additional information can consist of instructions to focus on certain part of the image or of instructions to omit something from the image. The image service sends the picture to CeACCC's pictorial database.

3. A pictorial recognition service indentifies the symbol and associated description of its meaning. The image service sends the symbol description and action guidelines for the actor.

4. The actor knows how to interpret the symbol and how to behave in the situation at hand.

Images on the right are examples of the files that the actor could could submit to pictorial database for recognition

Conclusion & Further Research

- We discussed context as a key to situation specific computing. In our research, context is defined as situation at user's hand.

- We have introduced our cross-cultural communication context tree and information flow architecture, and an example of initial implementation.

- Future work involves
  - Further development of the CeACCC system
  - Formalization of the context tree
  - Implementation of image recognition functionality on a mobile device
  - Larger-scale testing in actual environment
  - Context Modelling from Software Development point of view - increasing abstraction and formality

Thank You!

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