



Advanced Robotics Solutions
for Transport, Cleanliness, Security and Health

A large, semi-transparent watermark of the robosoft logo is centered in the background of the slide.

robosoft
Advanced
Robotics
Solutions

robuBOX-Kompaï :

Open Source software for companion robots

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Summary

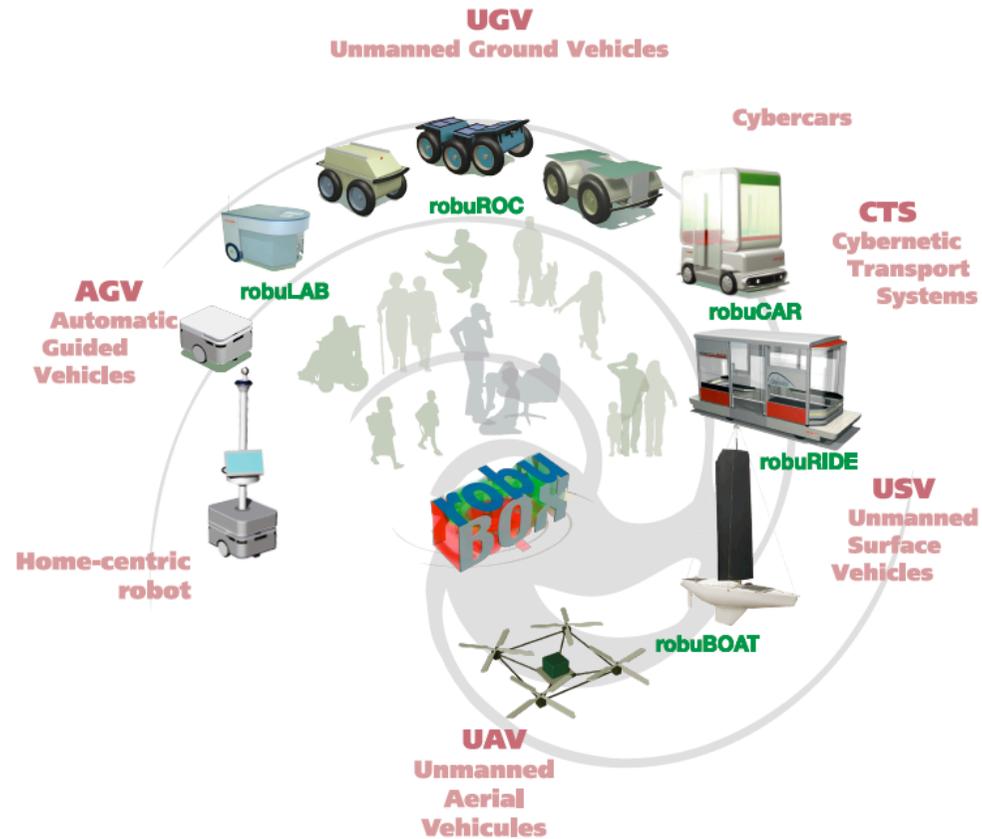
1. About us
2. Kompai - a closer look at the platform
3. What is PURE?
4. How is it implemented?
5. A concrete exemple: the robuLAB10
6. Development Roadmap
7. Kompai functionalities
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10. Dialogue customization

ROBOSOFT's profile

- Created in 1985 (startup of INRIA)
- Our mission : robotize services
- Our activity : R&D contractor
- 2 locations : Biarritz and Grenoble (F)
- 30 employees
- 6 M€ (\$8 M) sales in 2009
- More than 1,000 robots sold since 1985



We make robots to robotize services





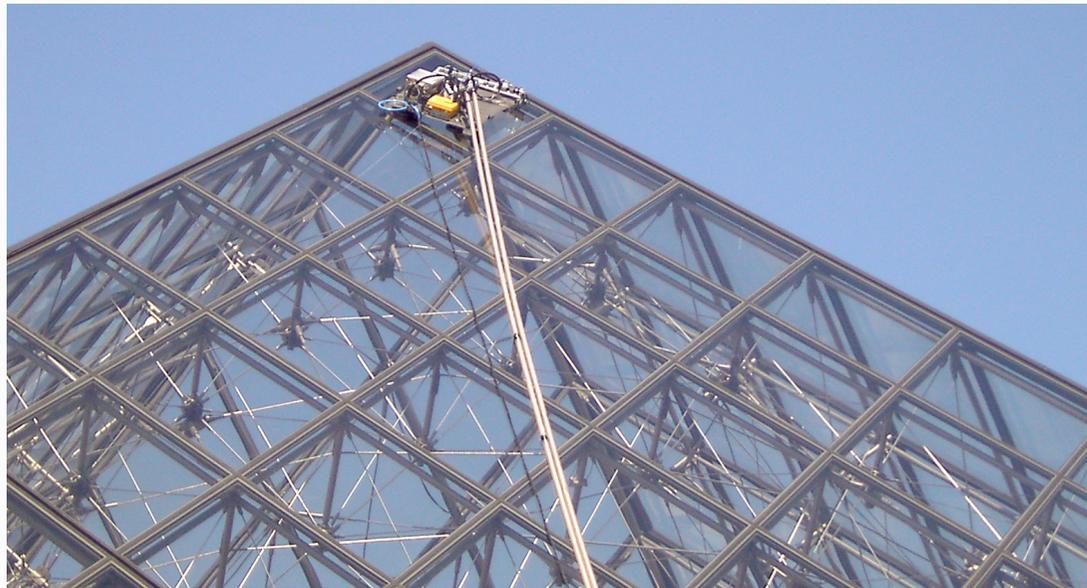
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Service robots

cleaning

robuGLASS - The Louvre Pyramid application

Faster
Cleaner
World's first!





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Service robots

security

robuROC

Exploration

Demining

Rough terrain





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Service robots

transport

robuRIDE

Driverless

Near 0 infrastructure!





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Service robots

Kompai

Advanced interactivity

Companion robot

Web-based cloud services

healthcare





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A closer look at the platform

Lower part



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Emergency stop

Wifi connection

On-board controller
real-time motion control
(CE)

Batteries
li-ion batteries

Odometry

2 DC motors
differential drive steering,
can turn on the spot

**Sensitive Bumper for
security**



Ultrasonic sensors
for obstacle detection

Intelligent video camera

Laser range finder
for mapping and navigation

Infrared sensors
for obstacle detection and
avoidance

Infrared sensors
for hole and stairways
detection



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A closer look at the platform

Higher part



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Pan-tilt web cam
with image processing
built-in functions

**Customizable head
and face**

Multi-touch tablet PC
SDK robuBOX-Kompai®
based on Microsoft®
Robotics Developer Studio

Adjustable support

What is PURE?

- PURE is an acronym for
« Professional Universal Robotics Engine »
- It supports the tasks common to all (Robosoft) robotic platforms:
 - Sensor acquisition
 - Actuator control
 - Feedback control loops
 - Robot supervision

What is PURE?

- A robotic platform is a collection of heterogenous devices ...
 - Multiple communication layers
 - USB gamepad
 - CANopen drives
 - RS422 laser range finder
 - Multiple paradigms
 - Synchronous or Asynchronous
 - Point-to-Point or Bus
- ... and basic motion primitives
 - Speed commands
 - Path following
 - Gamepad control

What is PURE?

- PURE alleviates the requirements and costs of high level applications
 - No more exotic hardware interfaces
 - Less hardware specific software
 - Less real time constraints
- PURE presents the functionalities of the platform
 - In a homogenous manner
 - Through a single communication interface
 - With a simple, easy to use and platform independent protocol

How is it implemented?

- PURE is written in C++
 - High-level yet real-time capable language
- Implements a thin object oriented abstraction layer
 - Currently on top of WIN32, under a customized Windows CE 6 runtime
- Provides a simple concurrency model
 - Synchronous tasks, triggered periodically
 - CANopen bus control, high level notifications...
 - Asynchronous tasks, triggered by external events
 - Data from an IMU, a laser, a high level request...
 - With transparent and thread safe data passing

How is it implemented?

- Core functionalities are implemented using this model and exposed through generic interfaces
- Generic interfaces are exposed through the PURE High level protocol
 - Independent of the physical layer
 - Server – Client model
 - Configurable data notifications
 - Modular service based model
 - Self descriptive



A concrete example: the robuLAB10

- All sensors and motor control is handled by PURE
 - CANopen drives (left and right motors)
 - CANopen I/O (bumpers, ground sensors, infrared devices)
 - I2C ultrasonic sensors
 - RS422 laser range finder
- Manual control with a gamepad



A concrete example: the robuLAB10

- Everything is accessible through UDP, as:
 - Differential drive
 - Telemeters
 - Laser sensor
 - Digital inputs
- Lets see this in action...

Development roadmap

- Already planned:
 - Integration of localization
 - Kalman filter, accounting delays from high level updates
 - Path following
 - Allows high speed motion
 - Distributed control
- Under investigation

Kompaï functionalities

1. Mapper

- Generate environment map using laser scan.

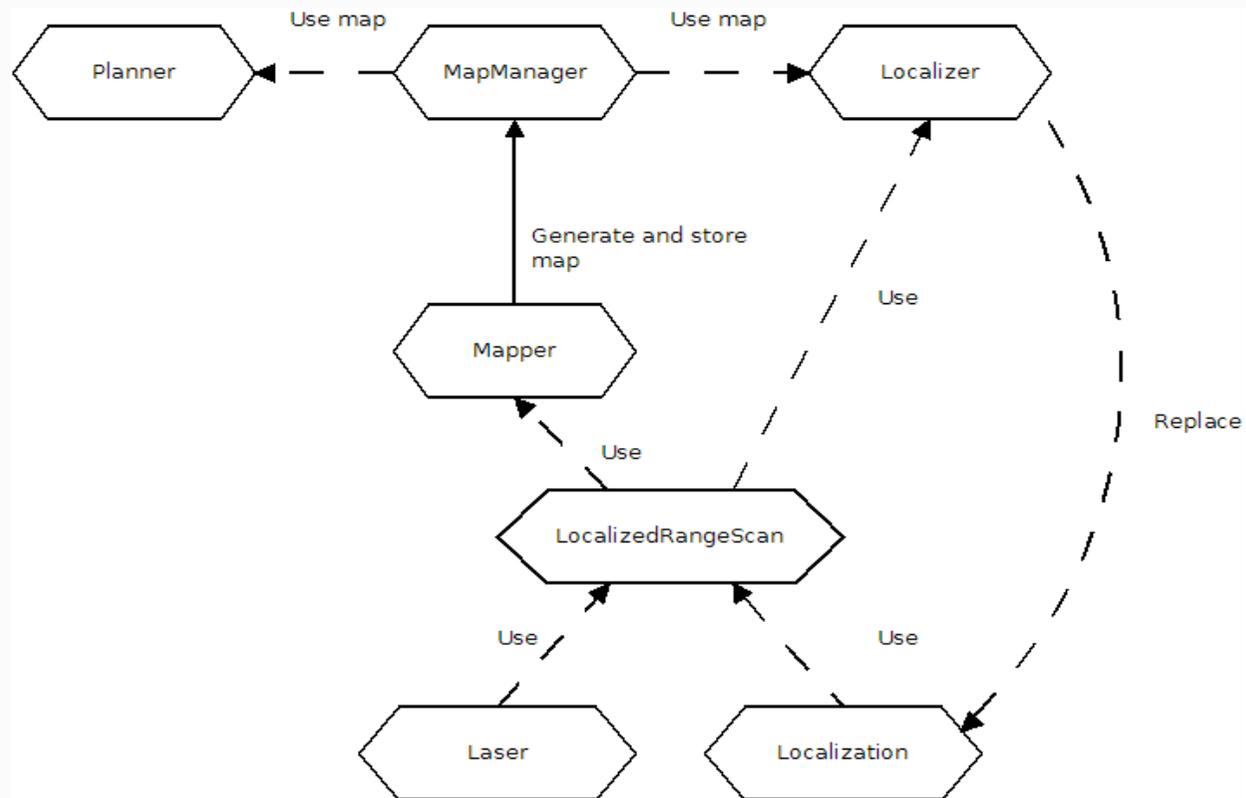
2. Localizer

- Localize robot using laser scan and a map.

3. Planner

- Generate a path from two points using a map.
- Obstacle avoidance.

Kompaï service architecture



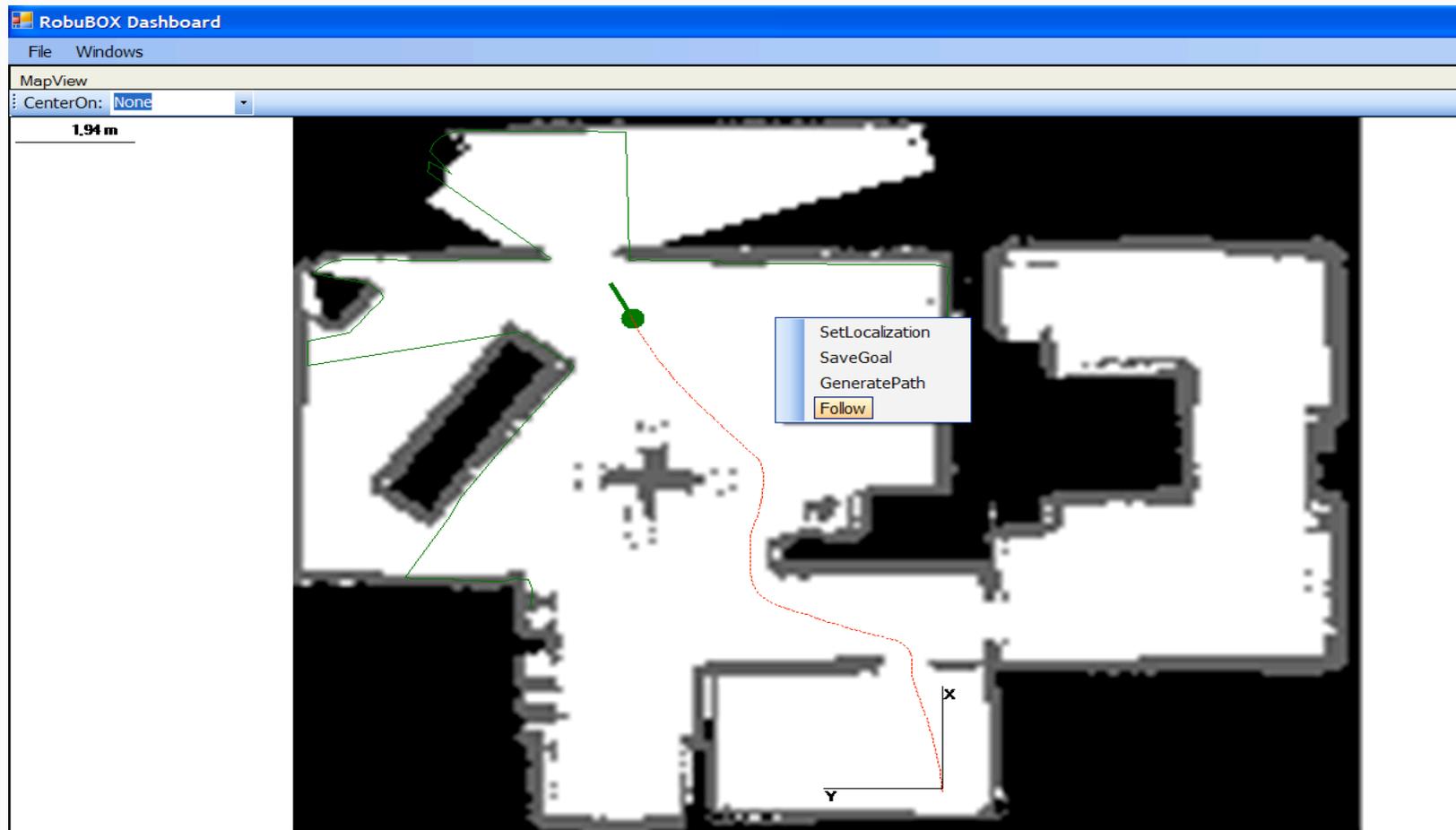
Kompaï service description

- LocalizedRangeScan
 - Merge localization and laser data.
- Mapper
 - Generate map, store it on harddrive, store map path inside map manager
- MapManager
 - Store map path and associated goals, provide current map to be used by localizer and planner.
- Localizer
 - Using a map and localized range scans, localize robot.
- Planner
 - Generate path over map.



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Kompaï live demo





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What is DIALOGUE?

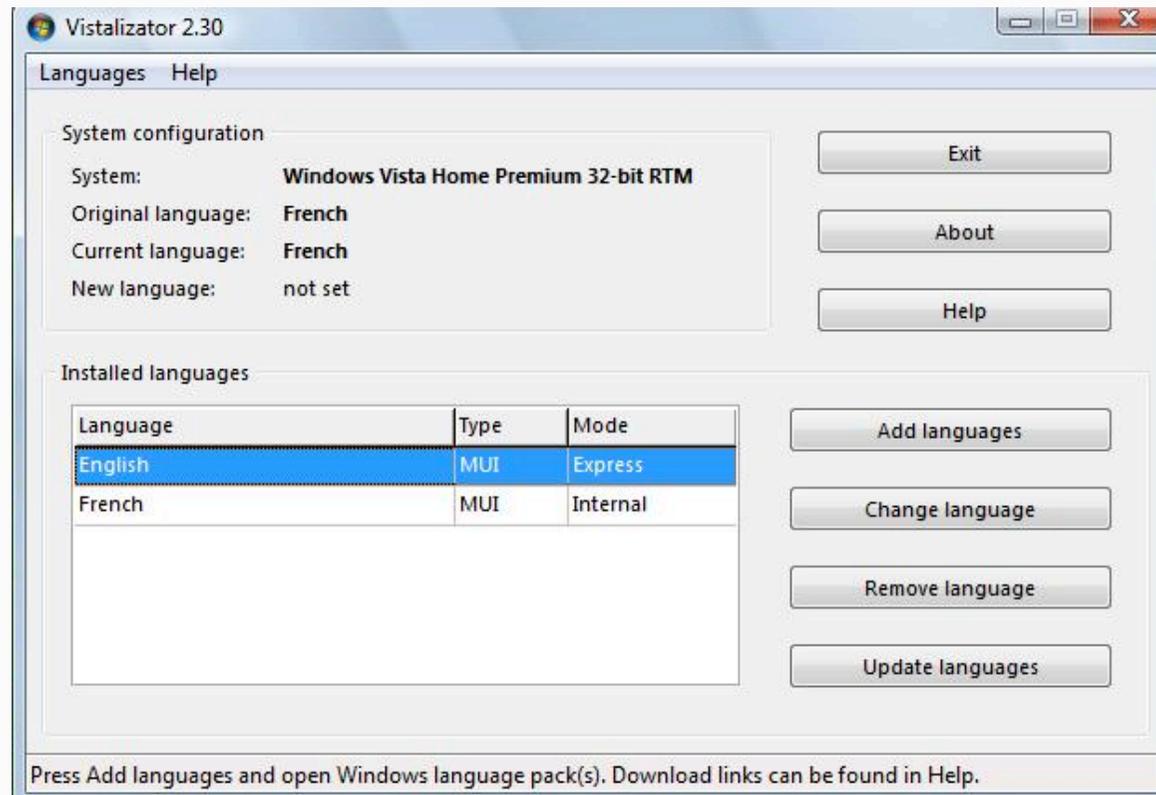
The Dialogue service is an application that allows communicating with Kompai tablet PC by voice recognition and voice synthesis.

Configuring the Tablet PC for Dialogue

If you want to work in a language different from the language of the Windows Vista OS installed on your Tablet PC you have to do the following steps:

- Download the free package of languages for Windows vista from Internet (it's available on several web sites).
- Download the program Vistalizador from Internet (it's free and available on several web sites).

Run Vistalizator.exe and you have the following window that appears:





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- If the language that you want to use is not in the list of installed languages, click on “Add languages” and select it.
- When the language appears in the list, select it and click on “Change language”.
- Then click on “Exit” and accept the system restart.



Speech Properties

Speech Recognition | Text to Speech

You can control the voice properties, speed, and other options for text-to-speech translation

Voice selection

Microsoft Anna - English (United States)

Settings...

Use the following text to preview the voice:

ave selected Microsoft Anna - English (United States) as the computer's default voice

Preview V

Propriétés de la synthèse vocale

Reconnaissance vocale | Synthèse vocale

Vous pouvez modifier les propriétés de la voix, la vitesse et d'autres options de conversion de texte par synthèse vocale

Sélection de la voix

ScanSoft Virginie_Dri40_16kHz

Paramètres...

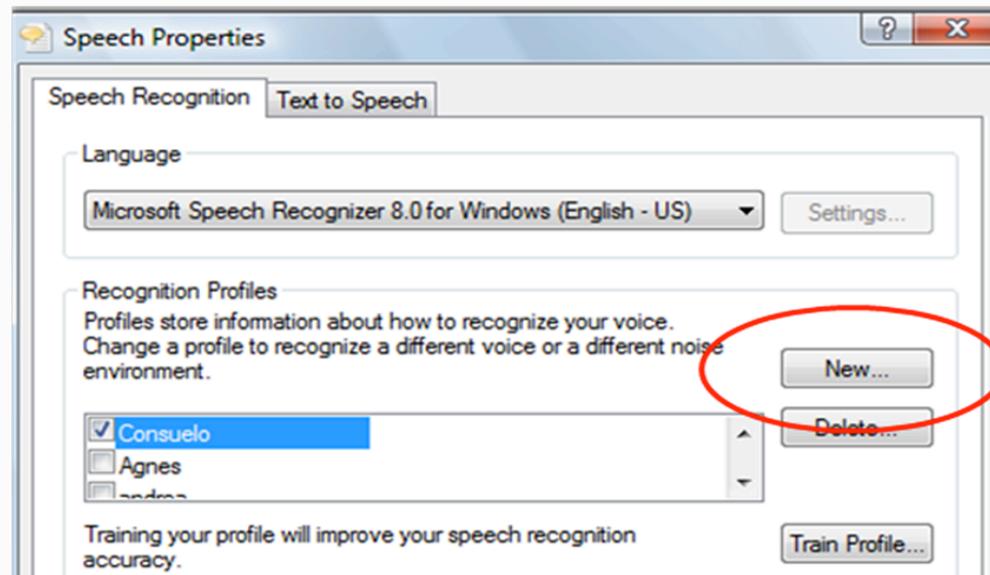
Utiliser le texte suivant pour tester la voix :

You have selected ScanSoft Virginie_Dri40_16kHz as the computer's default voice.

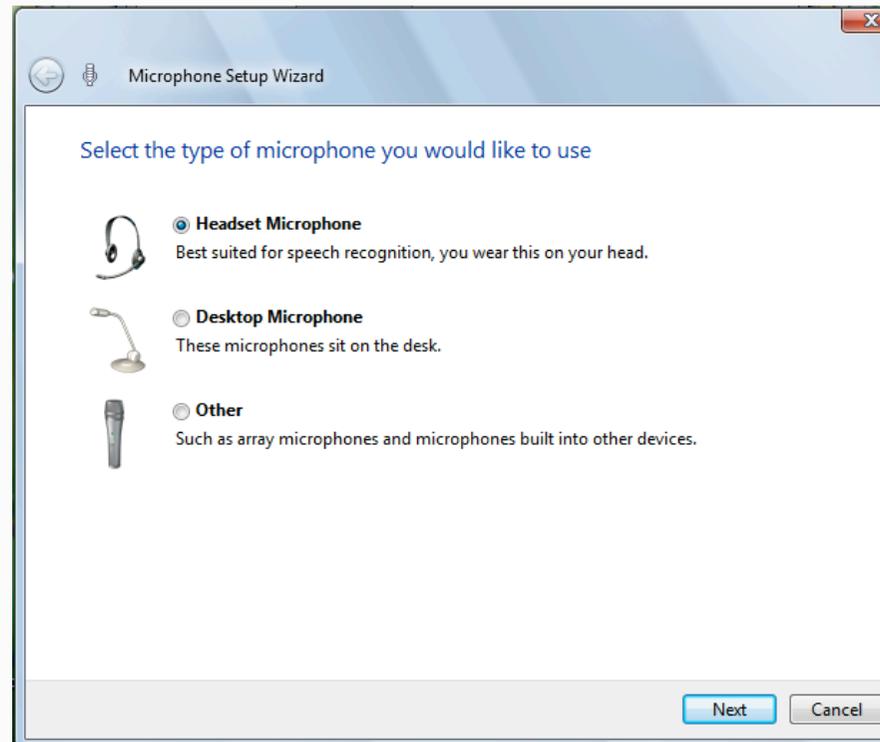
Tester la voix

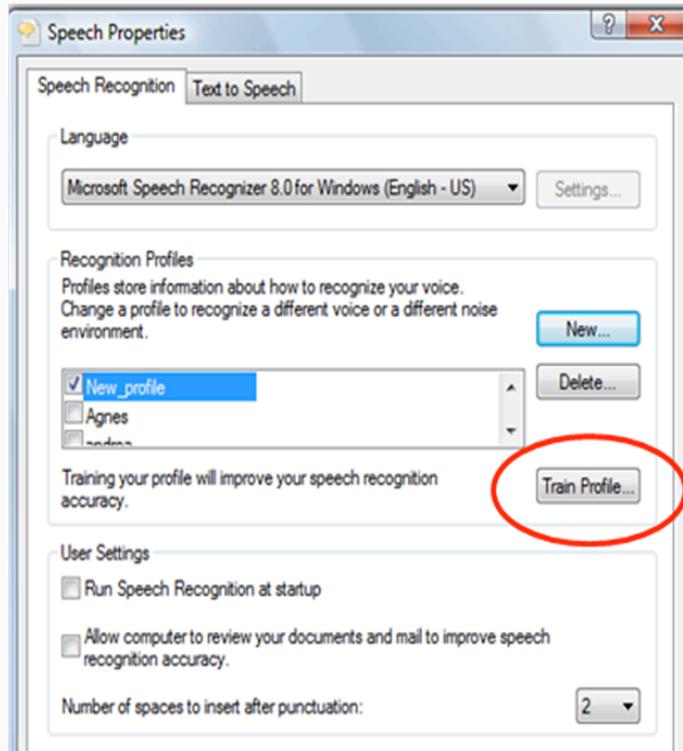
Teach your voice

Before you start the voice recognition, you have to teach your voice to Windows Vista. For that you need just 5/7 minutes. Go on ControlPanel -> VoiceRecognition of the TabletPC and create a new profile.



You can configure the microphone just reading the sentence suggested by the pc.





The phase of learning lasts for about 5/7 minutes and it consists of the reading of some sentences suggested by the pc. We advise you to do this training speaking normally and in a quiet environment.

Google account configuration

To use all the features available, you need a Google account for your Kompai.

By default, a generic account has been created for all the customers, in order for you to have an overview of the feature. You cannot modify anything in this account, so you won't be able to add or delete elements in the lists, agenda etc

- Create a Google account online
- You then need to activate your account Agenda/Calendar function
- Then create a new Calendar called "Robot"

You then need to activate your Google Documents webpage and create the spreadsheets:

- “ShoppingList”: the first line of this list MUST contain the headers “Product” and “Number”

[Gmail](#) [Calendar](#) [Documents](#) [Reader](#) [Web](#) [more](#) ▼

Google docs ShoppingList

File Edit View Insert Format Form Tools Help

€ % 123 ▼ 10pt ▼ **B** Abc A ▼  ▼ 

	A	B	C
	product	number	
2	pomme	5	
3	tomate	12	
4	fromage	6	
5			
6			
7			
8			

Basic interactions with Kompai

Welcoming introduction, confirmation of choices, stopping discussion... These functionalities are basic and don't need an internet connection.

In English:

Examples:

"Hello?"

"Kompai, listen to me"

"Shut up"

"Stop"

"Yes"

"No"

...

In French:

Examples:

"Bonjour"

"Kompai"

"Kompai, écoutes moi"

"Tais toi"

"Oui"

"Non"

...

Time and Agenda management

This functionality is used to manage the user online agenda. You can ask for the current date and time, and using the Google web-based features you can add/retrieve appointments.

In English:

Examples:

”Do I have any appointment today?”

“When is my next appointment with the doctor?”

“I would make an appointment”

“Wake me up in to 2 minutes please”

“What time is it?”

“What is the date?”

In French:

Examples:

”Est-ce que j’ai des rendez-vous aujourd’hui?”

“Quand est mon prochain rendez-vous avec le docteur?”

“je veux prendre un rendez-vous avec mon frère demain à 15 h”

“Réveilles moi dans 2 minutes”

“ Quelle heure est-il? ”

“ Quel jour sommes-nous? ”



Kompaï motion

This section REQUIRES that:

the places you want to send Kompaï to are defined in the correct language in its current map

the locations are defined and recognized by the voice recognition (locations defined in the Grammars).

In English:

Examples:

“Go to the window

“Go in to the kitchen”

“Go near the sofa, please!”

In French:

Exemple:

“Va à l’armoire”,

“Déplaces-toi à la
fenêtre”...



Shopping

This functionality is used to manage the user online shopping list. Using the Google web-based features you can add/retrieve items from the list. The list is located in the GoogleDocuments of the Kompaï account, named as ShoppingList.

In English:

Examples:

“What is in the shopping list”

“I would like to add 5 apples”

”I want to remove 3 tomatoes from the shopping list”

In French:

Exemple:

“Qu’est-ce qu’il y a dans la liste de course?”

“Ajoutes 3 pommes à la liste”

“Enleves 5 pommes à la liste”

Medical alarm

This functionality is used to send automatically an e-mail to the doctor when the user feels sick.

Kompai asks for some symptoms and sends the collected information by mail. If Kompai is not connected to internet the system says that it cannot send the e-mail.

In English:

Examples:

”I feel bad”

“I’m not fine”.

In French:

Exemple:

“Je ne me sens pas bien”

“J’ai mal au ventre”

Sending emails

This functionality is used to send an e-mail to a given person by dictating the text to Kompai.

The email address of the contact has to be correctly specified in the Google contact list and the name of the contact has to be defined in the Grammar xml file, to be recognized by Kompai.

In English:

Example:

”I would like send an e-mail
to Sylvie”

In French:

Exemple:

“Je veux envoyer un email
à Sylvie”

How to customize your dialogue

If you want change the sentences understood by Kompai, you have to make some changes to the grammars. All the grammars are stored in the folder C:\MRDS2008R2\Applications\Grammars.

For example, the actually syntax for the rule EMAIL in MainGrammar.xml is

```
<rule id="email">
  <ruleref uri="#politeness"/>
  <one-of>
    <item>write</item>
    <item>send</item>
  </one-of>
  <item>an</item>
  <one-of>
    <item>email</item>
    <item>message</item>
  </one-of>
  <item repeat="0-1">to</item>
  <item repeat="0-1">
    <ruleref uri="#name"/>
    <tag>out.name=rules.name;</tag>
  </item>
  <item repeat="0-1">please</item>
</rule>
```



```
<rule id="politeness">
  <one-of>
    <item>please</item>
    <item>I would like to</item>
    <item>I want to</item>
  </one-of>
</rule>
```

```
<rule id="name">
  <item repeat="0-1">
    <one-of>
      <item>the</item>
      <item>my</item>
    </one-of>
  </item>
  <one-of>
    <item>
      someone<tag>out="someone";</tag>
    </item>
    <item>
      Simone<tag>out="simone";</tag>
    </item>
    <item>
      doctor<tag>out="doctor";</tag>
    </item>
  </one-of>
</rule>
```

Add a new Goal location in the current map

You can send to Kompai the vocal order to move to a known place. To use this functionality you need that Kompai knows the map of the place where it is and all the goals associated to this map (SLAM). The goal name has to be defined also in the MainGrammar xml file as following

```
<rule id="place">
  <one-of>
    <item>
      kitchen
      <tag>out="kitchen";</tag>
    </item>
    <item>
      refrigerator
      <tag>out="refrigerator";</tag>
    </item>
    <item>
      table
      <tag>out="table";</tag>
    </item>
    <item>
      sitting room
      <tag>out="sitting room";</tag>
    </item>
  </one-of>
</rule>
```



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