“ENVIROfying” the Future Internet

BRINGING BIODIVERSITY TO THE FUTURE INTERNET

BIODIVERSITY APPLICATION OVERVIEW

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Introduction

1. Biodiversity – the variety of Life on Earth – makes our planet habitable and beautiful.
2. Human well-being is dependent upon "ecosystem services" provided by nature for free such as
   - Water provision
   - Air purification
   - Fisheries
   - Timber production
   - Nutrient cycling
3. Anthropogenic pressures are causing biodiversity to decline
4. Dependable data on the state of biodiversity is essential to establish the most efficient measures for biodiversity protection
1. ENVIROFI-BIO app explores the opportunities provided through new technologies to support biodiversity survey

2. The goal was to identify the necessary Enablers for such applications, so the necessary basic building blocks to simplify future development of such apps

3. ENVIROFI-BIO app currently tailored to trees, but the same mechanisms work for most other areas of biodiversity
Biodiversity Scenario Requirements

1. Enable users to provide observations on biodiversity using mobile devices (often in remote areas and under unfavorable weather conditions)
2. Integrate additional (possible contradictory) observations from third-party databases
3. Assess the quality of the observation through combination of context aware quality assurance methods and crowdsourcing
4. Utilize ontologies for unique identification of species as well as quality assurance (plausibility checks)
5. Provide observation data based on international standards
1. Ontology
   • Unique entry for each species
   • Identifications reference species entries

2. Area of Interest (AoI)
   • Define location where app will be used
   • Download and cache relevant data for use in the field

3. Object of Interest (OoI)
   • The object we are interested in
   • Contains only basic geographic information, rest is provided by observations

4. Observations
   • Covers all additional information on the OoI
   • Structured in accordance with O&M (ISO 19156)
1. First approach: label Object as „apple tree“
2. Problem: what if somebody says it’s a plum tree?
3. Continues: somebody else says it’s a pear tree
Basic Concepts: Ool versus Observations

Identification

Apple Tree

Identification

Fruit Trees

Identification

Pear Tree

Identification

Plum Tree
5. Crowd Sourcing
- Existing data from various sources available
- Additional OoI can be provided by users
- New observations on existing OoIs can be provided by users
- User’s are assigned a Trust Level based on
  - Credentials provided at registration
  - Their track record within the system
- Plausibility level for new observations determined by:
  - User’s Trust Level
  - Trust the user gives their own observation
  - Automated quality assurance mechanisms
- Observation with the highest trust level is displayed, others available for expert users
Basic Concepts: Preferred Identification

- Preferred Identification
  - Identification 80%
    - Apple Tree
    - Pear Tree
    - Plum Tree
  - Identification 50%
  - Identification 30%

Fruit Trees

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Getting Started

1. Login
2. Set Area of Interest
Getting Started: Login

Login User

kathischleidt@gmail.com
The app uses two types of popups:

**Help Messages**
Most popup messages are educational. These popups can be safely turned off by the user.

**Warnings**
The app will warn users before performing “dangerous” operations (e.g. deleting data or starting a large data transfer).
Getting Started: Main Menu

List Observations
Browse through Objects of Interest (trees), report new objects and observations, define new areas of interest.

Settings
User options

Areas of Interest
Shortcut to previously defined Areas of Interest
Getting Started: Area of Interest

- Select relevant area of the map
- Set Area of Interest
- Download Progress is Shown
- Enter Name for Area of Interest
- Save Area of Interest
- Select "List View" for Map View
- Confirm Download
- Enter Name for Area of Interest
- Progress is Shown

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Map View

Basic functions:
- Double-tap to zoom-in,
- Stretch to zoom-out,
- Drag map to pan

Zoom buttons
Add OOI button
Tap to add new object
Single OOI (tree)
Tap to show and add details
OOI group (11 trees)
Tap to zoom in
New AOI button
Tap to add new Area of Interest
„My position“ button
Tap to re-center the map on GPS position

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List View and Filters

List View

List view is synchronized with the Map View and presents an alternative view of the trees within currently active map area.

*Hint: press on a tree name to show tree details*

Filters

Filters can be used to reduce the number of individuals displayed by selecting only those corresponding to filter criteria. The filter is honoured by map and list view.
A table providing the initial observations on the individual are shown. Each entry is the result of one observation. Additional observations provided at a later point in time are displayed in separate blocks together with user information and a time stamp.
Adding Objects of Interest (OoI)

Why OoI?
OoI closely aligned with OGC’s “Feature of Interest” and the concept of “Thing” in Internet of Things.

OoI is one of the core data elements of the Environmental Georeferenced Observation Service SE, and used to represent species occurrences in this app.

Tap here, to enter the „add OoI“ mode.

Pan & zoom the map to choose OoI location

Press the crosshair to report a new OoI at this position

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Adding Observations

Concept of observation originates from the Observations and Measurements Standard (O&M) from OGC Sensor Web Enablement.

Each piece of data added to an OoI is an Observation.

One OoI will often have many Observations attached; multiple Observations of the same property may be attached to an OoI

**Note:** While for internal storage other data structures are used due to performance considerations, mapping to the standard O&M schema is simple.
Adding Observations - Properties

1. Each Observation is assigned a Property that describes what is being observed.
2. The available Properties were collated from existing data sources.
3. In cooperation with the Austrian Long Term Ecological Research Network (LTER) we assured that all requirements for scientific use are met.
4. The Observation Properties are thematically grouped for easy navigation and access.
The following types of Observed Properties have been defined:

1. Inventory Number
2. Identification
3. Location
4. Length Properties
5. Planting Year
6. Comment
7. Image
8. Classification of the Social Position
9. Status (with additional timestamp)
Adding Observations

Select Property

Select Property from list

The various fields for classification:

Save Observation

<table>
<thead>
<tr>
<th>Image Type</th>
<th>Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>kathikatz::Skype at 2013-06-10 14:30</td>
<td></td>
</tr>
<tr>
<td>Planting Year:</td>
<td>1936</td>
</tr>
<tr>
<td>Social Position (Kraft):</td>
<td>1 Dominant</td>
</tr>
<tr>
<td>kathikatz::Skype at 2013-06-10 15:49</td>
<td></td>
</tr>
<tr>
<td>Height [m]:</td>
<td>10</td>
</tr>
<tr>
<td>Crown Diameter [m]:</td>
<td>6</td>
</tr>
<tr>
<td>Trunk Circumference [cm]:</td>
<td>320</td>
</tr>
<tr>
<td>Diameter at Breast Height (DBH) [cm]:</td>
<td>107</td>
</tr>
<tr>
<td>Crowning Height [m]:</td>
<td>4</td>
</tr>
</tbody>
</table>

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1. Image recognition based on tree leaves
2. Plausibility based on eHabitat Plausibility Service
Your data and Aols

Stored Aols can be selected by the user

Known objects of interests (e.g. previously reported trees) within the new Area of Interest provided.

Note: Application can be used offline. Observations within your AoI will be synchronised whenever a network connection is available.
Possible Future Applications

- **Biodiversity**: plants and animal sightings, seasonal changes, invasive species, educational
- **Forestry & agriculture**: invasive species, spread of pests & infections
- **Administration**: state of inventory, need for actions (e.g. user input that “this tree is about to fall“)
- **Tourism**: support for nature guides, information on biodiversity in area
- ???
Download and documentation on:
http://catalogue.envirofi.eu/applications

**App Download & Installation**

**Bringing Biodiversity Into The Future Internet**

<table>
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<tr>
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<th>Documentation</th>
<th>Downloads</th>
<th>Used Enablers</th>
</tr>
</thead>
</table>

ENVIROFI-Bio app prototypes for android phones can be downloaded from the address above.

A tutorial explaining the app use and key features of the ENVIROFI biodiversity application is available from the Documentation tab.

Source code and the backend package are currently not available for download.

**Note:**
- Developed and tested on Android 4.1, 4.2; not compatible with 4.0
- Expected to work (but not tested) on Android 2.3.3 and higher

**Binary Package URL:**
ENVIROFI-Bio app downloads
Thank you for your attention

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