



A Framework for Acquiring Semantic Sensor Descriptions

Gather relevant sensor data on the fly at the sensor deployment site

Luka Bradesško, Alexandra Moraru, Blaž Fortuna, Carolina Fortuna, Dunja Mladenić



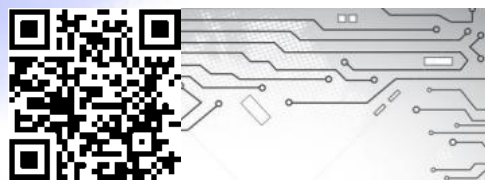


Introduction

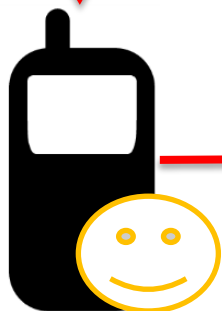
- Sensor meta data is highly relevant and contributes to understanding and managing the sensors and their measurements
 - Technical meta data (known before deployment)
 - Operation temperature, sensor type, power requirements and other technical specification data.
 - Contextual meta data (only available at the deployment site)
 - Location, time of the installation, orientation, surroundings, specific sensor settings modified at the site, proximity to the river, population density, other deployment specific meta data, etc...



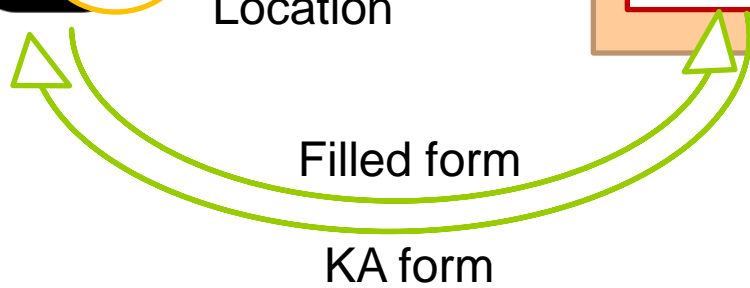
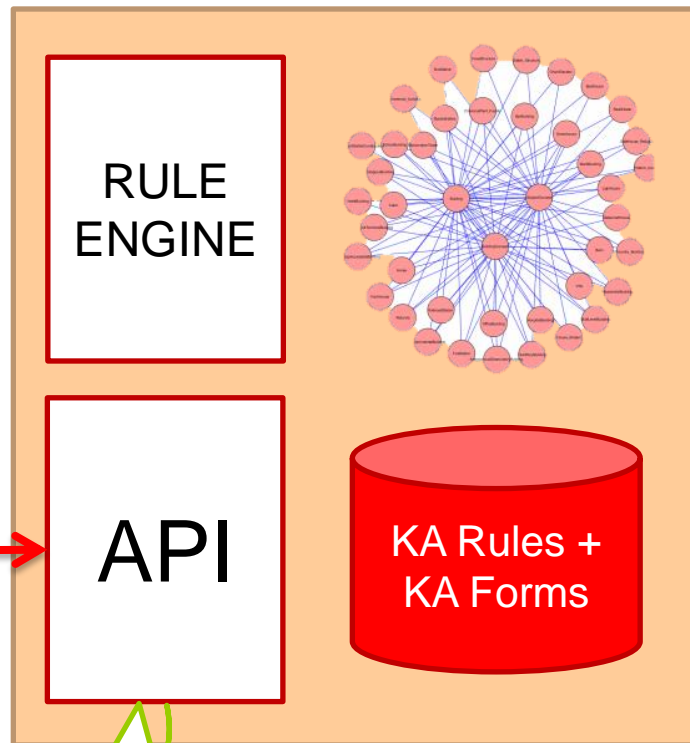
Proposed framework



Sensor node ID



User ID,
Sensor node ID,
Location





Meta-data Acquisition

Sensor Annotation

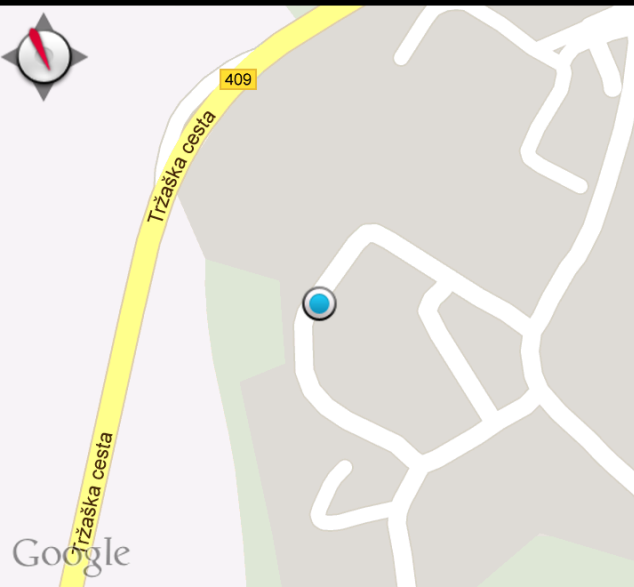
Scan new sensor code..

Scanned code: <http://sensors.ijs.si/semsense/resource/c-010>
Current Location: 45.93591104807596, 14.23622348669776

stanga 14 |mounted on

Are there trees around?

Send data to the server..



1 2 8 3 4 Cycorp Inc

motion sensor 1:
I don't know much about motion sensor 1 yet; let's change that!

[Motion sensor 1](#) is located in *[not situational spatial thing]*.

We are talking about motion sensor 1

I don't know Next Nothing else

room1 Ok Enough about mot

1 2 3 4 5 6 7 8 9 0

! @ # \$ % ^ & * ()

1/3 - ' " : ; , ?

ABC Slovenščina Done

1 2 8 3 4 Cycorp Inc

Ok

Height of a [sensor system](#) is similar to height of *[type of thing]*.

Menu please..

Ok. Menu. Pick one of the options below..

Talk about something else

What would you like to talk about?

sensor platforms sensory hair se

senso Ok sensor systems

Unknown Spy: [Curious Cat User 1273](#) knows something about [assistant \(app\)](#).



Meta-data Acquisition

Sensor Annotation

Scan new sensor code..

Scanned code: http://sensor resource/c-010

Current Location: 45.93591104807596,14.236

stanga 14

Are there trees around here?

Send data to the server..

◀ **detector** ▶ (aka sensor, sense)

About Basic Info Related **Advanced Info**

Is it true that instances of senses are similar in heights?

Mass of a detector is similar to mass of **Choose a value** ..

Every detector has maximum depths of ..

Every detector has maximum widths of ..

Every detector has maximum lengths of ..

Every detector has maximum heights of ..

Every detector has minimum heights of ..

Choose a value

- car
- refrigerator
- laptop computer
- television set
- cellular phone
- Some other type of thing

Google

◀ **detector** ▶ (aka sensor, sense)

About Basic Info **Related** Advanced Info

active

thing enduring thing localized three dimensional thing

detector

- + sensor thermal luminescent detector
- motion detector chemoreceptor tactile sensor
- vibration sensor electromagnetic radiation sensor
- detector of depth perception

10:00

is similar to

options below..

se

like to talk about?

sensory hair se

sensor systems

Unknown Spy: Curious Cat User 1273 knows something about assistant (app).



Meta-data Acquisition - rules

```
[IF <?concept><rdf:type> <ssn:Sensor> THEN  
<?concept> <ijs:generateForms>  
<ssn:observes>]
```

```
[IF <?concept> <rdf : type> <ssn:Sensor>  
AND <?concept> <ssn: observes>  
<_:observationProperty1> AND  
<_:observationProperty1> <rdf: value>  
<"temperature"> THEN <?concept>  
<ijs:generateForms>  
<ijs:hasTemperatureSensorType>]
```

Mt : BaseKB

Direction : Forward

(implies

(and

(isa ?S Sensor)

(isa ?S Observes Temperature)

(generateOpaqueSentenceForTerm ?S

(isa TheQuerySearchFocalTerm TemperatureSensor)))





Meta-data Acquisition - rules

```
[IF <?concept><rdf:type> <ssn:Sensor> THEN  
<?concept> <ijs:generateForms>  
<ssn:observes>]
```

```
[IF <?concept><rdf:type> <ssn:Sensor>
```

```
(implies  
  (levelOfSecurity  
    (WirelessFn ?X) PasswordProt  
    ected)  
  (generateSentenceForTerm ?X  
    (passwordForWiFi  
      (WirelessFn ?X) ?Y)))
```

Mt

Direction : Forward

```
(implies  
  (and  
    (isa ?S Sensor)  
    (isa ?S Observes Temperature))  
  (generateOpaqueSentenceForTerm ?S  
    (isa TheQuerySearchFocalTerm TemperatureSensor)))
```



Meta-data Acquisition - forms

```
<form subject = “?$1” object =”?$2” predicate =  
”ssn:observes”> “This sensor can measure ?$2”  
</form>
```

genTemplate:

(ConcatenatePhrasesFn

(BestNLPhraseOfStringFn "the width of")

(TermParaphraseFn-NP :ARG1)

(PhraseFormFn presentTense-Generic

(HeadWordOfPhraseFn

(BestVerbFormForSubjectFn Be-TheWord

(NthPhraseFn 2))))).

(TermParaphraseFn-NP :ARG2))

(ConcatenatePhrasesFn

(TermParaphraseFn :ARG1)

(BestNLPhraseOfStringFn "is")

(TermParaphraseFn :ARG2)

(BestNLPhraseOfStringFn "wide"))



Conclusions

- Have 2 implementations of the proposed system
 - Very simple prototype using Sesame and our own rule engine.
 - It was used in the Logatec sensor deployment
 - Have to improve it to move it out of the prototypical stage



Conclusions

Sensor Annotation

Scan new sensor code..

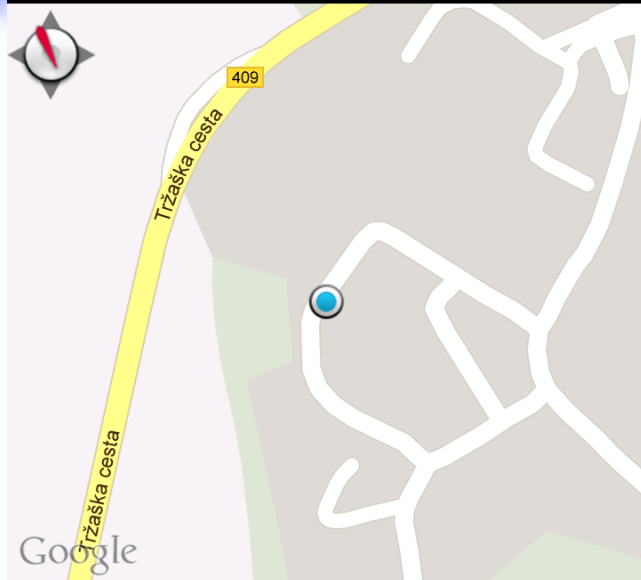
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stanga 14 |mounted on

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Implementations of the proposed system
Prototype using Sesame and our own rule

the Logatec sensor deployment

to move it out of the prototypical stage





Conclusions

- Have 2 implementations of the proposed system
 - Very simple prototype using Sesame and our own rule engine.
 - It was used in the Logatec sensor deployment
 - Have to improve it to move it out of the prototypical stage
 - More complex prototype using Cyc ontology and reasoning engine
 - Can be used for general knowledge acquisition
 - Used in Curious Cat phone application (ongoing work)



- Have 2 imp
- Very simple engine.
 - It was us
 - Have to
- More complex reasoning
 - Can be u
 - Used in

14° 02:42

Curious Cat

Cappuccino costs *[numeric value]* euros at Egoist Lounge Bar.

1.1

I also know that The cheapest cappuccino in the Slovenian city of Ljubljana costs 0.9 euros in Caffe Famel.

Luka Bradeško did its 02:24:58, October 1, 2012 visit to Egoist Lounge Bar together with *[person]*.

I don't know

No one else Enough about Egoist Lou

Janez: bread costs 5 euros at Dunajska Pekarna.

07882 Egoist Lounge Bar

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Questions?

- The presented work was done in cooperation with Cycorp Europe, Cycorp Inc. and Curious Cat Company Inc.
- Contacts
 - luka.bradesko@ijs.si
 - <http://ailab.ijs.si/>, <http://sensorlab.ijs.si/>
 - <https://play.google.com/store/apps/details?id=cc.curiouscat>

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