Ontology-driven CropBase knowledge system

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December 10, 2012

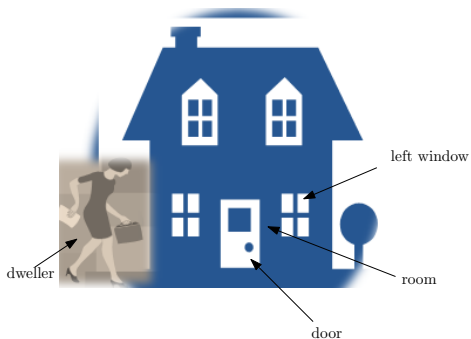**The University of Nottingham**

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OUTLINE

Introduction

Background

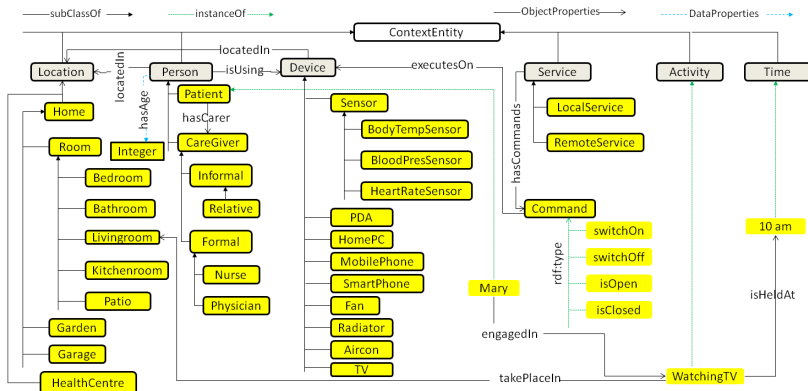Aims and Objectives

Research Methodology

INTRODUCTION

left window

dweller

room

door

$$Bedroom \sqsubseteq Room \sqcap \exists isPartOf \cdot Home \qquad (1)$$

$$Bedroom \sqcap \exists hasDoor \cdot Door \qquad (2)$$

$$Dweller(Mary) \qquad (3)$$

INTRODUCTION CONTD.

INTRODUCTION CONTD.

- ► CropBase: For example, there could be many sub-classes of the "Disease" class including for instance:

- ► FungalDisease, BacterialDisease, ViralDisease, PhysiologicalDisorder, and so on

- ► FungalDisease is_a SeedlingDisease causes SeedRot isCausedBy Rhizopus and so on

BACKGROUND

- ▶ There is a wealth of information available in different sources about crops, in particular about underutilised crops such as Bambara groundnuts, their genetics and agronomy

- ▶ Some of this information is available in informal sources on the web, for example on Wikipedia

- ▶ However, this knowledge is not entirely authoritative, it may be incomplete and for these reasons it is not suitable as a basis of decision making by crop growers

BACKGROUND CONTD.

- ▶ To our knowledge, there is little research has been carried out for developing formal web-based knowledge system for underutilised crops that aims

    - ▶ to eliminate inconsistencies in terminology

    - ▶ improper syntax and semantics

    - ▶ those are the main obstacles to sharing data and knowledge among disparate researchers

- ▶ There are formal plant and crop ontologies, for example (http://www.cropontology.org/). However, such ontologies tend to concentrate on main stream and not on underutilised crops

AIMS AND OBJECTIVES

- Existing information
  - to combine and expand existing crop ontologies;
  - if needed modify them to ensure consistency;
  - include data for underutilised crops;

- Development and demonstration of an ontology-driven integration framework
  - sharing and integration of knowledge among different sub-communities (CropFinder, CropMapper, CropBreeder, CropGrower, and CropUser)
  - by establishing a common ontology for integrating their diverse data sources

AIMS AND OBJECTIVES CONTD.

- ▶ Provide support for decision making by crop growers in selecting suitable crops for their circumstances
  - ▶ including the type of land and climate
  - ▶ likely plant diseases
  - ▶ pests and other problems

- ▶ Implement a web tool to provide this support with an ontology in the background

RESEARCH METHODOLOGY

- ▶ 1.Studying existing information:
    - ▶ Analysing existing standard ontologies in the domain of Crops (focusing on underutilised crop, e.g., Bambara groundnut)
    - ▶ Identify potential problems and semantic ambiguities
    - ▶ Identify and collect information sources required for the development of the knowledge tool

RESEARCH METHODOLOGY CONTD.

- 2. CropBase Ontology Design and Development:
    - knowledge representation using Web Ontology Language (OWL) which extends RDF and RDFS
    - OWL has been developed as an ontology language that defines classes and properties and their relationships
    - The World Wide Web Consortium (W3C) has declared two different standards for OWL, namely, OWL 1 and OWL 2
    - We will use OWL 2 RL, which is based on description logic (DL), a decidable fragment of first order logic that is used for efficient and tractable reasoning
    - We will use a state-of-the-art ontology editor and knowledge-base framework such as e.g., Protg (http://protege.stanford.edu/) for authoring the ontology

RESEARCH METHODOLOGY CONTD.

- ► 3. CropBase tool:
- ► the tool will use the ontology as the main knowledge source for answering user queries

- ► but will also involve an additional rule-based decision support mechanism which will ask for information about the concrete parameters relevant for the crop grower and display information about suitable crops in the form which is precise but easy to understand for non-computer scientist

- ► in technical terms, the tool is a hybrid system which uses both ontology definitions and rules, based on the principles (OWL 2 RL + SWRL)

RESEARCH METHODOLOGY CONTD.

Milestones	Planned dates	Months
Literature review on knowledge base development methodology	4	4
Collecting knowledge sources in the domain of Crops	6	2
Identify potential problems and semantic ambiguities	8	2
Ontology development for CropBase focussing on underutilised crops	10	2
First year interim report and possibly a conference paper	12	2
Development of decision support tool and a paper	18	6
Second year interim report	20	2
Evaluation of the decision support tool	30	10
Thesis writing and a paper	36	6

Thanks!