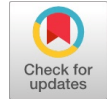


Modeling of Internal Context for agriculture in Pervasive Environment



Sini Anna Alex, Anita Kanavalli

Abstract: Context Awareness is an essential feature in the pervasive computing systems. Internal and external context will play a major role. Internal context modeling using OWL for precision agriculture is described here. This provides an upper context ontology which captures general concepts about basic context. The modeling grows in a domain specific hierarchical manner. Visualization of the model is incorporated in this paper to check the consistency of context information. In this paper we have designed a model for agricultural farming interface and created stories using SAP Lumira tool. This helps farmers in analyzing and visualizing the effect and when to change the strategy of farming. This paper discuss the importance of using ontology measures for modeling context information and presents the design, implementation and applications of an interpreter based on ontology. The proposed model infers new internal context information and the effect of visualization models in farming.

Keywords: context aware, Lumira, ontology, nutrient analysis

I. INTRODUCTION

Increased use of portable devices leads to the development of context aware applications. The constant changes in the environment have stimulated the development of a new computing paradigm. Context aware applications use the implicit information related to users or a specific context. Definition of a model to describe the contextual domain is addressed by a context aware service model. Ontology based models [1] provide logical interpretation of the entities, object and its relationships. Developers currently have little support in designing software architectures and in creating interactions that are effective in helping end-users manage their privacy. Representation of contextual information can be shared and reusable can be controlled semantically.

The OWL is chosen to specify the modeling of context as it allows reusing and modifies it through an efficient semantics. The paper is organized as follows. First, we explained about the OWL as formal modeling [2] and its features and advantages as context modeling language. Next, we explain our architecture model, followed by the AgriFarm context model. Also explained how SAP Lumira can help in visualizing the model in a different way of context awareness. Context Interpreter model is characterized by a set of context entities. These entities have different semantic values and attributes.

Manuscript published on 30 September 2019.

*Correspondence Author(s)

Sini Anna Alex, Assistant Professor in Computer Science Department of M S Ramaiah Institute of Technology

Anita Kanavalli, Head of Computer Science Department of M S Ramaiah Institute of Technology.

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC-BY-NC-ND license <http://creativecommons.org/licenses/by-nc-nd/4.0/>

The entities with different semantic meanings have to be formalized based on the long term usage. SAP Lumira model helps to group all these entities to be visualized in a precise manner. Formalizing the context model helps to store the context and its semantics grouped together for achieving clear context knowledge.

II. RELATED WORK

Modeling of a context is normally based on ontology solutions. Hence we search for a different method to analyze and interpret the models.

A. Context modeling using owl

OWL, a knowledge representation language [2], uses reasoning power of intelligent models and agents to identify contexts more precisely. It can be used for representing metadata which defines semantics associated. Using OWL the semantics and description of the concepts can be formalized. It allows us to describe the entity and their relationships. It also helps us to create instance of objects at a moment of time.

B. Camus context model

While context entities are conceptual entities, the information provided by them is called the contextual information. This contextual information [3] has its own syntactic and semantic meanings. Some of the context entities are the producers of contextual information while others are consumers or both. Contextual information gathered from at least one sensor is called the 'elementary context' while 'composite context' is any combination of elementary contexts or elementary and composite contexts.

III. PROPOSED MODEL FOR INTERNAL CONTEXT OF AGRIFARM

The context interpreter designed for farming interface has five modules. The five modules share the Domain Ontologies that describes the general concepts related to the application domain and their relationships. The storage of the domain ontologies in this repository promotes a shared knowledge organization and allows reuse. Isolation of these specifications permits the extension and redefinition of these ontologies for different domains. The knowledge Database stores [4] instantiated knowledge form the Domain ontologies, it represents a specific knowledge representation. This knowledge is specified through a set of if-then rules and known facts.



One rule establishes one relationship between clauses and depending on the situation can be used to generate new information or to fire an action.

The working memory stores known facts and assertions made by the rules. The inference Engine combines facts from the working memory with the rules database in order to assert new facts to identify specific contexts. The Query Engine allows access to the actual state of interpreted facts by the other modules in the Infraware platform. The Event Notifier is responsible for the dispatch of an action from the occurrence of a new event or monitored context. We proposed a predictive visualization model implemented through SAP Lumira [5] to setup the Context Interpreter. Our Context Interpreter is divided into five modules as presented in Figure 1: Lexical Query, Hash Table, Memory, Reasoning Engine, and Metadata. These modules together are able to carry on the context reasoning process.

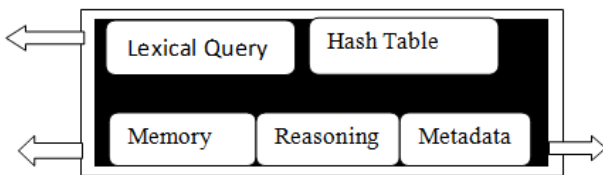


Figure 1: Internal context Interpreter Model

Analysis module Synthesis Query The Analysis Module will cleanse the raw data available directly from the test field and it also helps in segregating the items to be queried in a different fashion. The contents after the analysis process will be gone through the interpreter. The interpreter has a query machine which will query all the data in an atomic manner. All the data to be processed will be removed from any of the ambiguity or confusions and two indicators will help in the querying process. First indicator will help in identifying the related data to be processed and the second indicator will identify the information from a different data processing set. The data will be processed to and from the memory module. Metadata will help in inferring the processed data. Metadata is the details regarding information of the context information identified and recognized by the designed state machine. Hash Table is maintained to tag all the context information processed, this will help in query processing to identify the related data to be fetched. Query processing will check and validate with the predicate set for the actual information. Analysis module will cleanse and remove unwanted and not related data. It will process only the lexical unit of valuable context information to the synthesis module. The actual implementation of the interface is done in the Synthesis module which contains a set of inference models.

IV. ARCHITECTURAL MODEL

The architectural model is a Farmer friendly user interface module, where the nutrient system is calculated based on the soil data analysis and fertilizer application. The model designed using OWL describe the indicators like ph value, energy

inflow, retention value and organic content. The context interpreter model identifies a farm nutrient analysis model considering soil values and fertilizer contents. The model presented in Figure 2 allows the user to make inference and decisions about fertilizer application using the reference value. The reference value is fixed based on the concentration of soil nutrients. Some of the nutrients can be specified by absolute reference, some others using relative context reference. The excess usage of fertilizers can cause ground water contamination like high concentration of nitrate in the water. The implementation and visualization of the system allows users to take firm decisions.

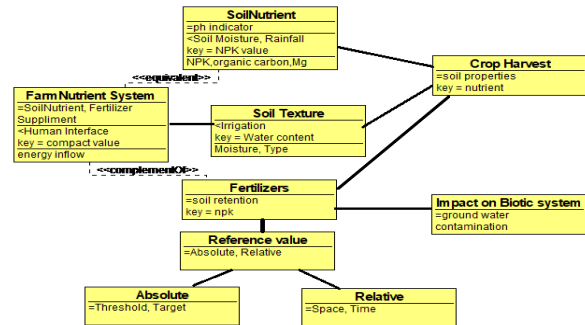


Figure 2: Context Interpreter Model for Farming Interface

Post Harvest System Analysis is done and educates the farmers with a horticulture kit contains economically suitable set of nutrients to be applied per acre. Crop to be cultivated based on the soil nutrient values also will be identified and circulated. Instant change in the climatic conditions may affect the crop yield. The soil texture varies drastically within a small geographical location. In Tumkur the soil nutrient value is too high. After a fixed period of time the analysis of the crop yield is done. The soil texture will change over a long period of time. The model in Figure 3 defines terms to describe and represent an application domain. The model defines a good set of variables with possible metadata constraints by describing the direct production activity. On field analysis should focus on establishing the location of the sensor devices. Location of the devices will be evaluated based on the size and shape of the location area, since the efficient utilization of resources will happen based on these parameters.

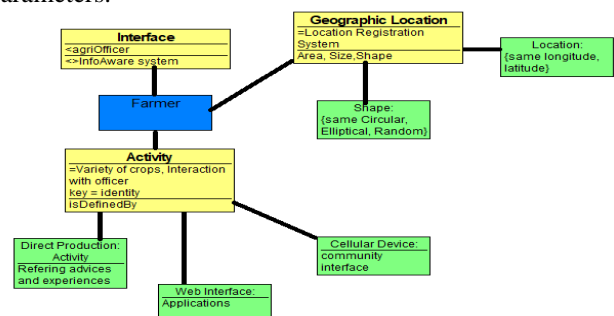


Figure 3: AgriFarm Topology Model using OWL

V. RESULTS

Table 5.1 Dataset for Workshop Participants

Participant Name	Gender	College	Reg_fees	Accommodation fees	Speaker	Speaker Industry	Total fees	City	no of participants
james	M	Reva	1000	500	satvik	cisco	1500	Bangalore	4
jack	M	RVCE	1000	500	satvik	cisco	1500	Bangalore	1
alice	F	KSIT	1000	500	satvik	cisco	1500	Bangalore	1
hayden	M	GCE	1000	500	satvik	cisco	1500	Mysore	2
Alex	M	GCE	1000	500	satvik	cisco	1500	Mysore	2
Prasad	M	AIT	1000	500	satvik	cisco	1500	Bangalore	1
lakshmi	F	Reva	1000	500	satvik	cisco	1500	Bangalore	4
krishna	M	Reva	1000	500	satvik	cisco	1500	Bangalore	4
anita	F	Reva	1000	500	satvik	cisco	1500	Bangalore	4
abc	F	SIT	1000	500	satvik	cisco	1500	Tumkur	2
dsf	M	SIT	1000	500	satvik	cisco	1500	Tumkur	2
redf	M	MSRIT	0	0	satvik	cisco	0	Bangalore	3
rtyu	M	MSRIT	0	0	satvik	cisco	0	Bangalore	3
pokh	F	MSRIT	0	0	satvik	cisco	0	Bangalore	3
manu	M	KCIT	1000	500	satvik	cisco	1500	Kushal Nagar	2
radg	M	KCIT	1000	500	satvik	cisco	1500	Kushal Nagar	2

Figure 3 is a normal distribution of values done in a statistical analysis model. SAP Lumira helps in creating story board by training the data set.

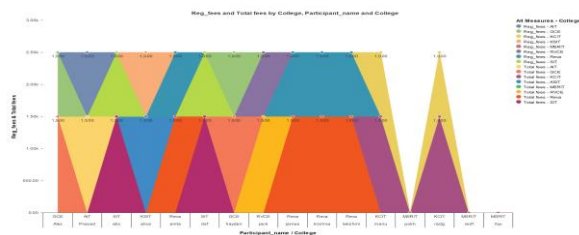


Figure 4. Cholesky analysis of the participant fees

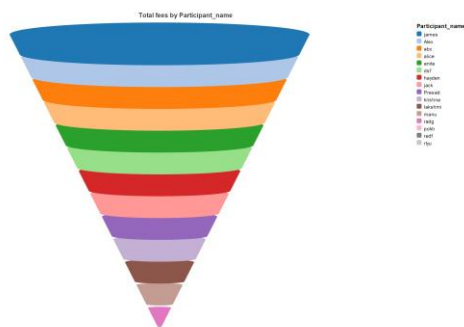


Figure 5: Hierarchical analysis of total fees paid by participants

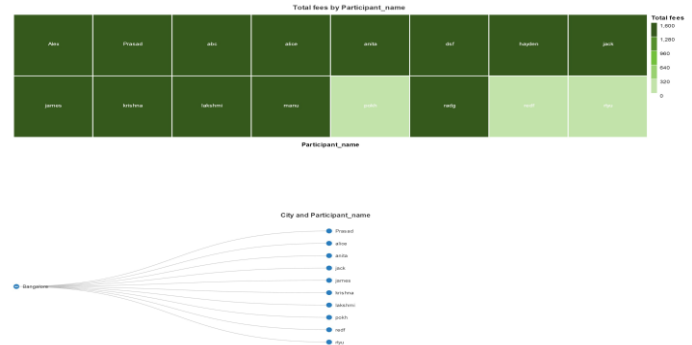


Figure 6: Creating infographics model

Figure 4 is organizing and enriches ad-hoc data sources. It pulls data directly from enterprise and consolidates and visualize without coding. This connects to SAP HANA[5] an analytics and in memory database tool to rapidly navigate massive amounts of data.

VI. CONCLUSION AND FUTURE SCOPE

The data can be trained and analyzed using SAP Lumira Tool effectively. Predict future outcomes and forecast as per market situations using Predictive Analytics for the proposed AgriFarm model can be done. In this paper we have designed the ontology model based on OWL. Using SAP Lumira the proposed solution can share visualization on different platforms and can share stories and generate report.

ACKNOWLEDGEMENTS

We acknowledge the management and staff of M S Ramaiah Institute of Technology for their support and encouragement to do this research.

REFERENCES

1. Ontology Based Context Modeling and Reasoning using OWL, Xiao Hang Wang^{1, 2}, Da Qing Zhang¹, Tao Gu^{1, 2}, Hung Keng Pung² Proceedings of the Second IEEE Annual Conference on Pervasive Computing and Communications Workshops (PERCOMW'04) 0-7695-2106-1/04 \$ 20.00 © 2004 IEEE
2. An Ontology-based Context Model in Intelligent Environments, Tao Gu, Xiao Hang Wang, Hung Keng Pung, Da Qing Zhang, Connected Home Lab, Institute for Infocomm Research, Singapore.
3. An Ontology-Based Context Model to Manage Users Preferences And Conflicts, Salima Bourougaa Tria, Hassina Seridi, Farid Mokhati, Informatica-An International Journal of Computing and informatics, Vol 40, No 1, 2016
4. Goslar K, & Schill A. 2004. modelling contextual information using active data structures. In: Proceedings of the EDBT workshops. Lecture notes in computer science, vol 3268. Springer.
5. Sapinsider.wispubs.com/Assets/Blogs/2014/July/Intro-to-SAP-Lumira, Dr-Berg, 2014

AUTHORS PROFILE



Mrs. Sini Anna Alex is working as an Assistant Professor in Computer Science Department of M S Ramaiah Institute of Technology. Her areas of interest include, ubiquitous computing, compiler design, mobile and wireless sensor networks, distributed, database systems and algorithm analysis. She published her papers in Scopus conferences and journals. She received Venus International Women Award for Young Woman in Engineering - 2018. She received RULA award for the best paper on pervasive computing systems.



Dr. Anita Kanavalli is working as the Head of Computer Science Department of M S Ramaiah Institute of Technology. Her areas of interest include Adhoc networks, high performance computing and microprocessors. She has membership in ISTE and IEEE. Her some of the research papers are published in Scopus Indexed Journals and Conferences. She completed certification course in CCNA and subject expert for EDUSAT.