A Centralized Repository - Semantic Homogeneity in Ocean Data Interoperability through Ontology-Driven Knowledge Representation

Revised project proposal submitted

(Incorporating 1. PAMC recommendations and Independent experts comments
2. Consultation and Discussion with INCOIS and SAC)

To

Office of Program Head (R&D in Earth and Atmospheric Sciences)

R&D in Earth and Atmospheric Sciences

Ministry of Earth Sciences

Prithvi Bhavan, Opp. India Habitat Centre

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by

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Revised Proposal

20th August 2015

R& D PROJECT PROPOSAL

(Amendments made in the revised proposal are in Green color font for ready reference based on discussions and consultation with INCOIS, Hyderabad and SAC, Ahmedabad)

Section 1: Project title

Title of the Project: **A Centralized Repository - Semantic Homogeneity in Ocean Data Interoperability through Ontology-Driven Knowledge Representation**.

Section 2: Subject

- □ Atmospheric Science
- □ Earth System Science Technology
- □ Geosciences
- □ Hydrology & Cryosphere
- ✓ Ocean Science & Resources

Section 3. Principal Investigator and Co- Investigators:

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Section 4. Principal Implementing Institution

a. Status : Private Educational Institution (Autonomous)

b. AICTE Registration No. : F.No. Southern/1-2016320814/2014/EOA

UGC Notification No. : No.F.22-1/2014 (AC)

c. Adhiyamaan College of Engineering, autonomous Educational Institution, affiliated to Anna University, Registered under Public Charitable trust. The PI – Dr Sunitha Abburu, is in service, at Adhiyamaan College of Engineering. PIs Institution agrees to undergo with a bond with the MoES for proper use and management of funds, and would be obliged to provide all supporting documents.

Section 5: Collaborating Investigators/Institutions

Assistance and support from INCOIS, Hyderabad, (Dr.Pattabhi Ramarao, Dr. Srinivasa Kumar, et al), through Director, INCOIS has been agreed. Further the project has been appreciated and expressed willingness to support and collaborate. INCOIS scientists have agreed to share sample data as per their administrative policies. The proposed methodology, design and implementation would be handled by PI and the team in Adhiyamaan College of Engineering, Hosur where this project will be implemented.

Section 6: Project salient features:

Intellectual merit: The present project aims to design and implement methodologies to facilitate and promote the following advanced data analysis and processing techniques:

- Make ocean data to be accessed through OGC SOS services
- Adopt semantic technologies to enrich and enhance the ocean data processing by:
  - Provide domain knowledge to ocean data through ontologies that enables :
    - Provide semantics to ocean observation data
    - Enhances the data processing through semantics, concepts, super and sub concepts etc., semantic relation between concepts (transitive, symmetric, reflexive, associate relationships etc.)
    - Establish semantic relation among data of various ocean observation measurements
    - Represents data in machine understandable format in RDF
    - Enable share, exchange, reusability of data
    - Concept based classification of ocean data through semantic methods.
  - Executes Semantic Queries
  - To uncover relevant and valuable ocean knowledge through semantic technologies

Data Collection and Analysis: Main sources of ocean observation data is In-Situ Observations [1], INCOIS [2], MOSDAC [3]. Project plans to consider observation parameters arising out of Moored buoy and Argo floats data. Data sets size is going to be approximately 10 lakh records. The data size estimation is purely tentative and can be varied based on the capacity of the hardware used and can be changed in consultation with the INCOIS. Datasets with heterogeneous formats, schema and vocabulary are going to be considered irrespective of national or international data. Few ontologies in ocean science ecology, marine biology ontology, phenOcean, phenOceanCoastal.owl, phenOceanDynamicsetc etc. Few web sources of oceanography ontology are: Semantic Sensor Network Ontology [4], Marine Metadata interoperability [5], SemSorGrid4Env [6].

Broader impacts:

- Semantic technologies and OGC SOS standards would bring out the best possible rationally optimum solutions for ocean data interoperability, which would derive new dimensions and opportunities in ocean data processing and related applications, for effective use of the ocean data, lead to interdisciplinary collaborations
- All applications and agencies dealing with the ocean data would surely benefit by this project, by the methodology to access data through OGC SOS services and ontology based semantic processing of ocean data

Project Summary:

The project title: "**A Centralized Repository - Semantic homogeneity in ocean data interoperability through ontology-driven knowledge representation**."

Principal Investigator : **Dr. Sunitha Abburu, Professor & Director**

Department : **Department of Computer Applications**

Institute Name : **Adhiyamaan College of Engineering(Autonomous)**

(a) Subject : **Ocean Science & Resources**

(b) The research objectives are the following:

- Design and Develop a frame work through which ocean data can be accessed by OGC SOS services
- Provide methodology to bring ontology concept based standard vocabulary for ocean data for selected observation parameters as mentioned in data collection section
- Represent ocean data in RDF
- Build ocean knowledge base through use of semantic technologies
- Query through ontology and related concepts
- Visualize query results in common user-understandable formats.

(c) Methodology to be adopted:

The proposed Approach is as follows:

- Choose appropriate Top-Level ontologies for the selected application
- Derive a domain ontology that merges top level ontologies. The domain ontology gives standard common vocabulary and relation between concepts.
- Collect and represent organizational standard vocabulary in RDF
- Map organizational standard vocabulary with domain ontology concepts
- Obtain mapping ontology relates organizational standards vocabulary with domain ontology concepts
- Implement OGC SOS services on ocean observations data
- Access ocean observation data using OGC SOS data access services
- Design and develop a semantic middleware that links ocean observation data with domain ontology concepts with the support of mapping ontology
- Execute inference engine over domain ontology and ocean observation data instances
- Develop and implement a SPARQL query end point that support user or expert to execute semantic query over domain ontology, ocean observation data instances and inferred data. Develop a visualization method that presents SPARQL query results in charts and geographic maps that enables effective analysis and decision making. Detailed methodology is shown in fig. 1.

(d) Expected outcome and deliverables of the project:

The proposed project delivers the following and will be tested at INCOIS:

- Domain ontology that provides standard common vocabulary
- Mapping ontology that relates organizational standard vocabulary with domain ontology concepts
- A software component that:
  - Facilitates OGC SOS services on ocean observation data
  - Provides semantic middleware that links ocean observation data with ontology concepts with the support of mapping ontology
  - Inference over ocean observation data instances and domain ontology
  - Builds centralized knowledge base that contains domain ontology, ocean observation data instances and inferred data
  - SPARQL query endpoint for querying knowledge base
  - Visualization of SPARQL query results using charts and geographical maps
  - Further the knowledge base enables:
    - Semantic data analysis of ocean data
    - Knowledge discovery
    - Effective decision making

(e) Brief budget:

S.No	Description	1st Year	2nd Year	Amount(Rs.)
1.	Budget for Research Manpower	6,60,000/-	6,60,000/-	13,20,000/-
2.	Budget for Consumables	1,00,000/-	1,00,000/-	2,00,000/-
3.	Budget for travel within India	80,000/-	80,000/-	1,60,000/-
4.	Budget for other costs (maintenance and consultancy)	70,000/-	90,000/-	1,60,000/-
5.	Budget for permanent equipment	10,18,628/-	-	10,18,628/-
6.	Institution Overheads	2,31,435/-	1,11,600/-	3,43,035/-
Total in Rs.		21,60,063/-	10,41,600/-	32,01,663/-

Note: The cost has been further reduced after the discussions due to removal of Oracle No SQL and reduction in operation and maintenance cost.

Section 7: Project Description:

(a) Objectives

The objective of the proposed research work is to provide an effective and efficient technical solution to address semantic heterogeneity in ocean observation data and achieving information interoperability and semantic information retrieval and effective visualization using domain ontologies and OGC international standards and services taking inputs for the proposed method

from ocean observation data from ocean observation systems. The proposed project implementation brings out

- A frame work through which ocean data can be accessed through OGC SOS services
- Provide methodology to bring ontology concept based standard vocabulary for ocean data for selected observation parameters as mentioned in data collection section
- Represent ocean data in RDF
- Build ocean knowledge base through use of semantic technologies
- Querying through ontology concepts and its related concepts
- Visualization of query results in common user understandable formats

(b) State of knowledge

Characteristics of ocean observation data:

Ocean observations are backbone for various operational services such as fishing zone advisory services, ocean state forecast, storm surges, cyclones, monsoon variability, tsunami, etc. Various scientific domains and research communities from all over the world heavily depend on ocean observation data are physical oceanography, chemical oceanography, geology, geophysics, coastal systems, ecology, fishery and aquaculture, bio-molecular science, human impacts, climatology, biogeochemistry and disaster management etc. [7] has listed out the need of ocean observation data as follows:

- Operational ocean information and advisory services
- Forecasting of ocean and atmosphere
- Ocean Modelling
- Improving safety at Sea
- Validation of satellite sensors
- Sustainable exploitation of ocean resources
- Prevention and reduction of the impacts of natural hazards
- Mitigation of the impacts and adaptation to climate change and variability
- Safeguarding the health of ocean ecosystems
- Management procedures and policies leading to the sustainability of coastal and ocean environment and resources
- Value added Services

The sources for ocean observation data are remote sensing satellites and In-Situ Observations. Oceansat-1, oceansat-2 and few foreign satellites are involved in ocean observation from remote sensing side. Indian oceanography organizations Indian National Centre for Ocean

Information Services (INCOIS), National Institute of Ocean Technology (NIOT), National Institute of Oceanography (NIO) and Indian Meteorological Department (IMD) have established In-Situ ocean observation systems such as Argo Floats, Moored Buoys Drifting Buoys, Tide Gauges, XBT, Current Meter Arrays, Wave Rider Buoys, Deep Ocean Tsunami Buoys, Coastal Radars, Seismic Network and Gliders etc. All these ocean observation systems produce information on physical, chemical and biological parameters of ocean and coasts on various spatial and temporal domains that is vital for both research and operational oceanography. Major characteristics of data from the ocean observation systems are:

- Big ocean data (15 TB per year)
- Heterogeneous syntax (Different observation systems provide information in different formats such as ASCII, Binary, NetCDF and HDF etc.)
- Heterogeneous semantics (Different observation systems use different vocabulary)

Very common issues in managing data with above characteristics are:

- Handing large volumes of data is complex
- Heterogeneous formats and semantics violates interoperability
- Integrating heterogeneous data is highly complex
- Information exchange and share among various scientific domains and research communities is difficult
- Information search and obtain most relevant data is difficult due to lack of common vocabulary and structure

To address the issues many organizations, research communities and academicians have proposed solutions.

The Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO) [8] major programs are Global Ocean Observing System (GOOS) and International oceanography Data and Information Exchange (IODE). 147 states from various countries in the world have taken membership in IOC/UNESCO to achieve the objectives 1) Facilitate and promote the discovery, exchange, access marine data and information 2) Encourage the long term archival, preservation, documentation, management and services of marine data 3) Develop or use existing best practices for the discovery, management, exchange and access marine data with international standards 4) support international scientific and operational marine programmes.

In the world India has 2nd place in utilizing ocean data in various applications. INCOIS expert group have been inventing various methods and tools to provide Ocean information and advisory services to society, industry, government agencies and scientific community through

sustained ocean observations, constant improvements through systematic and focused research in ocean modeling, data and information management [9].

Pattabhi Rama Rao et al., [10] have proposed an open source WebGIS based architecture to publish and share geo-spatial information from costal ocean observing systems on the internet. This architecture exploit potential of open source tools to develop ocean data and information management system. This architecture supports OGC WMS and WFS services for information access. [11] describes a system that manages oceanographic meta-data using XML and XQuery with the support of functionalities provided by oracle database.

The OGC WFS provides an interface allowing requests for geographical features across the web using platform independent calls. A Web Map Service (WMS) is a standard protocol for serving geo-referenced map images over the Internet that are generated by a map server using data from a GIS database

Semantic technology and ontologies:

Semantic technology is meaning-centered enabling machines and people to understand, share and reason at execution time. Popular semantic technologies are ontology, reasoning, SPARQL, SWRL and mapping etc. Semantic technology describes a domain using explicit meanings through ontology.

Today, ontologies are being created in many scientific disciplines to crisply define the concepts that are discussed or measured in that discipline. An ontology is particularly useful for defining the characteristics and relationships between physical measurements that are recorded in scientific data sets. Due to the significance of semantic technology, many international, national organizations have represented the ocean knowledge through ontologies which are made available in the World Wide Web. Ontology is a formal, explicit specification of a shared conceptualization [12]. Ontology is a World Wide Web Consortium (W3C) approved technology for conceptual modeling of a domain and knowledge representation. Ontology enables machines as well as people to understand, share and reason at execution time. Ontology provides vocabulary that describes a domain of interest and a specification of the meaning of terms used in the vocabulary [13]. Ontologies support Open World Assumption (OWA) AAA slogan - Anyone can say anything about any topic. Italy established International Association for Ontology and its Applications (IAOA) [14] to promote interdisciplinary research and international collaboration at the intersection of philosophical ontology, linguistics, logic, cognitive science, and computer science, as well as in the applications of ontological analysis to conceptual modeling, knowledge engineering, knowledge management, information-systems development, library and information science, scientific research, and semantic technologies in

general. Ontology plays a vital role in domain knowledge representation and management in various applications such as meteorology, oceanography, disaster management and health care etc. An ontology design pattern [15] is a reusable successful solution to a recurrent modeling problem. [16] gives an approach for ocean science repository integration using ontology pattern. Cristiano et al., [17] described ontology based data structure that can be used for creation of a centralized repository of metadata from the heterogeneous ocean data. Objective of this approach is to ease the information exchange and share among various scientific domains and research communities. Adopting OGC SOS services and ontology support to ocean data enables easy information sharing and exchange. Few research articles found in those lines are [18] [19].

[20] illustrates an ontology based Service Oriented Architecture (SOA) for management of heterogeneous data from environmental sensors. To achieve data integration, the architecture uses interoperable web services and ontology mapping techniques. Jonathan et al., [21] proposed knowledge integration approach for ocean costal information management and support coastal managers to access knowledge for coastal management applications. [22] describes an ontology based automatic extract, transform and load (ETL) method for ocean data integration. Samina et al., [23] presented an ontology based solution to represent knowledge about oceans and ocean life and achieve interoperability, between different ocean datasets and services. [24] illustrates semantic mediation framework to relate multiple oceanographic vocabularies and ocean data integration.

OGC :

The Open Geospatial Consortium (OGC) [25] provides international standards and services to address data interoperability issues. In OGC 475 commercial, governmental, nonprofit and research organizations from America, Europe, Africa, Australia and Asian countries are collaborate to develop and implement open standards for geospatial content, services, data processing and sharing. The OGC SOS services are

- GetCapabilities: Provides the details of the SOS service such as metadata about the operations, process or systems and the overview of the observation offerings
- DescribeSensor: Provides detailed information about the sensor systems or processes available by the observations offerings. These include contact information, classification metadata, deployment information, capabilities, and input and output details

- GetObservation: Provides access to the observed data. It contains the metadata about the observation offering, so information about the feature of interest, procedure and phenomena is provided as well

The Oceans Science Interoperability Experiment (Oceans IE) [26] brings together the Ocean-Observing community to achieve interoperability of ocean observation systems by using Open Geospatial Consortium (OGC) Standards. Ocean IE investigated OGC Web Feature Service (WFS) and Sensor Observation Service (SOS) to represent and exchange ocean data from In-Situ. The experiment concluded that for the Oceans community use of in-situ sensors that the OGC Sensor Observation Services (SOS) was better suited than the use of OGC Web Feature Services (WFS) for this purpose. SOS getObservation supports many the query components such as geographic location, time, observed property and procedure, while WFS getFeature only supports query by geographic location. OGC SOS supports use of semantic web technologies to address the problems data overload and semantic heterogeneity.

Challenges

A detailed study on recent ocean data and information management methods and techniques concludes various challenges:

- Effective management of large volumes of data delivered in regular intervals from ocean observation systems
- Integration of heterogeneous data formats
- Semantic homogeneity
- Effective management of knowledge base for oceanographic domain
- Semantic information search and retrieval

(c) Importance of the proposed project

This project is nationally and internationally important to the research community and ocean data application domain communities at large in several ways, namely,

- In initiating the practical foundation needed in ocean data access facilities through OGC SOS services and standards, that leads to Emerging Directions and Future Challenges for Semantics-Based Computing of ocean Data
- In opening new pathways for a great deal of research potential in semantics-based approaches and ontology-driven techniques to ocean data.
- Leads to new pathway of great transformation from data driven ocean applications to knowledge driven ocean applications.

(d) Justification for support

In ocean observation data and achieving information interoperability and semantic information retrieval modeling involves heavy data collection, processing and expert consultancy. The project also includes processing of ocean sensor data in various formats. The proposed approach has to deal with heterogeneous data formats analysis, data extraction, processing and integration from heterogeneous data sources and construction of mapping Ontology, ocean knowledge base and a methodology for semantic ocean data retrieval.

To cope up with the rapid technological developments and to deliver the specified semantic solution, the specified duration of the project is very short, viz, 24 months. Due to short duration of the project and to execute the project uninterruptedly the specified hardware and software is essential, due to the significance and voluminous semantic ocean data processing and testing the methodology, workstations with powerful processers, server, printer, hard disk are essential. More details are given under the respective heads.

Oracle NoSQL has been removed based on the recommendations of experts during the meetings requesting to explore the usage of open source software.

The existing equipment with PI, has been procured under external funding agencies like DRDO & ISRO, which may have to be returned at the end of the project and/or whenever sought by the sponsoring agencies, as per the original project approval conditions. Hence it may not be available for execution of current proposed project.

The high technical significance of the current project stresses on high quality analysis and voluminous data processing. Hence the requested equipment and man power is very much essential for smooth and efficient execution and timely completion of the project.

Reliability of Cost Estimates: The cost estimated for the equipment and manpower is highly realistic as per the current market and extensive work involved in the project.

(e) Patent details (domestic and International) If anticipated: Nil; however, possibilities for copyright of the developed software will be explored.

(f) Methodology (should explicitly mention the hypotheses being tested)

For effective presentation and to bring more clarity**,** the architecture of the proposed research work is depicted in the diagram

Details of the Proposed Approach is as follows:

- Choose appropriate Top-Level ontologies for the selected application
- Derive a domain ontology that merges top level ontologies. The domain ontology gives standard common vocabulary and relation between concepts.
- Collects and represents organizational standard vocabulary in RDF
- Maps organizational standard vocabulary with domain ontology concepts

- Obtain mapping ontology relates organizational standards vocabulary with domain ontology concepts
- Implements OGC SOS services on ocean observations data
- Access ocean observation data using OGC SOS data access services
- Design and develop a semantic broker that links ocean observation data with domain ontology concepts with the support of mapping ontology
- Executes inference engine over domain ontology and ocean observation data instances
- Develops and implements a SPARQL query end point that support user or expert to execute semantic query over domain ontology, ocean observation data instances and inferred data
- Develops a visualization method that presents SPARQL query results in charts and geographic maps that enables effective analysis and decision making

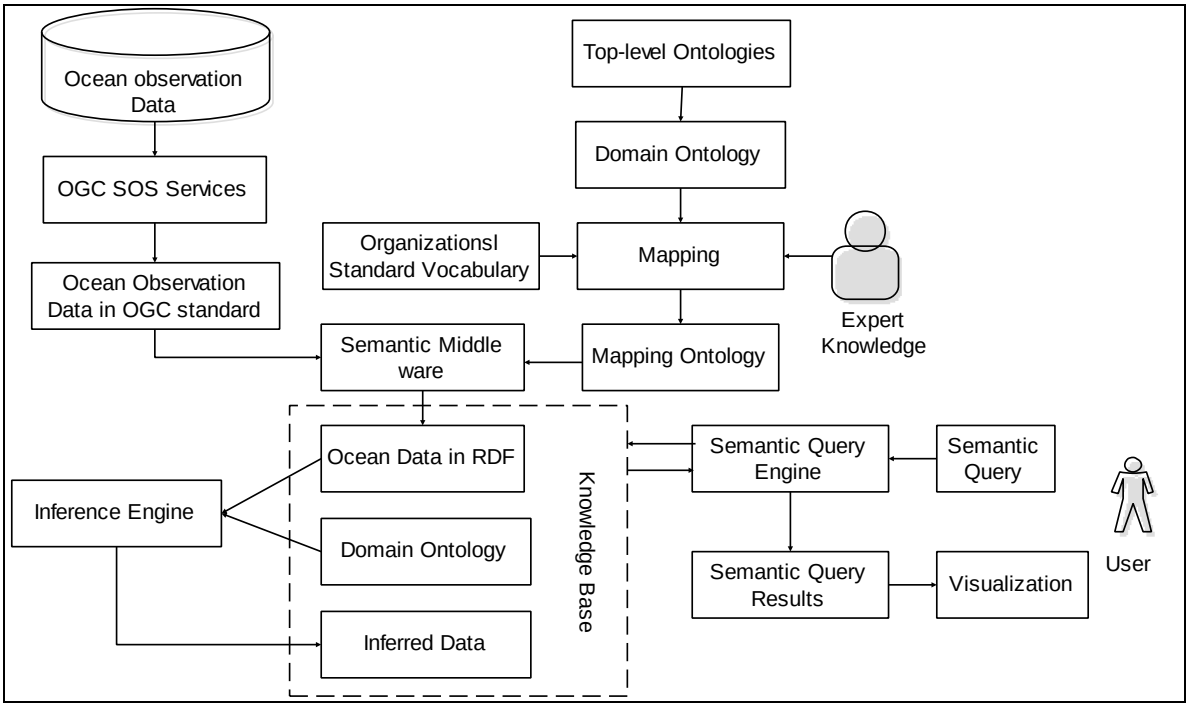

Fig. 1. Proposed System Architecture

The objective of the proposed research work is to provide an effective and efficient technical solution to address voluminous data, semantic heterogeneity in ocean observation data and achieving information interoperability and semantic information retrieval and effective visualization using domain ontologies and OGC international standards and services. Fig. 1 shows the proposed system architecture. Inputs for the proposed method are ocean observation data from In-Situ ocean observation systems. The proposed methods integrates various tools and technologies as described below to address the issues.

Inference enables to derive new data using transitive, symmetric, reflexive, associate relationships among ontology concepts. Semantic query enables to query ocean observation data through ontology concepts and its related concepts. E.g. Locate above room temperature, Locate extreme frost etc. Visualization presents semantic query results in user understandable format using charts and geographic maps.

Novelty of the Proposed Project highlights:

- Semantic interoperability over ocean observation data
- Provide ocean data observations in common standard vocabulary
- Provide semantic description to ocean observation data through ontology
- Semantic processing of ocean observation data
- Enable ontology concept based query over ocean data

The first phase (implementing OGC SOS services for ocean data access) of the project outcomes are going to be in line with the Center for Operational Oceanographic Products and Services (CO-OPS) implemented OGC SOS [27]. Parallely, the second phase of the project brings semantic technologies to ocean data processing enabling the search features based on ontology concepts which are in line with the services provided by NASA Climate Model Data Services (CMDS).

The Technology provides and enables MoES Institutions:

- A methodology to access ocean data by adopting OGC SOS international standards
- A methodology to describe semantics to ocean data
- Integrate syntactic heterogeneous data using RDF
- Semantic interoperability in ocean observation parameters
- Build ocean knowledge base that supports ontology concept based ocean data retrieval
- Establishing inter relationship among various observation Through ontologies
- Common understanding among various stakeholders
- Semantic data analysis
- Knowledge discovery
- Effective decision making

References

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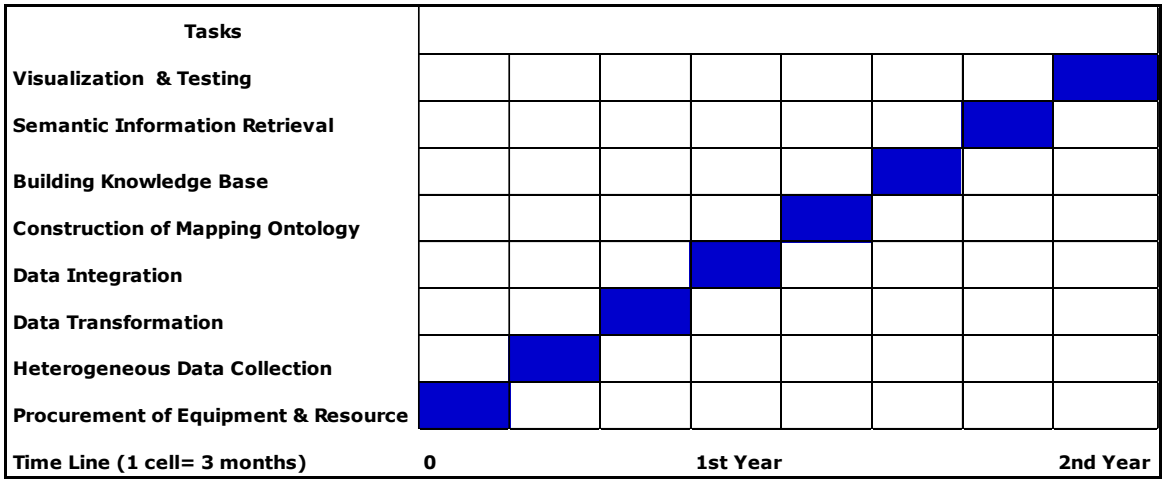
(g)Work schedule and detailed plan of implementation with year wise time lines and targets



(h) Utilization of research results

The ontology based semantic central repository enables, various scientific domains, Research communities, academicians to access, share and exchange ontology based ocean data that improves marine operational research, modeling, decision making through semantic query and visualization.

Section 8: Budget

(a) Budget for Research Manpower & Justification for their salaries and wages

Justification of manpower:

To expedite the research work, the project has been organized into two streams which can go in parallel that requires two manpower for speedy and smooth implementation of the proposed project.

JRF (1): To identify the concerned ontologies and Construct mapping ontology. Building the knowledge base and design of Semantic information retrieval system.

JRF (2): Identify the various data streams, formats involved in ocean data, Identification of a standard format which brings out interoperability and easy data exchange among all the applications domains and agencies which are using the ocean data. Develop a methodology to implement the OGC SOS services and standards to ocean data.

Designation & No of persons	Monthly Emoluments	1st Year(m.m.*)	2nd Year (m.m.)	Total (m.m.)
JRF – 1	25,000 +10% hra	3,30,000/-	3,30,000/-	6,60,000/-
JRF – 2	25,000 +10% hra	3,30,000/-	3,30,000/-	6,60,000/-
Total in Rs.		6,60,000/-	6,60,000/-	13,20,000/-

(b) Budget for Consumables with justification

In ocean observation data achieving information interoperability and semantic information retrieval modeling involves heavy data collection, processing, sematic technologies and expert consultancy. To achieve the tasks the consumables and travel is essential as proposed below:

Item	1st Year	2nd Year	Total
Toner /Cartridge	40,000/-	40,000/-	80,000/-
Stationary	60,000/-	60,000/-	1,20,000/-
Total in Rs.	1,00,000	1,00,000	2,00,000/-

(c) Budget for travel within India with detailed justification.

Budget in Rs.	1st Year	2nd Year	Total
Travel (Only inland travel)	80,000/-	80,000/-	1,60,000/-

(d) Budget for other costs and justification for the same

		1st Year	2nd Year	Total
1.	Maintenance	30,000/-	40,000/-	70,000/-
2.	Expert consultancy	40,000/-	50,000/-	90,000/-
	Total in Rs.	70,000/-	90,000/-	1,60,000/-

Institutional Overheads:

Budget in Rs.	1st Year	2nd Year	Total
Institutional Overheads 12%	2,31,435/-	1,11,600/-	3,43,035/-

(e) Budget for permanent equipment and justification.

In ocean observation data and achieving information interoperability and semantic information retrieval modeling deals with huge data analysis and processing. To handle voluminous ocean data and to use the sematic technologies, a server and workstations with good processor is required. Printed copies of the literature and the designs enables easy references, comparison of the text content, highlight the important points write comments enables effective results and faster progress. In this reference a printer is essential. To cope up with the rapid technological advances and to speed up the project two dedicated resources needs to be fully involved without any interruption that requires printer, hard disk, workstations and server. The external hard disk facilitates portability of the research objects and facilitates availability of the research elements at any location which will help in extending the work after the working hours. The research work is carried out by a group of people. To check the status, direction, progress of the research the research group has to have daily discussions. The technical discussion enables clarity of thinking, leads to the right direction and have a brainstorm session on various aspects of the research work. The technical content or the work done by individuals, projected on a screen, facilitates comfort, easy access, encourages easy discussion and every individual can participate very efficiently. Hence the justification.

Oracle NoSQL has been removed based on the recommendations of experts during the meetings, requesting to explore the usage of open source software.

To handle the above tasks the specified hardware absolutely essential and PI has taken utmost care to bring down the budged to the bare minimal cost. Installation, transport, operation and maintenance are included in consumable and maintenance section.

S. No	Generic name of the Equipment	Qty	Item cost	Estimated Costs in Rs.
1	Work Station-2	2	2,20,817/-	4,41,634/-
2	Graphic card	1	59,999/-	59,999/-
3	Server-1	1	3,36,063/-	3,36,063/-
4	Printer-1	1	65,000/-	65,000/-
5	External Hard Disk 2TB-3	3	10,000/-	30,000/-
6	Projector (Dell) 1610 HD	1	71,432/-	71,432/-
7	Projector screen	1	10,000/-	10,000/-
8	Data card	1	4,500/-	4,500/-
	Total			**10,18,628/-**

Section 9: Existing facilities

Justification:

The high technical significance of the current project proposed stresses on high quality analysis of voluminous data processing. Hence the requested equipment and man power is essential for smooth and efficient execution of the project.

The existing equipment with PI, has been procured under external funding agencies like DRDO & ISRO, which may have to be returned at the end of the project, as per the sponsored project terms and conditions, whenever sought by the sponsoring agencies. Hence it may not be available for execution of current proposed project.

(a) Equipment within the research group of PI/Co-PIs.

Computer - 2	HP Intel® Core™2 Duo CPU E7500 @ 2.93GHz
Server - 1	HP Server PROLIANT, Intel Pentium Xenon Dual Core
Laptop - 1	Intel i3 processor, 4GB RAM, 1GB Graphics Card
MFC printer	HP LaserJet
Software's	Oracle 11g , windows-server-2008-r2, Windows 8 desktop Edition , Adobe Master Collection , Kaspersky
Equipment available with PI's Department	
Computer- 200	Intel Pentium 4, 2GB Ram
Server - 1	SPARC Processor @ 143 Mhz, 64 MB RAM,
Printer	TVS MSP 240 Star Printer

(b) Equipment in the Department/University/Institution

Workshop Facility, Water & Electricity, Laboratory Space/ Furniture, Telecommunication including e-mail & fax, Transportation, Administrative/ Secretarial support, Information facilities like Internet/ Library, Computational facilities.

(c) Equipment in other Departments or Centers of the institution in the region including Regional Sophisticated instrumentation centers: As needed for academic purpose.

Labs established by civil department at Adhiyamaan College of Engineering.

- Structural Dynamics lab established Under MoES Funds.
- Integrated Surveying Lab Established under DST Funds.
- Image Processing Lab Established under DST Funds.
- Photogrammetry Lab Established under DST Funds.
- Robotics Lab Established under DST Funds.
- Embedded Systems Lab Established under DST Funds.
- DGPS Lab Established under DST Funds.

Section 10 : CURRICULUM VITAE (Max 2 pages)

Detailed Bio-data of the Principal Investigator

Name	:	**Dr. Sunitha Abburu**
		Prof. & Director, Dept. of Computer Applications
Address	:	**Adhiyamaan College of Engineering, Hosur,**
		Krishnagiri - 635109, Tamilnadu.
Date of Birth	:	**04/06/1971**
Institution's Address	:	**Adhiyamaan College of Engineering,**
		Hosur-635 109, Krishnagiri District, Tamil Nadu.
Contact No	:	**+91 (0) 8050594248, +91 (0) 9600507590**
Mail id	:	**drsunithaabburu@yahoo.com**
Field of major scientific interest	:	**Ontology, Semantic Technologies, Data Mining.**
Approved Research Supervisor	:	Anna University, Bharathiar University

NBA - National Board of Accreditation activities (New Delhi): Expert Member: Visited various Educational institution as an NBA expert evaluator as a part of accreditation.

Presented two Papers in 2nd World Summit on Accreditation, Organized by National Board of Accreditation, March 8th – 10th 2014, New Delhi.

Educational Qualification: M.C.A (St. Anns, Osmania University, Hyderabad, A.P, 1996), M.Phil in Computer Science (Sri Venkateswara University, Tirupathi, A.P, 2001)., Ph.D . in Computer Science (Sri Venkateswara University, Tirupati, A.P, 2007)

Professional Experience at a Glance: Industry: 3 years, Teaching: 16 years 4 months.

International Journal Publication : 37

R&D Projects : **Completed - 2 Ongoing - 2**

Selected list of International Journal Publication : (Annexure)

Sunitha Abburu, Nitant Dube, Nayak M. R., Suresh Golla, "An Ontology Based Methodology for Satellite Data Semantic Interoperability", Advances in Electrical and Computer Engineering (AECE), ISSN: 1582-7445, accepted for publication.

Sunitha Abburu, Suresh Babu Golla, "Ontology Storage Models and Tools: an Authentic Survey", Journal of Intelligent Systems, ISSN: 2191-026X, accepted for publication, Free Journal.

Sunitha Abburu, G.Suresh Babu "Effective Partitioning and Multiple RDF Indexing for Database Triple Store" Engineering Journal accepted for publication to be published in October 2015 issue (IF 0.1) Free Journal.

Sunitha Abburu, Suresh Babu Golla, "An Engineering Evaluation on the Glimpse of Satellite Image Pre-processing Utility Tools", Engineering Journal, Vol. 19, No. 1, 2015, pp. 129-138. Free Journal.

Dr. Sunitha Abburu , Nitant Dube, M.R.Nayak " Ocean Data Techniques And Standards – Tools And Analysis Using Semantic Sensor Ontology - An Emerging Area - Indian Scenario**" ,** ISRS Proceeding Papers of Sort Interactive Session ISPRS TC VIII International Symposium on "Operational Remote Sensing Applications: Opportunities, Progress and Challenges",

Hyderabad, India, December 9 – 12, 2014

Number of Interaction with other institutions: 7

Number of Seminars, Workshops, Symposium, Trainings attended: 14

Number of Conferences / Seminars / Workshops organized: 4

Detailed Bio-data of the Co- Investigator

Name	:	D.RAMYA DORAI
Date of Birth	:	16-06-1980
Designation	:	Associate Professor, Dept. of CSE, Adhiyamaan college of engineering, Tamilnadu. Mail- ID: ramyadorai6@gmail.com

Educational Qualification: B.E(Bangalore College of Engineering and Technology, 2003), M.E(Sona College of Technology, Anna University-Chennai, 2006), (Ph.D.) Anna University.

Teaching Experience : 11 Years

List of publications :

Kalaivani.R,**Ramya Dorai.D**(2013), Cluster Based Leader Election and Intrusion Detection System for MANET. International Journal of Computer Science and Management Research. Vol. 2 pp. 1459-1462.

Kalaivani.R,**Ramya Dorai.D**(2013), Secure Protocol for Leader Election and Intrusion Detection in MANE International Journal of Advanced Research in Computer Science and Software Engineering Ts. Vol. 2 pp. 62-66.

Kanimozhiveena.E,**D.Ramya Dorai**(2013), A Framework for Building Applications based on Hidden Topics with Short and Sparse Web Documents. International Journal of Advanced Research in Computer Engineering and Technology. Vol. 2 pp. 984-988.

Kanimozhiveena.E,**D.Ramya Dorai**(2013), , An approach for Reducing Data Sparseness in Web Documents using Hidden Topics from External Data, Australian Journal of Wireless Technology, Mobility and Security, January 2013

A.Melveena, **D.Ramya Dorai** (2013), A Novel Framework for Self-Reconfigurable wireless mesh Networks. International Journal of Science Engineering and Technology Research(IJSETR). Vol. 2 pp. 167-171.

Number of Workshops/FDP/Seminars Attended: 23

Section 11: Other research projects with investigators (one page)

1. Title of the Project : Ontology Based Knowledge Management and Semantic Information Retrieval by Constructing Multiple sub Ontology.

Funding Body : DRDO

Duration : 3 Years (January 2012- January 2015)

Total Cost : 18.75 Lakhs

Status : Completed

2. Title of the Project : Ontology-Based Semantic Annotation Generation and Retrieval of Images Using Multiple Sub Ontologies

Funding Body : ISRO

Duration : 2 Years (June 2013- June 2015)

Total Cost : 10.01 Lakhs

Status : Completed

3. Title of the Project : Disaster Management Conceptual Modelling, Simulation and Visualization on City GML Model for Effective Decision Making"

Project Status : Ongoing

Funding Body : DST

Duration : 2 Years (April 2015 – April 2017)

Total Cost : 21.20 Lakhs

4. Title of the Project : "Development of Semantics Driven Geospatial Public Health Management System".

Project Status : Ongoing

Funding Body : DST

Duration : 2 Years (June 2015- June 2017)

Total Cost : 14.60 Lakhs

Section 12: Any other information (in direct relevance to the project)

Convener for a **multidisciplinary** conference on Disaster Management, funded by DST-SERB. Technically sponsored by Science Q international Publisher.

Title : Exploration of Computation and Information Technology for Disaster Management

Dates (2nd series) : September 11th-12th 2015

Date (1st Series) **:** August 8th- 9th 2014

Website : http://ecitdm.in/

The conference was successful. Next series of the conference, necessary Initiatives have been started.