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# UML Based Modeling for Data Aggregation in Secured Wireless Sensor Network

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## Abstract

Up till now, less research has been done in developing a Wireless Sensor Network (WSN) data aggregation with the help of Object OrientedModeling and Design (OOMD). These kinds of applicationincludeuse of complex data structures and different algorithms for aggregating data. Usually for such calculation, mathematical modeling is done. To visually represent any research problems,Unified Modeling Language (UML)is more efficient tool for modeling. In this paper, demonstration of UML diagrams is presented for modeling of data aggregation in WSN which leads to better development of application.As a result of additional sensor nodes being deployed in the wireless sensor networks, demand on resource constraints is reduced, whichleads to increase in redundantdata. Data aggregation protocol helps to reduce this redundancy by organizing the data efficiently. Due to the constraints on energy in the WSNs,  Use of data aggregation techniques and data dissemination across WSN plays an significant role in the network life cycle time as they help to conserve the energy of sensor nodes.In this, data is collected by sensor node, then dedicated cluster node aggregates it with data aggregation algorithm and then it is forwarded to base station.This flow of various activities is modeled using UML diagrams. Heresystem is analyzed withhelp of use case diagram, class diagram, sequencediagram, collaborationdiagram and activity diagram. Modeling this kind of problems using UML approach helps to visualize, specify ,construct and document  the system artifact effectively which is helpful for various stakeholders of the application.

*Keywords:*WSN;Data Aggregation; Cluster; Cluster Head; UML;OOMD;

## 1. Introduction

WSN has small sensor nodes also called as motes.It has various capabilities like information sensing, computation,high-speed communication and result generation. In various application sensors are deployed and they collect environment information (for example temperature, humidity) from all sensors which is in turn send to the base station. WSN generates a huge data which need to be aggregated at various different levels. To examine the performance of a sensor network, bandwidth,signal strength, memory, battery power etc. have been utilized; its efficiency can be improved by reducing the cost of cluster development.The basic requirement and challenge of data gathering task is sensor energy conservation so that its lifetime is increased.

Modeling activity is atcentre of Software Development Life Cycle (SDLC)which leads to better application development and reusability. The Unified Modeling Language (UML) is a graphical language which is effective for visualization, specification, construction, and documentationof a software-intensive system's artifact. The UML provides a standardpracticesfor writing a blueprint of system. It coversvarious conceptual things, such as system functionality through use cases and business processes.It also covers concrete things like database schema, reusable component, classes which are written in a specific programming language[1]. This paper mainly focuses on how to follow and apply process of formal development with UML in WSN data aggregation which is based on the OOMD.

## 2. Related Work

FengyuanRen[2]proposed Attribute-aware data aggregation (ADA) scheme.It uses packet-driven timing algorithm and potential-based dynamic routing method (PSDR)with packet attribute. Guorui Li[3]proposed data aggregation based on temporal correlation using Auto Regressive moving average (ARIMA). Enam, R.N [4]proposedData Aggregation based on Energy Efficient Differential in a Dynamic Cluster Based WSN. She proposed virtual grid algorithmusing clustering mechanism. Hemant Sethi[5]proposed an Energy Efficient Interest Based Reliable Data Aggregation (EIRDA) Protocol for WSNs. Here each cluster considers the uniform distribution of sensor nodes using EIRDA which is a static in nature.Ren P. Liu[6] proposed an Efficient Reliable Data Collection (eRDC) algorithm. Implementation of eRDCuses hop numbers and quality of next hop link for findingtotal number of re-transmissions.Basavaraj S. Mathapati[7]proposed an Energy Efficient Reliable Data Aggregation Technique for WSN. Bala Krishna [8] proposed energy efficient data aggregation technique in WSN using a novel approach which classify the energy efficient data aggregation protocols based on structure, search-based and time-based approaches. Sumit Chaudhary [9] have proposed the effective and efficient mechanism and architecture of energy efficient techniques for data aggregation and collection in WSN using principles like global weight calculation of nodes, data collection for cluster head and data aggregation techniques using data cube aggregation. They have modeled data collection technique with one UML diagram.

## 3. UML Applications in various domains

The UML effort started in October 1994officially with fusionof Booch, Jacobson's OOSE (Object-Oriented Software Engineering), and Rumbaugh's OMT (Object Modeling Technique) approach. After its introduction, UML has beenuniversally adapted and used by the community of software development.It is because of models help to depict graphically, specifying, constructing, and documenting the artifacts of a software-intensive system.

It facilitates comprehensible modeling techniques to describe system models and used for various applications, ranging from engineering modeling tobusiness processes, mainly for documentation purposes.

Nilesh J. Uke [10]illustrates an effective solution to modeling object tracking in video using UML diagrams. Various modules like shot segmentation, feature extraction, and object tracking are integrated for detection of moving objects from video. It is modeled using UML diagram. Infantino et al [11]demonstrates use of UML in mechatronic to validate andverify the conceptual robot design. Shi-xiang& Wang [12]used UML Profile which allows capturing software perspective of CPS (Cyber Physical Systems) applications.