

# Fusion and Filtering Of Sensor Data by Middleware Solutions: A Survey

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**ABSTRACT:** Number of sensors are increasing day by day due to the advancements in the sensor network technology sensors have been small in size, more efficient and less expensive. Hence are used up to large extent. So many sensors generate very large amount of data. To transfer such a big amount of data from a sensor to the cloud application makes use of very high energy . So to reduce that requirement of such high energy we need to minimize that data which is to be transferred from sensor to that cloud. It is done by filtering and fusing techniques. Further the problem of dealing the large amount of data created by the so many sensors increases. If we want to deal with or handle such a huge amount of data we need more memory space every time and every moment and that is our first and foremost requirement to reduce the amount of memory used by any system. To handle that data by the in between solutions or middle ware solutions are have been discussed.

## I. INTRODUCTION

According to the new technology that is Internet of Things (IOT) It is considered that everything in this universe or environment can be connected to the internet. And all the objects or devices gets recognized automatically by an identification number as soon as they enter into the IOT environment. These devices can interact with each other they even have intelligence i.e. they have decision making power as well . So these devices are known as “Smart Objects”. [1]



Fig 1 Sensors in Smart Environments

This whole concept is introduced just to give people a more convenient environment or a user friendly atmosphere .So that everything that a user wants to do can be done automatically and in a very easy way. To fulfill this requirement of the user every object in the IOT environment has to collect data from the environment only.

The data is collected from the physical and virtual sensors. In the case where the data sources or the sensors are limited in number it is easy and possible to collect the data and do the analysis of that data. But as we are moving towards the Internet of Things there are billions of sensors from which data is to be collected. This is because we want everything

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 9, September 2015

to be connected to the internet so every device has some sensor or sensors connected to it which will give the information about that object or the functions performed by that object and so many other things.

Number of sensors are increasing day by day . Further the problem of dealing the large amount of data created by the so many sensors increases. If we want to deal with or handle such a huge amount of data we need more memory space every time and every moment and that is our first and foremost requirement to reduce the amount of memory used by any system. To handle that data in between solutions or middle ware solutions are created. [2]

### II. RELATED WORK DONE

#### A) Layers in the sensor network:

Low end and high end sensor nodes generates data. The data is collected by low end and static sink nodes . Low end computational device receives the data sent by sink node. The some processing is done on that data and the processed data is sent to the high end computational device for further processing. Finally the data reaches the cloud where the it is stored , processed and shared. The devices in the network have different capabilities like their memory , communication ,processing and energy. According to their capabilities these devices have been divided into layers. So total six layers have been identified and the devices in these layers are according to their capabilities. Layer one has low capability devices and layer six has highest capability devices.

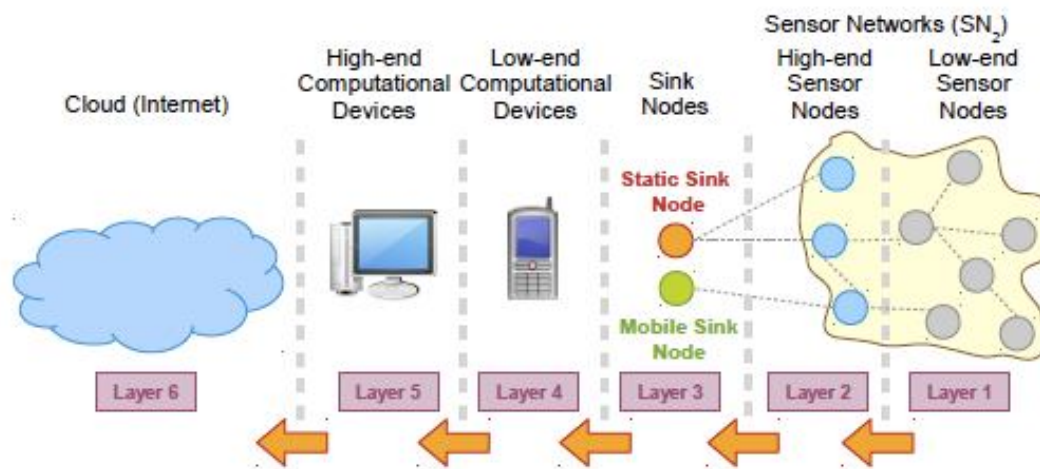


Fig 1. Layered structure of a sensor network

Due to the advancements in the sensor network technology sensors have been small in size, more efficient and less expensive. Hence are use up to large extent. So many sensors generate very large amount of data. To transfer such a big amount of data from a sensor to the cloud application makes use of very high energy . So to reduce that requirement of such high energy we need to minimize that data which is to be transferred from sensor to that cloud. It is done by filtering and fusing techniques.

#### B) Middleware Solutions :

Now a days there is a fashion of using middleware solutions so that sensors and actuators (that actually processes the data after collecting from sensors) can be connected to the internet. These solutions include Global Sensor Network , HiFi , IrisNet as the major middleware solutions. The Purpose of each of them was the same just with little bit changes in its features and capabilities . The biggest disadvantage of this solution was that how to configure and connect with those automatically.

Sensors in the market are now with their APIs (Application Programmable Interface) that gives the interface to retrieve sensor data to the application software. Different middleware solutions uses different mechanisms to retrieve data from sensors. The Global Sensor Network uses wrappers. Wrapper is a kind of program or an

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Vol. 4, Issue 9, September 2015

Application Programmable Interface that is specific for a particular sensor. And these wrappers are to be generated manually by the human being. This is very tedious job for the human to generate wrappers for so many sensors [4].

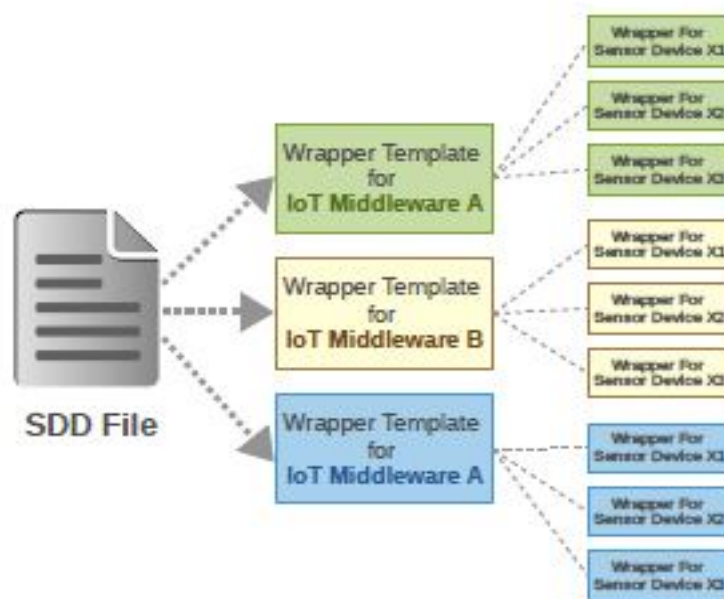


Fig 3. The Wrapper Generation Process

A mechanism for the automatic generation of wrappers is introduced known as ASCM4GSN i.e Automatic Wrapper Generation Layer the wrapper generation always begins with a Virtual Sensor De\_nition (VSD). When a VSD mentions a name of a wrapper that GSN currently does not have in the wrapper repository, first, GSN searches the Sensor Device De\_nition Local Repository (SDDLRL) to look for a matching Sensor Device De\_nition (SDD)\_le. We discuss SDD\_le in detail in the next Section. For now, SDD\_le can be explained as a specification\_le that contains all the information that is required to generate a wrapper class. If Sensor Device De\_nition Local Repository (SDDLRL) does not have a matching SDD\_le, GSN will automatically connect to the Sensor Device De\_nition Cloud Repository (SDDCLR) and search for a matching wrapper de\_nition\_le. If there is a matching SDD\_le, GSN will fetch the SDD\_le and feed it to the Automated Wrapper Generation Layer. This layer generates the wrapper class, compiles it, and pushes it to the wrapper repository.[5]

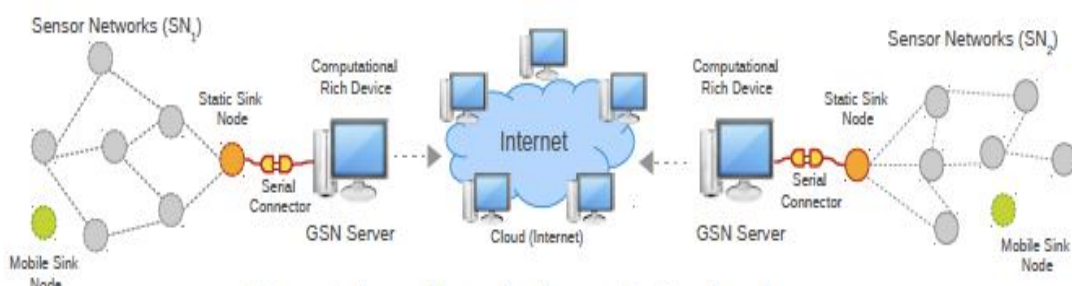


Fig 4. Sensor Networks Communicating Over Internet

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Vol. 4, Issue 9, September 2015

Mobile phone has some special capabilities like processing of data which can fuse or filter the redundant data and pass on the desired information to the next level.

Along with middleware solutions context aware computing is used to reduce the redundant data and find out the actual information. By making uses of such a large number of sensors many sensors collect the same type of data means they give the same information i.e redundant information to filter out that sensor data a CASSARAM a context aware sensor search, selection and ranking model is introduced. It uses priority based Euclidean Distance Compares in multidimensional space techniques to index and rank the sensor. [2]

### III. CONCLUSION

Various middleware solutions have been proposed to handle the big data generated by the sensors in the IOT environment. Automatic Configuration and connectivity of the sensors is done in the mobile middleware solutions because mobile has the processing and computing capabilities that is why it is used as a middleware solutions i.e. has wifi , bluetooth also which helps it more in achieving its goal.

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