A New Approach For Collecting Secured And Classified Data From WSN Gateway By Cellular Network Based Cell Phones

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Abstract —_Wireless sensors networks are newly emerging but rapidly growing class of networks which are implemented in variety of applications for monitoring the environmental conditions in real time. The WSN based, real time applications can be achieved by the interaction of mobile phone users with WSN gateway through cellular network to access the data from WSN. The technique of combining the data sharing feature of WSN gateway with mobile phones through cellular networks is one of the most challenging are in the field of networking due to the nature of large amount of metadata collected by the numerous numbers of WSN sensors. In the case of mobile phones based WSN, there is no need to send every data collected by the sensor nodes of WSN to mobile users. So, data classification is needed in the WSN gateway, before sending the WSN data to mobile users._
Keywords — Wireless Sensor Network, Data Classification, Metadata, Classified WSN data.

I. INTRODUCTION

Recent advances in Internet of Things(IOT) and Information and Communication Technologies, the real time data gathering feature of WSN is shared with external networks like Internet, mobile phone access cellular networks or satellite[1] through WSN gateway to extend and enhance the usage of WSN in various applications. In most of the WSN based real time applications, mobile phones are used as the access points due to the abnormal growth of mobile phones all over the world [2]. Mobile users always carry their phones, wherever they are going. Any mobile phone will be used to access information from WSN gateway through cellular networks. This property makes the possibility of receiving the results of WSN to mobile users immediately. In WSN technology, large numbers of sensors are widely deployed in the area of interest to monitor the environmental events according to the types of applications. All of these dispersed sensors sense the environmental data and report the data to base station in the predetermined intervals from one second to one minute. The base station forwards this received data to WSN gateway. Thus, the WSN gateway receives enormous amount of meta data in each and every second. Sending all of these metadata from gateway to external networks or any server becomes meaningless if they are directly send to the external networks and at the same time, this leads to network congestion also. The enormous amount of metadata collected in the gateway containing duplicate data due to the deployment of many sensors in the same area nearby near. This duplicate data must be avoided in the gateway itself before sending them to external network. Different categories of users are accessing the WSN data from WSN gateway. So, different levels are security must be provided to the WSN data at the WSN gateway based on their accessing rights. At the same time, the users can communicate with gateway of WSN at any time and get the specific information he wants to access. To provide solutions for the above said problems, we need data classification in the gateway before sending the data to external networks.

II. WIRELESS SENSOR NETWORK

Wireless Sensor Network is a special kind of wireless communication network consisting of a numerous numbers of spatially deployed autonomous devices called sensor nodes. Theses sensor nodes are equipped with different or various types of sensors for sensing the environmental conditions depending on the requirements for which they are deployed.

WIRELESS SENSOR NETWORK
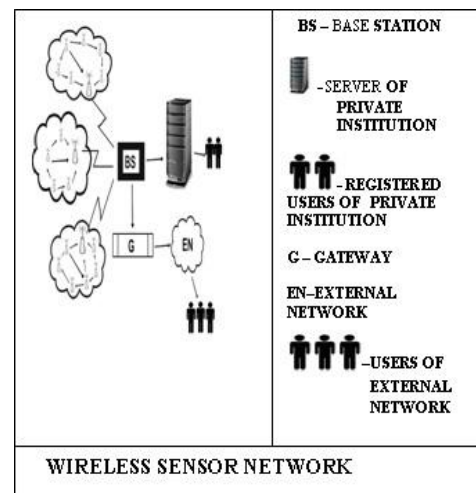
These sensor nodes also contains limited storage memory for storing the sensed data, low power microprocessor for performing small computation on the sensed data, low data rate RF transceivers for sending and receiving sensed data to and from the other sensors. These sensors are powered by small batteries. The deployed sensors of WSN sense the environmental conditions and process the sensed data if needed. Then, they send the sensed data to the

nearby sensors or to the nearby cluster heads with the help of communication interface or protocol specially designed for the deployed sensors. Thus, the cluster heads collect sensed data from all the surrounding sensors and transmit the data to the base station after performing processing and aggregation on the collected data. Due to high memory constrained capability of the base station, it has the ability to receive a lot of data from many cluster heads and store them in its memory. Then, the base station process the stored data using its high power processors. After processing, it sends the processed WSN data to the server which belongs to the owner of that particular WSN or to the gateway node which acts as an intermediate node for sending the WSN data to external network from which the WSN data are accessed by the users of external networks.

III. CELLULAR NETWORK

The concept of cellular network technology is introduced for providing wireless connection among mobile devices roaming throughout the world. In cellular network system, a large geographical land area is split into many cells of regular geometrical shapes like square, circular, hexagonal etc., but different sizes according to the subscriber densities within the cell and also out of the cell. Each cell contains a fixed location radio transceiver and other radio equipments known as base station. The nearby cells are grouped into clusters and each cluster is controlled by a base station controller (BSC). This base station controller is responsible for assigning different sets of radio frequencies for each base station situated in corresponding cells to avoid interference. This base station controller is also responsible for handling handover between mobile phones moving from one base station to another base station. By this way, the cellular network provides radio coverage over large geographical area. Many base station controllers are connected to mobile services switching center (MSC) and the mobile services switching center is connected to different types of registers which store the static and dynamic information about the mobile users. Each mobile services switching center is connected to other fixed networks and other external wireless networks through high performance switches. By this way, the cellular network technology not only allows the mobile users to communicate within the cellular network but also allows them to communicate with other wireless network users and wired network users.

IV. ARCHITECTURE OF HETEROGENEOUS NETWORK OF WSN AND MOBILE PHONE BASED CELLULAR NETWORK

In our proposed architecture of the heterogeneous network of wireless sensor network and cellular network, data are accessed by cellular network based

mobile phones from wireless sensor network through WSN gateway. In this architecture, the scattered sensors of each wireless sensor network sense the environmental event and send this data to cluster head (CH).

CELLULAR NERWORK
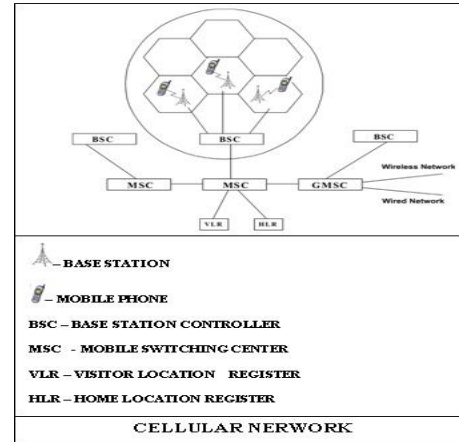
Whenever the cluster head receives the sensed date from different sensors, it immediately sends them to the central server of sensor network base station (SBS). In this manner, the central server of the base station receives data from cluster heads of its entire sensor networks connected to it. Then it performs necessary data processing if necessary and sends the resultant data to the gateway of sensor network (GSN).

HETEROGENEOUS NETWORK OF WSN AND CELLULAR NETWORK
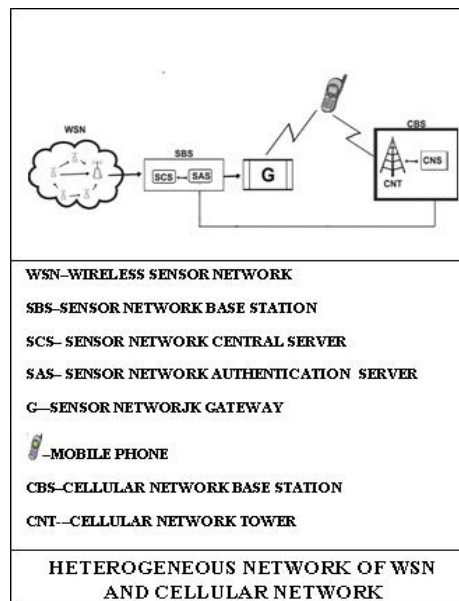
The sensor network gateway (GSN) acts as sink node for the sensor network and acts as intermediate node for sensor network and cellular network. Thus, any cellular network based mobile phones can access the sensor network data from the sensor network gateway (GSN). For accessing WSN data from the sensor network gateway, the mobile phone must be

authenticated by the sensor network authentication server (SAS) through the cellular network base station.

V. DATA CLASSIFICATION

Data collection is the initial function in every process or work, before starting that process or work. Data collection can be done in a variety of ways either by manual or by any type of man made things (e.g. tools or machines or sensors) depending on the type of the process or work to be done. Data collection can be done for private or public organization and for the personal usage. The collected data can be used as private or public or secret data according to the requirements for which the data is to be collected. The data collected by any data collection method are unstructured data which are not in proper order and it does not contain meaningful information. The collected unstructured data often contain duplicate data and unwanted data and the volume of collected data are large in amount. This unstructured data cannot be directly used for any process or work and for taking any decision based on it. So, data classification is essential for converting the unstructured data into structured data. Data classification is the process of arranging or categorizing the unstructured data based on some rules and criteria and placing the right data in right place according to the sensitivity and criticality. Data classification is the act of analyzing and separating the collected data or information into different categories that will mandate the internal controls, accessing levels and security levels. Data classification provides different security levels based on the internal controls and accessing levels. Data Classification is done based on the following rules: (i) Search the sensitive data from unstructured data. (II) Identify the permissions or accessing levels and protection levels of data according to the necessity of the application. (III) Determine the specific user or group of users who should access or should not access the specific data. (IV) Apply appropriate Data Classification method, technique or algorithm to classify the sensitive data according to the needs of users. According to the accessing levels, data can follow four levels of accessibility such as (a) Public Data: Public Data is the data accessed or shared by all the persons without any restrictions. (b) Private Data: Private Data is the data which is used only by the registered users of the data and is restricted from public users. (c) Confidential Data: Confidential Data is the data accessed by the registered or authorized persons from different groups of data according to the rights on the particular group. Different groups of data are formed from the whole available data by data classification. (b) Secret Data: Secret Data is the top most level of data which needs very high level of security. Data Classification is done based on the above said rules and accessing levels of data. Data classification is an essential part for the proper

management of data. It is also needed to maintain the data security to protect the sensitive data from theft and unauthorized usage of data.

VI. NEED FOR CLASSIFICATION OF DATA IN THE WSN GATEWAY

Generally, wireless sensor network can be deployed for private concern or for public usage. In the case of WSN deployed for private concern, the users of private concern receives the WSN data from the WSN base station and this received WSN data from the base station by the private concern can be used as private data or secret data for that particular concern alone. In the case of WSN deployed for public purpose, the WSN data can be shared with the outside world. To share this WSN data to outside world, WSN needs to be connected to the infrastructure network or heterogeneous network through gateway node. The gateway node collects the sensor data from WSN base station and forwards them to one of following, according to the purpose in which the wireless sensor network is deployed. (i) Wi-Fi, Bluetooth based mobile phone. (ii) Satellites. (iii) TCP-IP based Internet and (iv) Mobile phone access cellular networks

Generally, in wireless network technology, numerous numbers of sensors are deployed in the area of interest nearby near. All of these deployed sensors periodically report the sensed data in the form of data packets to WSN base station. As the sensors periodically sends the data packets at particular intervals of time, new data is added constantly in the databases of base station and the base station forwards their collected WSN data to the WSN gateway continuously. So, the gateway node receives enormous amount of metadata from WSN base station and quickly become overwhelmed with task of storing and managing the enormous amount of metadata. The metadata received from WSN base station contains duplicate data due to the deployment of sensors nearby near and at the same time, the collected metadata are mostly in unstructured manner. These unstructured metadata on the shared file system is a challenge to take appropriate decision. In the case of WSN data accessed by mobile phones through cellular network, the gateway node acts as an intermediate node between WSN and cellular network. Normally, the gateway node receives large amount of unstructured meta data from the WSN base station. Sending this enormous amount of unstructured metadata becomes meaningless if they are directly sent to mobile phone access cellular network. Also, this leads to network congestion in the network. In the case of mobile phone based cellular networks, different categories of mobile user's access information from WSN gateway through cellular network. Different levels of accessing rights will be given to the different categories of users. According to the rights provided to

the users, different levels of security must be provided to the WSN data resides in the WSN gateway. According to the security levels, WSN data must be kept in the right place from which the specific user can access the specific information he wants to access. Before sending WSN data to cellular network, data classification is needed for rectifying the above said problems. Data classification performs the following function in the WSN gateway node. (i) Avoid duplicate data in the WSN gateway node. (II) Converting unstructured data into structured meaningful data in the WSN gateway node. (III) Improve the buffering capability of WSN gateway node. (IV)Separate and store the WSN data in different files in the WSN gateway node for providing different levels of security to different categories of WSN data. (V) Placing right data in right place for fast and easiest accessing of WSN data by the mobile phone users. (VI) Avoid unauthorized accessing of WSN data from WSN gateway node.

VII. CONCLUSION

This paper discuss about the needs of data classification in the WSN gateway node. When the mobile phone users receive the classified WSN data from the gateway node, they can view their reports in their mobile phones display screen in short and meaningful manner. This technology assists the mobile phone users efficiently communicate with the WSN gateway to access the classified WSN data from anywhere and anytime. Thus the accessing of sensed data in the classified format from WSN gateway through the cellular network based cell phones adds a new dimension to the mobile phone users.

VIII. FUTURE AND ONGOING WORK

This paper presents the concept and architecture of a heterogeneous network of wireless sensor networks and cellular network and the needs for the classification of WSN data in the WSN gateway. In future work, we will refine the architecture and perform data classification using classification algorithms and permitting the end users to access the relevant WSN data according to their accessing rights already provided to them. We are going to continue our research work of data classification in WSN gateway using spatial agricultural data. This data classification in wireless sensor network gateway will give a good solution to the transmission of relevant data between WSN gateway and mobile users having different types of accessing rights on WSN data using the heterogeneous network concept between wireless sensor network and Mobile Phone based Cellular Network.

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