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An Architecture of Future Forest Fire Detection System

Sunny Samanta
Computer Science and Engineering.
SDET- Brainware Group of Institutions
Kolkata, India
e-mail:sunnysamanta549@gmail.com

***Abstract*—** With the progression of advancement in micro-electromechanical system (MEMS), several revolutions has been made in the field of Internet of Things (IoT), in which any objects can ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. In this field, Wireless Sensor Network (WSN) is become so popular for sensing and monitoring physical and environmental conditions and continuously sending this data to the external cloud for further analysis. Forest fire is one of the most dangerous disasters for the ecological environment. It destroys animal habitats and food chain, damages ecosystem and deaths of forest lives. Therefore fast fire detection and monitoring system may help to protect the forest ecosystem. Therefore we proposed an architecture having a novel mesh network which will be smarter for collecting data from the nodes of WSNs. Our proposed methodology would be more beneficial in the future smart forest.

Keywords- Green Environments; Internet of Things (IoT); M2M; MEMS; Wireless Sensor Networks (WSNs)

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I. INTRODUCTION

All The Internet of Things (IoT) interconnects "things" which may be machines, sensors or everyday objects that independently exchanges data between them. In IoT, Machine-to-Machine (M2M) data communication is required and the data transferring is done between device-to-device and device-to-server either directly or over the network. In different fields several M2M services are already planned for cellular IoT (like smart traffic, real time traffic information to the vehicle [1, 2], GPS tracking, environment monitoring). In May 2015, Machina Research estimated that the thirty billion connected devices will be deployed by 2025 [3]. So researchers are still working on this domain for upgrading the future IoT based M2M data communication.

In this context we have architected a smart environmental monitoring system for forest fire detection. Here we have used Long Term Evolution-Machines (LTE-M) network, which is future oriented technology especially for M2M data communication.

II. STATE OF THE ART RVIEWS

The IoT is anticipated to be the next revolution in the field of mobile technology. Due to the demand of IoT, experts forecast that by the year 2020 fifty billions devices will be connected with the internet which is seven times more than world's population [4]. IoT connectivity is significantly growing faster than normal mobile broadband connections so that smart, intelligent network will be best option for this M2M data communication. Today 2G modules are also, working for IoT, but low power consumption, wide area coverage, low cost and specially designed for mobility architecture are key requirements for M2M data communication. Hence LTE-M technology will be designed to solve the needs of M2M data communication. Now many researchers have already used LTE-M network for collecting data from external environment. Several research works have already published in the field of preventing, controlling and detecting forest fires using ZigBee/IEEE 802.15.4 protocol [5, 6].

In this context we have proposed an architecture which sense data from the environment and LTE-M modules collect those data and send the data to the cloud for further analysis purpose.

III. PROPOSED METHOD OF FOREST FIRE DETECTION AND MONITORING SYSTEM FOR BOTH MOBILE AND STATIC ISSUES

In the most of wireless sensor networks (WSNs), few number of nodes act as intermediate or data collecting node, that collects the data and to transfer that data to the sink node periodically. When the data size is too large then this routing process is not eco-friendly. Hence, we have proposed an architecture that doesn't require complex routing algorithm rather the sensor nodes are easily connected to the other sensor nodes or sink node in much easier way.

For our purpose architecture, we have mounted sensor nodes on the belt of the animal which is considered as mobile sensor nodes that are randomly moving around the forest along with animal. These sensor devices measure temperature, humidity, light and carbon monoxide (CO) at various locations in the forest and when the animal goes in the range of the coordinator node which will also connected with other stationary nodes (like tree or some fixed structure) and that also can continuously sense the data from the external environment. On the other hand we have also installed stationary sensor nodes throughout the animal movement path in such a way that a cluster is formed up in the specific area [7, 8, 9]. These clusters have been formed to focus on current environmental data in specific area for forest fire detection and monitoring purpose. We have also proposed an architecture having one sink node in each cluster area. Our proposed work may have the less number of sensor nodes in large area in the forest [10]. Using our proposed methodology sensor nodes are deployed as a star network and to be connected directly with moving animal when they comes in the range of cluster head i.e. considered as sink node in the context. Then sink node can able to collect and analyze the sensed data accordingly. Hence no intermediate node is required for our proposed methodology and that will be also overcome the complexity of complex route selection algorithms in previous WSN context.

IV. LTE-M AND WSN BASED ARCHITECTURE FOR FOREST FIRE DETECTION AND MONITORING SYSTEM

We have architected our proposed model based on LTE-M technology which will be mounted on the belt of forest animals. When animals are moving in the forest and come in the range of stationary nodes where ZigBee wireless sensors are deployed then the modules of LTE-M will collect data from ZigBee wireless sensors and will send it to the cloud where the sensor data will be analysed accordingly [11, 12, 13]. Figure 1 shows the WSN system where sensor nodes collect the data from the environment and transmit the data to the sink node of the cluster. Then sink node will collect the information through all the sensors and form a database. After some threshold time LTE-M module will be transferred the data to the cloud server.

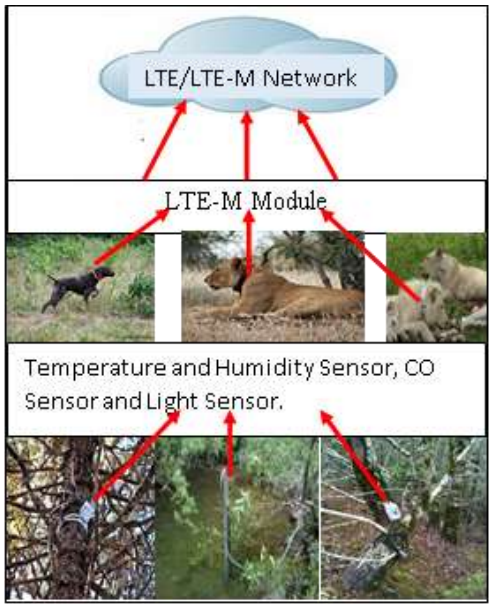

Figure 1. LTE-M based Network System Architecture.

V. CONCLUSION

Our proposed issue will be implemented in different fields for M2M data communication. This context we have introduced the concept of smart environmental monitoring scheme for forest fire detection, with the inclusion of the IoT and LTE-M modules that are low cost and most efficient system for today's M2M devices. In this paper we have proposed a technique where sensor nodes can directly communicate with the moving nodes deployed on the belt of the forest animal. Therefore it will decrease the requirement of complex routing algorithm for connectivity. In this mechanism we will also track and monitor health condition of the forest animal in efficient way.

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