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THE DISASTER COMMUNICATION SYSTEM USING IOT TECHNOLOGY CONVERGENCE

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ABSTRACT

To introduce a system building measure for keeping up a system through the Internet of Things (IoT) innovation intermingling when the data and correspondence framework crumples in a fiasco circumstance. Dissecting as of now dispersed and used IoT innovation is important to cure the burdens of the fiasco and security radio system dependent on PS-LTE innovation through IoT innovation union and to shape the best system accessible in a debacle circumstance. The present examination determined another utilization of the current innovation by investigating the detecting gadget innovation for actualizing IoT, the innovation for inclusion in shadow regions, and system extension innovation from the viewpoint of a debacle circumstance. IoT implies that everything is associated with the Internet and intelligently worked by using the processing power and systems administration capacities that are inserted in individuals, things, and nature. Starting here of view, the sensor hubs comprising a keen sensor arrange and the passage establishing a little cell are just a single thing. The likeness of the design and required capacity between the sink hubs of the keen sensor and the passage of the little cell has confirmed the achievability of the innovation assembly of the brilliant sensor and little cell. As such, the savvy sensor has processing power that the little cell doesn't have and its own capacity, which can be steadily determined during a catastrophe. Besides, if inclusion can be reached out through the Wireless Mesh Network (WMN) innovation union, the application to the field and gathering correspondence will be expanded in a debacle circumstance. We planned a Disaster Response Smart Sensor Small-Cell (DR3S) organize had practical experience in catastrophe circumstances by considering the qualities of these advancements. Through this investigation, we inferred a system building measure had some expertise in catastrophe circumstances, DR3S organize, through IoT innovation combination. It is normal that the helplessness of the calamity system will be successfully enhanced.

1. INTRODUCTION

Disaster communication has been developed by applying the public safety LTE (PS-LTE) to address the problems of equipment dependency and shadow areas of TRS technology1. However, the LTE network has limitations; its network survivability is vulnerable when the information communication infrastructure, such as a base station and exchange, collapses, and its communication coverage is narrow in shadow areas, such as inside closed buildings and underground sections2,3. In this study, we demonstrate that compact computing power embedded in various objects and environments is an appropriate alternative for effectively overcoming this limitation. To achieve this, we analyse existing IoT-related technologies from the perspective of a disaster situation and present a network architecture that can efficiently build a disaster communication system by converging the technologies and its expansion measures. IoT-related technologies with the characteristics of maximizing the advantages of the existing technology and minimizing its disadvantages should be derived to apply IoT technology to the establishment of a

disaster communication system. The smart sensor, a key component of the IoT, is equipped with data-processing capability and determining and communication functions that computers have. It is a compact, low-power sensor that performs the intelligent sensing function of measuring the physical, chemical, and biological information from a target and converting it into a transmittable signal4. The application of the smart sensor has been expanded into large-scale environmental monitoring systems and more. The smart sensor can configure the sensor network through a built-in communication function. In addition, since its low production cost, micro miniaturization, low power consumption, and ability to be equipped with various devices are possible by utilizing the MEMS, semiconductor SoC, and embedded software technology, it is easy to link to the establishment of a disaster response system. Note the data-processing capabilities and communication function of the smart sensor itself5 in figure general, the smart sensor serves to collect information on the situation according to its objective, processes it, and transfers it to the gateway.

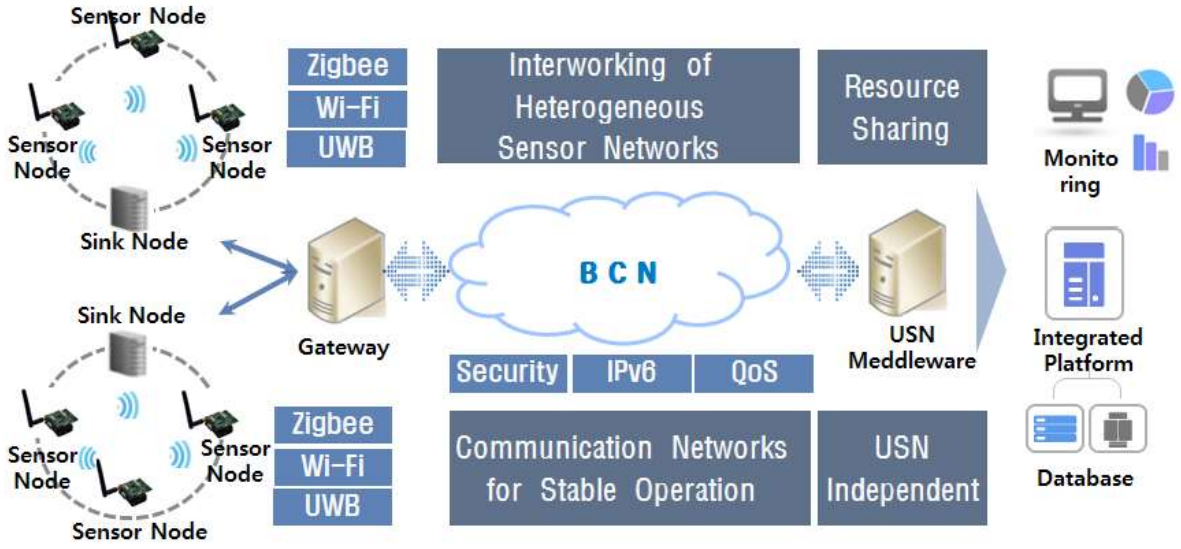

Figure 1. Configuration of Smart Sensor Network

Although figure 1 shows a network configuration using a smart sensor, it is the same as the configuration of the ubiquitous sensor network (USN). The USN is a network that recognizes and transfers environmental information through sensor nodes installed in various locations, thereby supporting its utilization. It collects environmental information in real-time through small-sized sensor nodes. In particular, the small-sized sensors constituting the USN are quickly being replaced by smart sensors due to the development of micromachining (MEMS) technology and VLSI. Therefore, it is difficult to classify the USN and smart sensor networks as separate concepts. These small-sized sensors make up Ad-hoc, Multi-hop, and Mesh-Network, by using various networking technologies, such as ZigBee, Wi-Fi, and UWB6. They interact and transfer information. The USN consists of the sensor nodes, sink nodes, and gateway. The sensor nodes collect sensing data and transfer them to the sink node. The small cell, another component of the IoT, is being utilized as a technology for improving indoor shadow areas (such as home, office, and underground sections)

that radio waves do not reach well and receiving intensive data traffic in small areas. The advantages of the small cell are described in Table 1.

Table 1. Advantages of Utilizing Small Cells

Advantages	Description
Low power	Low power consumption by providing a service within low coverage
Provision of their own capacity	Providing their own capacity since they are connected to the mobile communication network using the Internet line as backhaul without going through the base stations
Easy infrastructure establishment	Can be installed regardless of location if there is an Internet connection
Serviceability	Simultaneously available voice and data services, can take advantage of the existing terminal

The convergence technology to be finally utilized is the WMN, which provides a high-speed wireless LAN service with wide coverage through the connection between the APS in outdoor environments, such as a particular city, industrial field, or transportation facilities7.The WMN features self-configuration, which automatically configures networks in emergency situations when the communication infrastructure is poor, such as fires and disasters because the communication reliability according to the multipath on a mesh topology is ensured through the self-configuration. It also provides automatic recovery of networks: physical network switching, searching for a new optimum route in traffic overload, and periodic searching for an optimum radio link. In addition, it has the following advantages: securing wide area coverage through multi-hop routing, reusing frequency through automatic frequency selection, consuming low power, and so on. Therefore, it is a suitable network technology for applications in disaster situations.

2. PROPOSED WORK

Expanding networking technology is essential for configuring the sensor network by utilizing the smart sensor and linking the sensor network to the measure of establishing disaster communication. In other words, a smart sensor feature that can perform the role of the sink node and gateway, rather than only being equipped with a specific protocol stack for performing the intrinsic functions of the sensor node, such as simple information collection and transfer, is needed. Therefore, the first condition for applying the smart sensor to the disaster communication system is that the networking capability of the smart sensor should have the TCP/IP stack for external network interworking and the protocol stack of the sensor network itself at the same time. In addition, since the cell radius should be wide and the small cell should fully cover the number of

users to utilize the small cell for disaster communication, it should provide a hand-over function between Femto-cells, Picocells, and Micro-cells8,9.

Division	Smart sensor	Small cell
Applicability	Provides a base for prompt access due to being embedded in objects and environments	Installed and operating in homes, buildings, and underground sections based on existing mobile companies
Usability	Normal operation is possible under any circumstances due to having its own computing power	Possibility of not working in a disaster situation due toneeding to utilize external power
Communication	An integrated interface between heterogeneous USN networks by utilizing various communication protocols, such as ZigBee, Wi-Fi, and UWB, is needed	Handover function between Femto-cells, Pico-cells, and microcells, stable operation via implementation of frequency interference removal function
Computing power	Providing information processing and computing capabilities by having its own computing power	Centered on simple communication function without providing its own computing power
Wired or wireless	Operation is based on the wireless network, and only the sink node and gateway are wired	Wired network is essential to provide fixed-mobile convergence
Communication protocol	ZigBee, Wi-Fi, Bluetooth, UWB, etc.	Bluetooth, Wi-Fi, WiBro, etc.

Table 2 summarizes the features for the application of the smart sensor and small cell technology in disaster communication. While the smart sensor has superior applicability, usability, and computing power, it has a limitation: it requires an integrated interface of heterogeneous protocols and interworking with the wired infrastructure through the sink node, gateway, and so on. Due to being already commercially available and utilized, small cell technology provides fixed-mobile convergence and has superior communication. However, it lacks its own computing power and requires a connection to the wired network and external power supply. In terms of the coverage of shadow areas in disaster communication, the advantages and disadvantages of the smart sensor and small cell technology are complementary. At the end of the day, the keen sensor has processing power (that the little cell doesn't have) and its own capacity that can be steadily determined during a calamity, while the little cell has the vital fixed-versatile intermingling in savvy sensor systems.

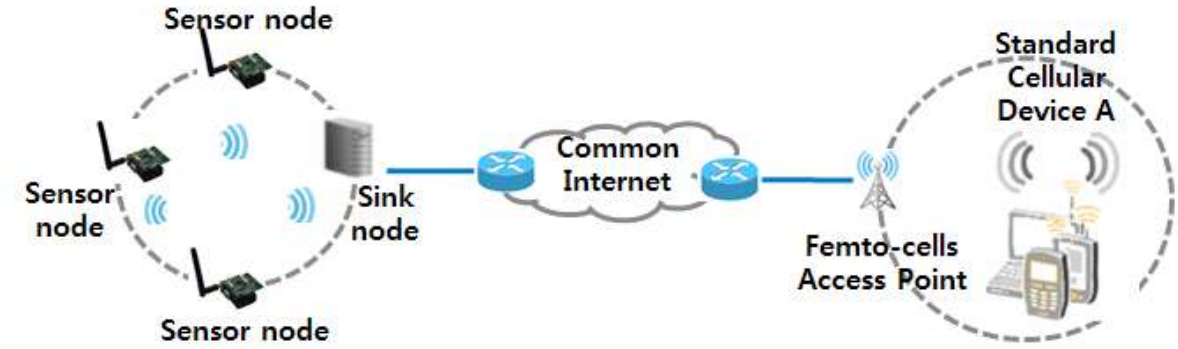

Figure 2 conceptualizes the configuration of the operation of each smart sensor network and small mobile.

A similarity: they are interworked with multipurpose internet networks. In the event of a disaster, the smart sensor network mainly transfers cognitive information on the disaster situation, while the small cell mainly maintains the communication system by eliminating call congestion and shadow areas. However, such a scenario can be realized under the condition that the sink node located at the end of the smart sensor network and access point (a key factor of the small cellular) have dependable energy deliver and are linked to stressed out networks. However, the worst-case state of affairs—that the facts and conversation infrastructure may additionally crumble in a catastrophe scenario cannot be dominated out. It's far vital to derive the not unusual denominator of the clever sensor and the small mobile generation to maintain a strong communication machine even when the information and communication infrastructure collapses. As discussed to date, the clever sensor interconnects the information accrued in a heterogeneous sensor network with the stressed network via the sink node and transfers it to the gateway. The get admission to the point of the small cellular is established in homes, homes, and underground sections and interworked with the wireless cellular tool and stressed out the network, thereby offering voice and records communication services. In other phrases, the sink node of the clever sensor network and get right of entry to the point of the small cellular each act as a gateway for interworking stressed out and wireless networks (the sink node of the conventional smart sensor community performs the function of a gateway at the identical time). In addition, the smart sensor network is embedded in

objects and environments according to the arrival of the IoT surroundings; consequently, it's miles effortlessly reachable from numerous locations in our dwelling environments.

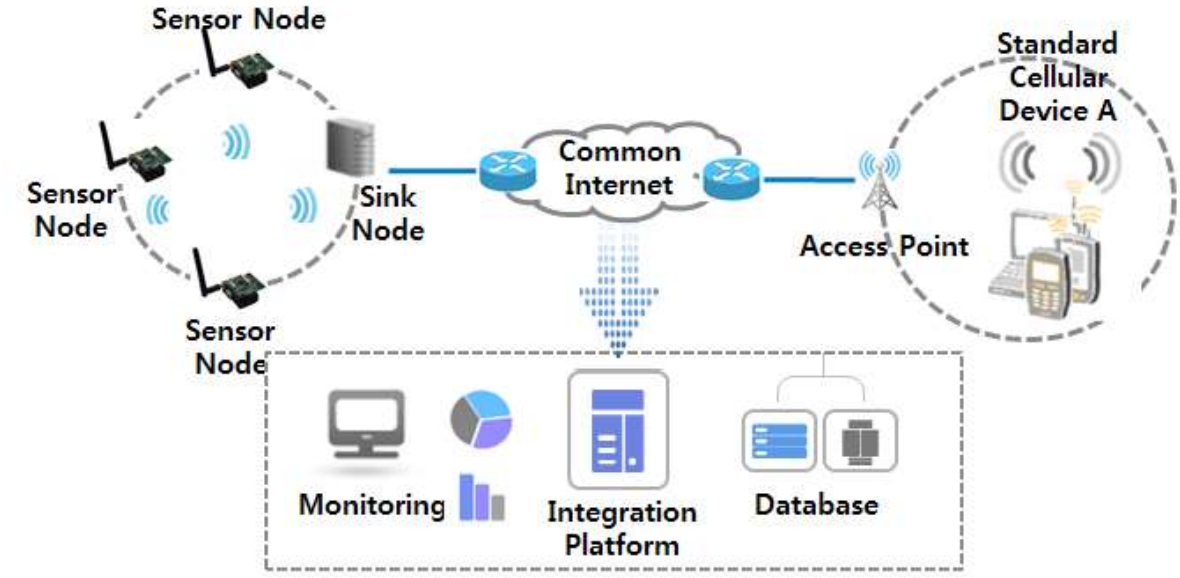

Figure 3. Possibility of Interworking the Smart Sensor Network and Small Cell.

Figure 3 conceptualizes the possibility of interworking the smart sensor network and small cell by briefly outlining these similarities. The security, usability, communication, manageability, and so on of the analysed small cell can be mostly covered by the sink node architecture. For example, if the certification module of the Wi-Fi Protected Access (WPA) and WPA2 are applied to the security module of the sink node architecture, the security of the small cell can be achieved10,11.

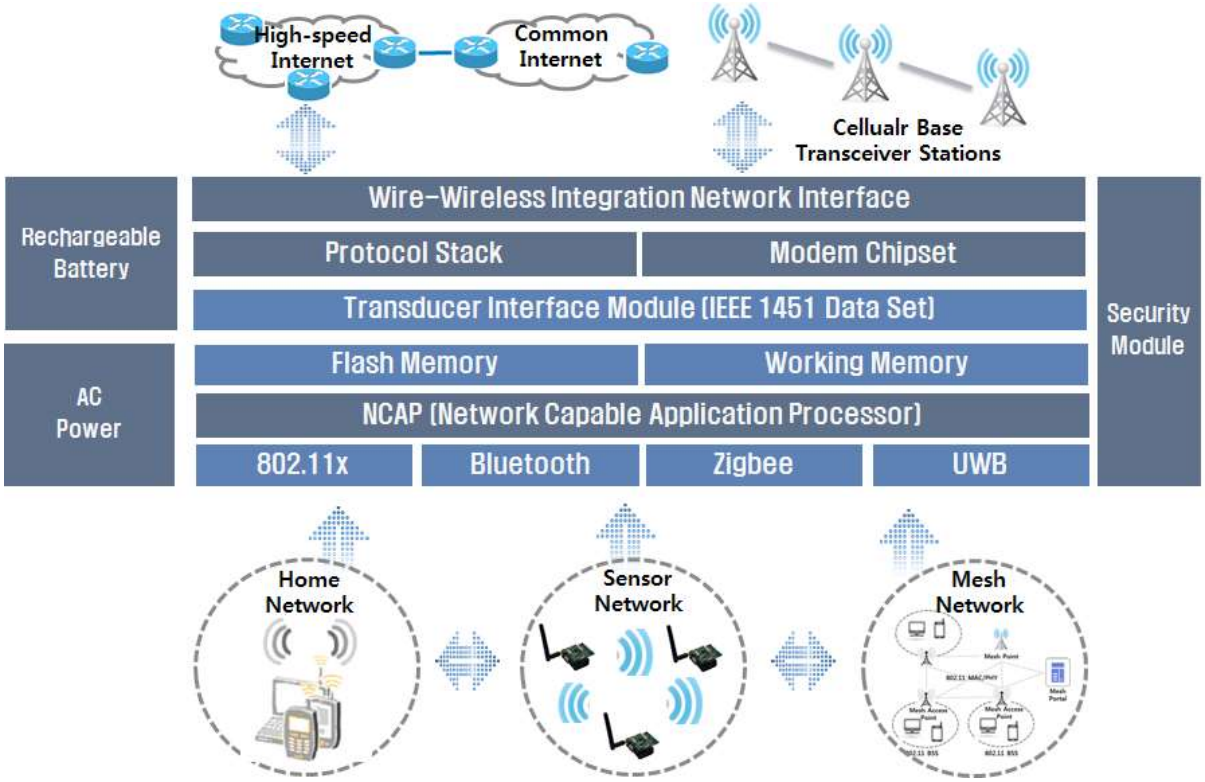

Figure 4. Planning of the Architecture of the Sink Node in DR3S Network.

In addition, the specified function related to the serial electricity, which could replace the AC strength of the small mobile, can be done through the rechargeable battery of the sink node. The similarity among this structure and the specified characteristic demonstrates the feasibility of the era convergence of the clever sensor and small mobile and means that it can be beneficial within the field and birthday party conversation in a disaster. Primarily based on the outcomes of this analysis, the structure of the sink node constituting the DR3S that may be used in the discipline and birthday celebration communication in catastrophe situations is designed as proven in determine 4. The structure of the DR3S sink node is geared up with a rechargeable battery for properly operating the sink node in a catastrophe state of affairs, AC energy for the electricity supply in fashionable situations, and a primary security module12,13. It is also geared up with a community-capable application processor that could process diverse USN verbal exchange protocols, running memory, and flash memory, both of which temporarily store computing and calculated information and save the transit information. Similarly, the structure turned into planned for stressed out and wireless networking interworking, so it turned into interworked with the excessive-pace net network and base station by means of utilizing the modem chipset for the TCP/IP protocol stack and LTE connection and thereby presenting a cord–wireless integrated network interface14,15. The DR3S sink node includes a protocol stack and modem chipset to carry out the position of the get right of entry to the factor of the small mobile at the equal time. In addition, it was configured so that the verbal exchange device with the mobile base station as well as the high-velocity internet community through the cord–wireless integrated network interface changed into feasible. The unit network at the bottom of the configuration covers the smart sensor community

and small mobile. From the angle of viewing all the components of the unit network as one issue, the sink node performs the function of the get right of entry to point at the equal time. This configuration makes it feasible to flippantly accommodate the advantages of the clever sensor network and the small cellular. The DR3S community is without difficulty applied for the field and birthday celebration conversation in a disaster.

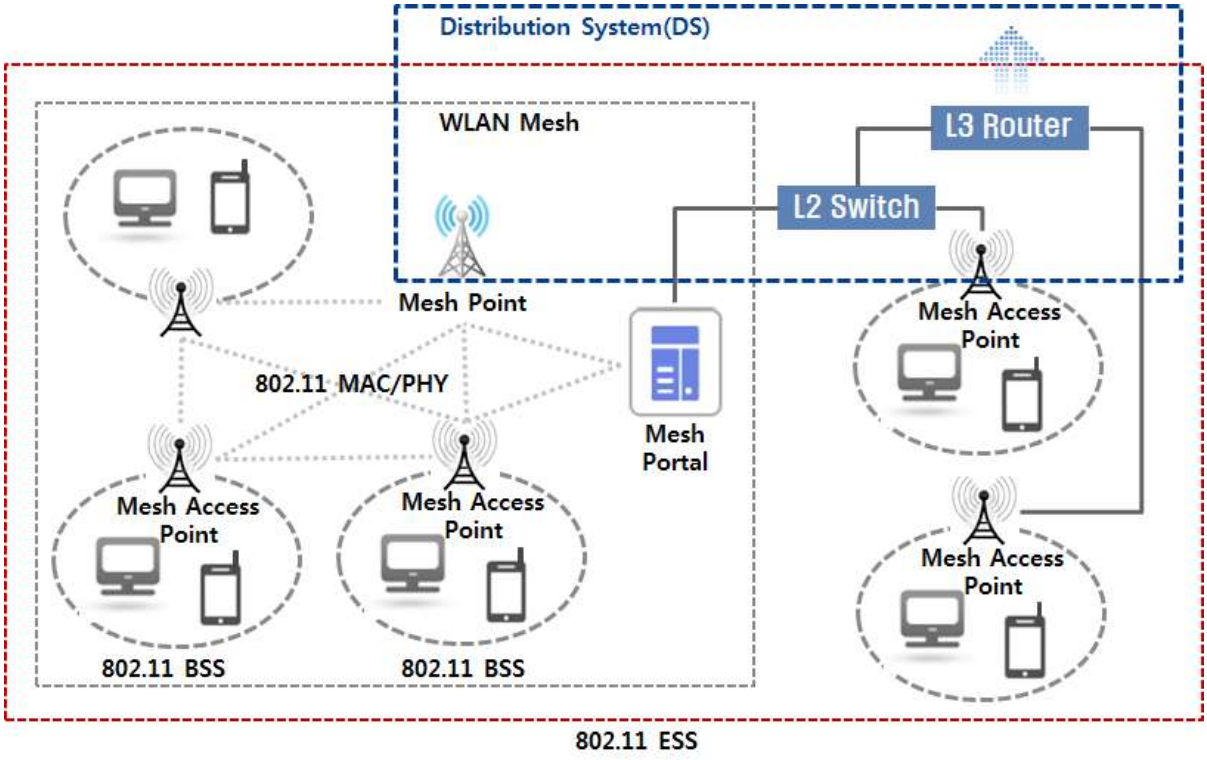

Figure 5. Planning of the Architecture of the Sink Node in DR3S Network.

As proven in figure 5, the mesh factor (MP) serves to detect a neighboring MP and is chargeable for the relationship setup16. In addition, the mesh gets admission to factor (MAP) performs the role of the AP, while the mesh portal (MPP) is chargeable for the connection to the WLAN mesh and external network17,18. The AP of the primary carrier set(BSS) configuring the WLAN through default plays the position of the MP inside the WMN. The MAP gets the statistics from the MPP to stumble on surrounding MP and MPP, and all of the protocols are compliant with the 802.eleven standards. The MPP is hooked up to the L2 switch thru stressed traces and to the external WMN. Consequently, it extends the insurance by means of configuring the prolonged offerings set (ESS)19,20.

3. CONCLUSION

As such, the keen sensor has processing power (that the little cell doesn't have) and its own capacity that can be steadily determined during a calamity, while the little cell has the important fixed-portable combination in shrewd sensor systems. Therefore, the perspective of viewing them as separate things and independently considering the networks is not desirable.