Toward Integrating Wired and Wireless Systems: Dynamic Address Allocation in a Mutual Complement Network

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1 Mutually complementary wireless and wired network

The mutually complementary wireless and wired network is intended to improve home security, reduce energy consumption, and improve the convenience of living [1]. As shown in Figure 1, there can be many home appliances connecting to the network.

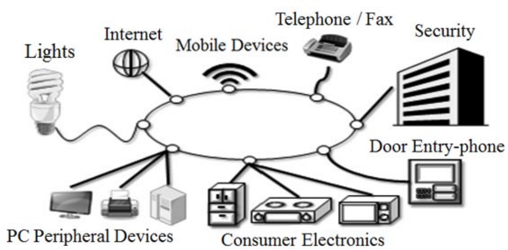

Fig. 1 Adaptation of wireless and wired complementary network

However, networks for these appliances are working in isolation. Therefore, a comprehensive household network in which mutually complementary wireless and wired networks are connected to these individual networks could be created through principal gating. Principal gating does not necessary mean communicating all pieces of information, but providing an exchange of information in a hierarchy to determine whether that particular network is working. Principal gating also means transmitting whether a particular network or a mutually complementary wireless and wired network operates as an emergency network.

To have individual home or organization networks operate to provide sensors and alarms and form a regional emergency network, a majority of buildings in a region must have such networks. The communication performance of a mutually complementary wireless and wired network has the potential to work very well. Using two different types of communication simultaneously significantly improves communication performance over that of individual networks operating independently. To transmit data from node A to node B, as shown in Figure 2, the Zigbee, and a power line communication (PLC) can transmit the same data simultaneously. The same applies when data is transmitted from node A to node C [2].

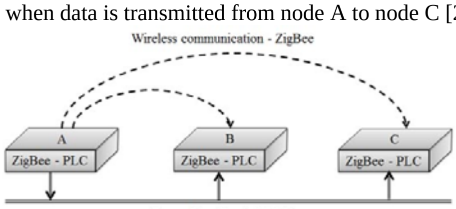

Fig. 2 Wireless and wired communication takes place simultaneously

2 Adaptation of complementary network with complex communication channel method to school building

Complex communication method

A Complex communication method consists of three communication methods which are used in a mutually complementary network. They are 1) a direct communication method is the method where the data is sent directly to the destination terminal. If the communication is not established between the source terminal and the destination terminal the communication will be terminated [3][4]; 2) a simple routing communication method whose purpose is to transfer data to the destination via other possible transmission terminals in case that data is unable to be transferred directly as shown in Figure 3; and 3) a routing communication method as shown in Figure 4 is referred to the method which transfers the data to the destination through the nearby terminal to ensure the data transfer.

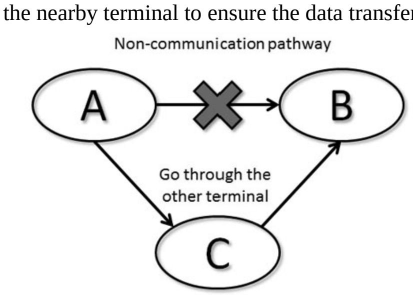

Fig. 3 Simple routing communication method

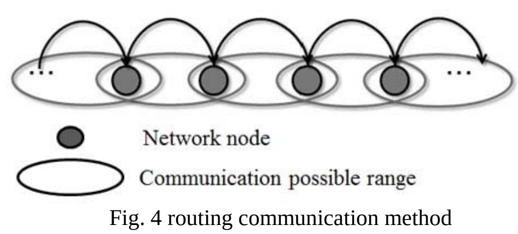

Fig. 4 routing communication method

In addition, the terminal that is a representative of the pathway communication is located in each area. Regarding measurement, one packet of data transmission requires approximately 0.5 seconds for a one way transmission. Hence, a successful packet transmission would require 1 second at least or 0.5 seconds for the transmission and another 0.5 seconds for the response. Therefore, the maximum number of transmission means the minimum time. In this case study, it takes 14 seconds from the 4th floor to the basement, B1. Figure 5 shows the concept of complex communication method. In a place having a good pathway for a network, minimizing the transmission time can be achieved. Through the result of the combined complementary network and complex communication channel in our case study, it can be seen that mutually complementary network can be adapted in large school building [5]. One limitation is that each is input manually to the routing table. Nevertheless, this research aims to find the way to set the terminal address dynamically.

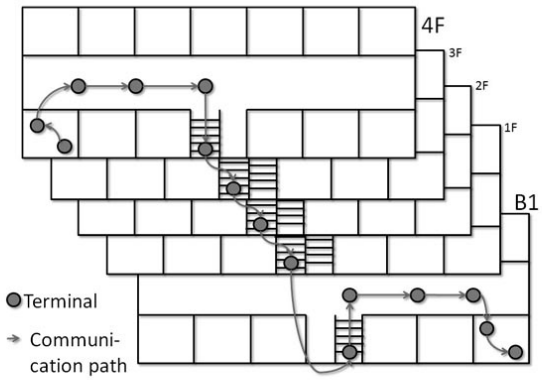

Fig. 5 Concept of complex communication method

3 Master communication network method

Methods for dynamically assigning terminal addresses have been studied, but to date have not been successful it was found that it is unexpected to accomplish. Therefore, to some extent the terminal address was determined in advance in the previous research. Based on that method, the new address determination method called the 'Master Communication Method' has been employed.

In the master communication method, the master terminal's address is manually determined in advance. After forming the child node in this region the communication can be achieved and the child terminal can obtains its address automatically. When the master terminal is established the communication network connection is not established, but the master terminal address is set.

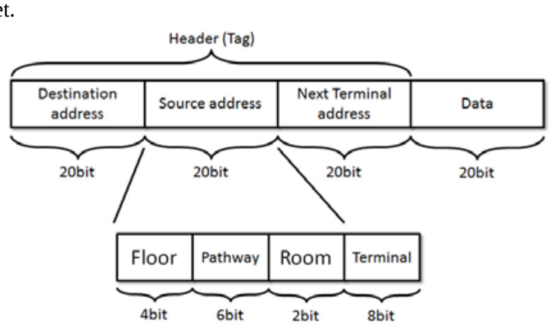

Fig. 6 The structure of header and address

For the master communication network algorithm, data is partitioned and the header information is embedded, then the data is sent in accordance to the header information. As shown in figure 6, the header contains three addresses, the destination address, the source address, and the next destination address. Communication to the next terminal is occurred based on the destination address and the next destination address. Destination address means the desired destination address; the source address refers to the address of the original terminal, whereas the next terminal address is the address which is determined in order to prevent the next terminal address from sending the data to all the other terminal addresses. Each address is further divided into four parts: a floor, a pathway, a room, and a terminal number. Its data format has 4bits for the floor, 6 bits for the pathway, 2 bits for the room, and 8 bits for the terminal number. Figure 6 shows the structure of header and address. Each terminal stores all the terminal addresses that are connected to it where the possible transmission address can be determined.

This research considers three axes X, Y, and Z for its algorithm where X axis stands for the pathway, Y axis for the floor, and Z axis for the room. Figure 7 shows the structure of each axis. Based on the positive or negative position on the graph, the direction of the communication can be found, and then the data can be transmitted properly in less time consumption. The base axis is located in each stairway on each floor.

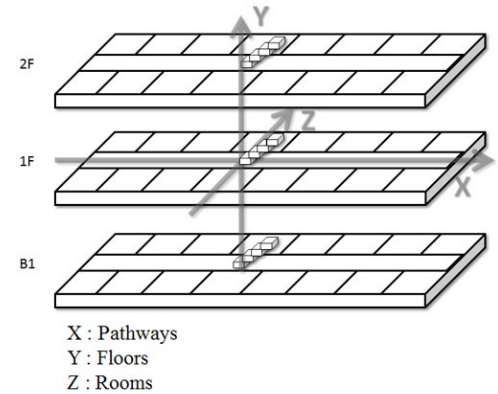

Fig. 7 The structure of each axis

On the other hand, due to the problems, which were caused by improper header and terminal address design of dynamic address allocation for each terminal still exist, this algorithm is unable to accomplish to meet the major goal of the mutually complementary network where its goal is to make this network simpler to use without require technical knowledge. In the following sections, the existing problems will be picked up for the discussion, then followed by the new method to solve those problems.

4 Conclusion

Some methods of assigning terminal address have been studied since the previous research, but it was found that a complete automation for terminal address allocation is unlikely to be achieved by some of the issues. To some extent, manually assigning the terminal address was found to be an easy method. Hereafter, this research hopes to study to identify the location where manual assignment is required and where automation address assignment could be achieved.

5 References

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