A Study of Fire Refuge Guide Simulator Based on Sensor Networks

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Abstract. Recently, fire accidents in large buildings usually cause in tragic consequences. Many buildings are currently equipped with modern fire detection systems for preventing such accidents, but these support no clues as to how to escape. A lot of evacuation systems are aiming at providing more efficient means for alarming and guiding people. The evacuee guidance simulator provides to give clear navigation to nearest exit. This simulator must generate virtual objects such as sensors and guidance lights, connects it with nodes, inputs necessary information, and sets up virtual building environments. In this paper, we present the architecture for creating virtual objects to develop an evacuation guidance simulator. This simulator supports to evacuate people from the disaster area or the outbreak of fire with rapidity and safety for the virtual condition that a disaster or fire occurs in a large scale building.

Keywords: Fire evacuation guidance, Virtual sensor, Simulator.

1 Introduction

Recently, there has been an increasing trend in human-centric, ubiquitous, subliminal computing environments, which pervade everyday life and enable them to enjoy an easy and convenient life. The ubiquitous computing technology has been combined with various fields including medicine, education, architecture and environment, and thus has provided ubiquitous services. Particularly in architecture, the ubiquitous computing technology has been applied to the development of new intelligent system. The existing system is to monitor the states of buildings or bridges in real time, but the new intelligent system is expected not only to be aware of emergencies but to cope with them.

As buildings have been larger and taller, it has been more difficult to cope with emergencies. Actually, disasters in such buildings have inflicted huge losses of both life and property. In this regard, it is urgent to develop an effective evacuee guidance system. This paper designs virtual sensors and guidance lights for an evacuee

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guidance simulator, which aims at enabling the simulator to locate the spot a fire broke out, making a connection with sensor network, as well as to lead people to make a detour to avoid the fire and take shelter in a safe place. Here at, it needs to develop user interface as regards the node generator and the node connection.

The rest of this paper is structured as follows. In Section 2, we describe our proposed architecture for creating virtual sensor and guidance light, and show how our design addresses. Finally we conclude in Section 3.

2 Architecture for Creating Virtual Objects in Fire Refuge Guidance Simulator

It generates building environment-related information to execute the evacuee guidance simulation, and structure-related information to guide evacuees into the safe route. Node-related information shows guidance light and sensors. The guidance light nodes are divided into leading lights, emergency exits on respective floors, the final emergency door and the safety zone. A leading light is four directions (upper, lower, right and left). Sensor nodes are divided into sensor and sink. The guidance light consists of a structure of a building, which provides information necessary for the execution of the evacuee guidance algorithm. Fig. 1 shows building environment-related information that is necessary for the fire refuge guidance simulation.

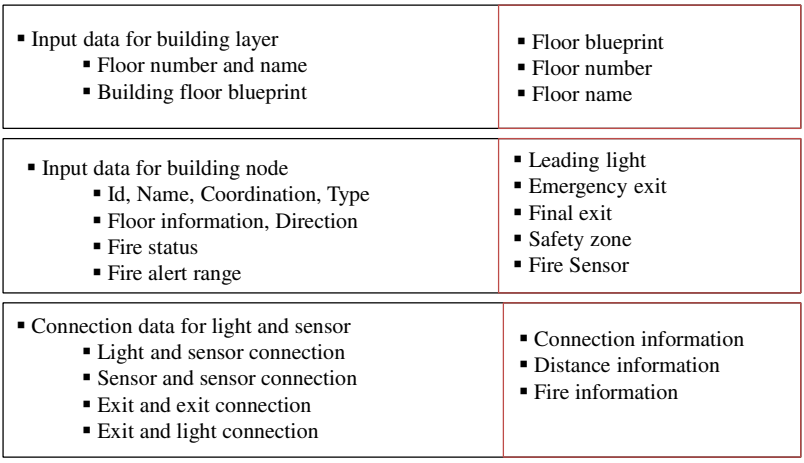

Fig. 1. Information related to fire refuge guidance simulation in building environment

The creating module for virtual sensor is a structure of a building, which provides information necessary for the execution of the evacuee guidance algorithm. It does not provide information directly for the algorithm, but the sensor cannot be aware of fire if it is not connected with the guidance light. Fig. 2 shows the architecture for creating virtual sensor for monitoring fire in building.

Information related to guidance light is the identification number of every guidance light, their coordinate (x, y), information to show the shortest route (upper, lower, right and left), information on the types of guidance light (leading lights, emergency exits, the final emergency door and the safety zone), image information, floor-related information to build up a network with the building, fire information, administrator information to manage guidance light, and registration information to set up guidance light. Fig. 3 shows the information related to guidance light.

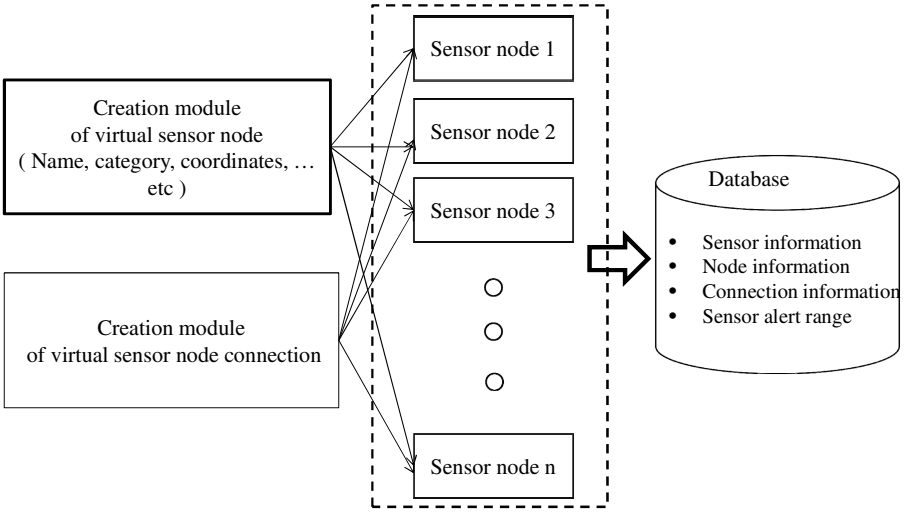

Fig. 2. Architecture for creating virtual sensors

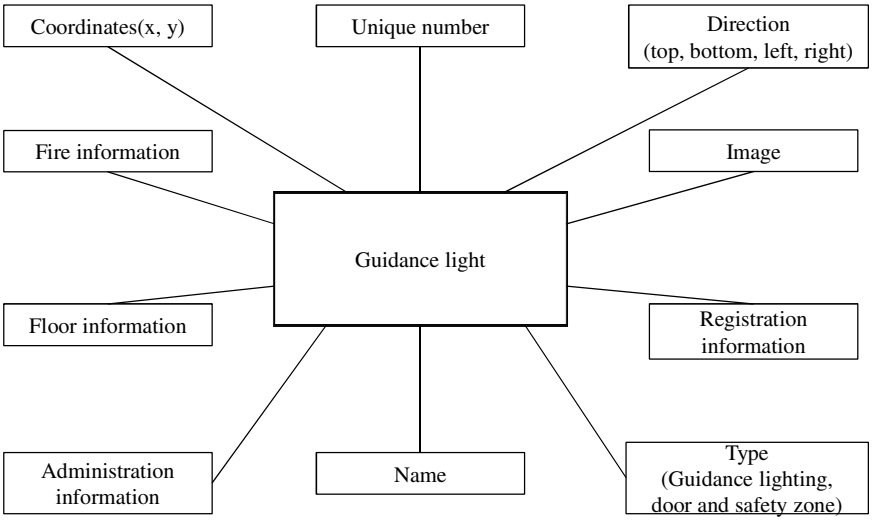

Fig. 3. Information related to virtual guidance light

Guidance light-related information is generated as the creation module of virtual guidance light nodes. In this case, the information shows the names of guidance light, their directions and coordinates, floors and the outbreak of fire. In the building-related information generating module, there is 'floor selection' on the menu bar, and information on the chosen floor is provided for the guidance light. In respect to the outbreak of fire, the guidance light is so initialized that it may give an answer "No." But it gives an answer "Yes" when the sensor, connected to the guidance light, is aware of a fire. Fig. 4 shows the architecture for creating virtual guidance lights.

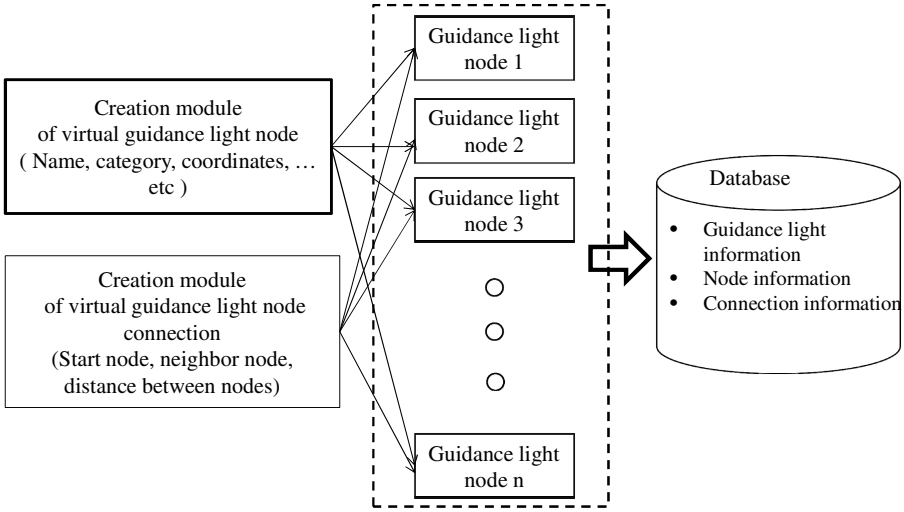

Fig. 4. Architecture for creating virtual guidance lights

The execution of the evacuee guidance algorithm needs information on the connection between guidance light, and the judgment of fire outbreak needs information on the connection between the guidance light and the sensor.

Information, related to the connection between guidance light, shows the identification numbers of a starting guidance light node and a neighboring one and on their distance. As regards information on the connection between guidance light, two guidance lights are chosen by a double click on 'guidance light control' in the building-related information creating module. The information shows the identification numbers of the starting node and the neighboring one and their distance. A guidance light can be connected not only with another one but with many ones at the same time. Fig. 4 shows the architecture for creating virtual guidance lights.

Information, related to guidance light-sensor connection, is generated by a double click on 'guidance light control' and on 'sensor control' in the structure-related information generating module. The information shows the identification numbers of the guidance light and the neighboring sensor. A guidance light can be connected not only with a sensor but with many sensors, and vice versa. Fig. 5 shows the architecture for connecting between virtual guidance light and sensor nodes. The information related to guidance light-sensor connection, i.e., their identification numbers, is saved in the mapping table between virtual guidance light and sensor nodes.

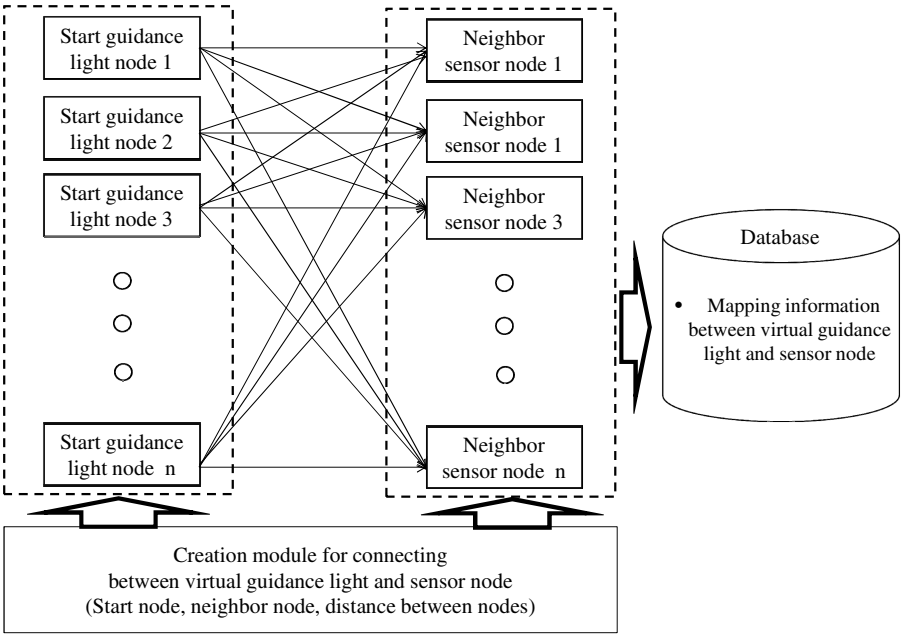

Fig. 5. Architecture for connecting between virtual guidance light and sensor nodes

3 Conclusions

The evacuee guidance simulator evaluates to evacuate people from the disaster area or the outbreak of fire with rapidity and safety for the virtual condition that a disaster or fire occurs in a large scale building. This paper proposes architecture for creating the virtual objects such as sensors and guidance lights of this simulator. This simulator is expected to minimize loss of life in case of an emergency in a large scale building.

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