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Home Safety Sensor and Actuator Platform Design based on MPEG-V

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Abstract. According to change the form of family from a large to small due to industrialization, socially disadvantaged people such as the elderly, the disabled or children and workers leaving home for long time have hardly cope with frequently disaster responses. Therefore this paper is designed sensor and actuator platforms which monitored and controlled safety of real home through virtual environment, implemented prototype based on ISO/IEC MPEG-V standards and verified by demonstration.

Keywords: MPEG-V, Home safety, Sensor, Device, Interface device, Virtual monitoring client

1 Introduction

The safety issue is emerging as important because many of disasters and accidents are happened increasingly, so personal safety activity is needed. But the change the form of family from a large to small due to industrialization that people such as socially disadvantaged people such as the elderly, the disabled or children and workers leaving home for long time make themselves difficult to respond to disaster. MPEG-V is standard for a variety of services by connecting of real and virtual environment and there are related several studies [1], [2], [3], [4]. We are designed sensor and actuator platforms which monitored and controlled safety of real home through virtual environment, implemented prototype based on ISO/IEC MPEG-V[5], [6] standards and verified by demonstration in this paper.

2 Home Virtualization for Safety Monitoring based on MPEG-V

Architecture of home virtualization architecture for safety monitoring is shown in figure 1. The proposed architecture is consisted of sensor and device platforms equipped in real home environment, interface device (ifd) for connecting between real and virtual environment, and virtual monitoring client (vmc) for monitoring and controlling from users, so it makes home accident prevention and rapid response.

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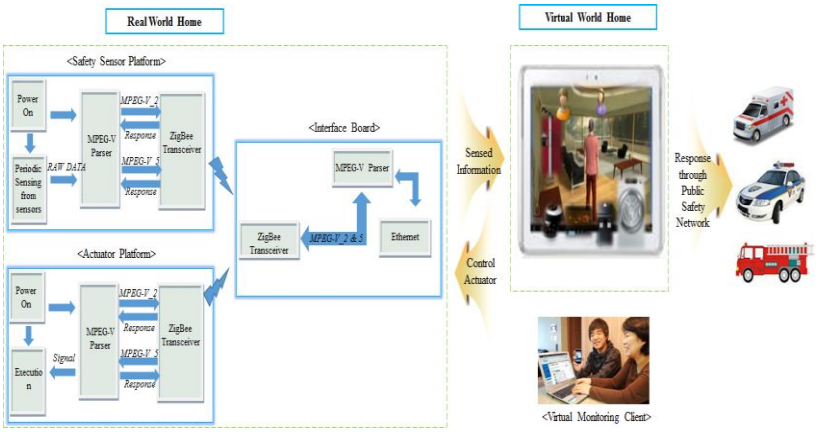


Fig. 1. Home virtualization architecture for safety monitoring

The metadata syntax examples of sensor and device capabilities, sensed information, and commands based on MPEG-V are described table 1 by EBNF (Extended Backus-Naur Form) style. Due to lack of paper space limitation, we present few examples, but we implement temperature sensor, humidity sensor, furniture door sensor, window door sensor, refrigerator door sensor, door lock sensor, body weight sensor, gas (voc) sensor, gas valve, and door lock actuator for prototyping. The table 2. is described of examples for XML style packet based on MPEG-V.

Table. 1. Examples of schema for home safety sensor and device capabilities

No.	Type	Metadata syntax
1	Temperature Sensor	TemperatureSensorCapabilityType :: = SensorCapabilityBaseType [maxValue] [minValue] [Location]
2		TemperatureSensorType ::= SensedInfoBaseType [unit] value
4	Gas Valve	GasValveCapabilityType ::= SensoryDeviceCapabilityBaseType
5		GasValveType ::= DeviceCommandBase value

Table. 2. Examples for packet format based on MPEG-V

No.	Packet Name	Packet format (XML format)
1	Temperature sensor capability	<?xml version =“1.0” encoding=“EUC-KR”?> <homesafety> <cidl:SensorDeviceCapability xsi:type=“scdv:TemperatureSensorCapabilityType” id=“ts0001” maxValue=“120” minValue=“-20” numOfLevels=“1400” offset=“1.0” unit=“celsius”/> </homesafety>
2	Gas valve capability	<?xml version =“1.0” encoding=“EUC-KR”?> <homesafety> <cidl:SensoryDeviceCapability xsi:type=“dcdv:GasvalveCapabilityType” id=“gv0001”/> </homesafety>

3	Sensed information of temperature sensor	<?xml version =“1.0” encoding=“EUC-KR”?> <homesafety> <iidl:SensedInfo xsi:type=“siv:TemperatureSensorType” id=“ts001” activate=“true” value="20.0”/> </homesafety>
4	Device command for gas valve	<?xml version =“1.0” encoding=“EUC-KR”?> <homesafety> <iidl:DeviceCommand xsi:type=“dcv:GasValveType” id=“gv001” activate=“true” value=“Open”/> </homesafety>
5	Response	<?xml version =“1.0” encoding=“EUC-KR”?> <homesafety><id=“return id” ack=“OK”/></homesafety>

3 Prototyping and Demonstration

We prototyped sensor and device platform, interface device, and virtual monitoring client GUI software. Sensor and device platform is developed on freescale mc13224v (arm7tdmi-s) hardware platform and contiki 2.7 and interface device is developed on samsung s5pv210 (arm cortex-a8) and embedded linux 2.6.x. The prototype and test environment are shown in figure 2. The communication methods between sensor or device and interface device are implemented by ZigBee or RS485 protocol and between interface device and virtual monitoring client is implemented by tcp/ip socket on the ethernet.

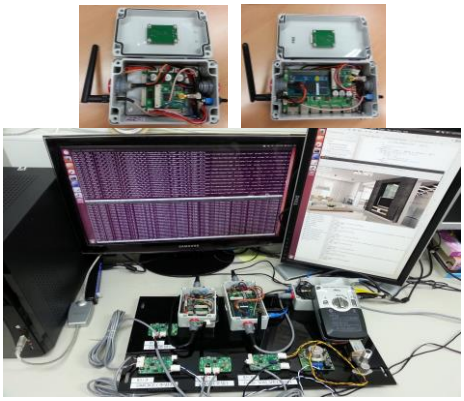
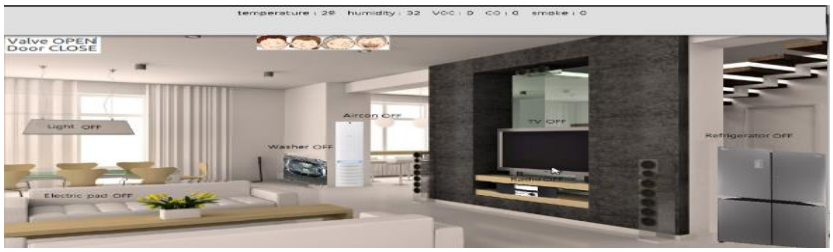
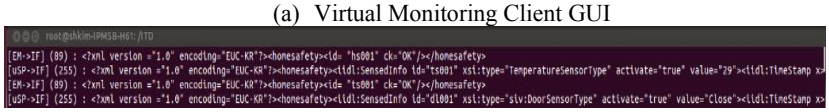


Fig. 2. Sensor and Actuator Platform (left: sensor and actuator platform, right: interface board)

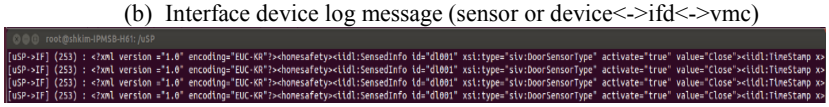
The packets from sensor and device to vmc through ifd are formatted by MPEG-V XML style. The figure 3. shows user GUI (a) for virtual monitoring and control home, log print from sensor or device debug terminal (b) and ifd debug terminal (c).



(a) Virtual Monitoring Client GUI



(b) Interface device log message (sensor or device<->ifd<->vmc)



(c) Sensor or device log message (sensor or device<->ifd)

Fig. 3. Demonstration

5 Conclusions

In this paper, we designed sensor and device platform, interface device, and virtual monitoring client software based on MPEG-V (2 and 5) and implemented prototype and verified by demonstration. In the future, we plan to expand IoT concept and interfacing to SWE (Sensor Web Enablement) project.

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