

The Implementation Model of the Emergency Video Call System for Deep-Depth and High-Rise Buildings Lifts

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Abstract

In the lift industry, there are requirements for a new model through IT convergence. And the elevator installed in the deep and high layer is increased. So it emphasized the importance of the elevator safety. And Emergency Call device in the elevator is enacted into law in Korea. Especially, in a deep and high layer elevator, emergency and prompt action is necessary for a passenger when the accident occurred. Emergency situations that occur in the deep depth and high layer elevator is required is the provision of a rapid and passenger comfort. And also, equipment provided for a video call system may also be utilized in the normal as well as the emergency effectively. In this paper, in order to solve this problem, we propose an emergency video call system that is applicable to deep depth and high layer elevator. This would provide a more secure elevator environment.

Keywords: Deep-Depth Building, Elevator, Emergency System, Lifts Service, Video Call

1. Introduction

According to the sophistication of the building, the elevator industry is rapidly evolving. The intended use has also been expanded to various fields. It has become an essential part of everyday life. And also elevator accidents in these situations are occurring too frequently. So it emphasized the importance of the elevator safety. And Emergency Call device in the elevator is enacted into law in Korea. Especially, in a deep and high layer elevator, emergency and prompt action is necessary for a passenger when the accident occurred. In this paper, we propose an emergency video call system as a way to cope with emergency situations effectively in the deep depth elevator. Accidents occurring in the deep depth elevator are required to identify information faster than normal elevator accidents because it is possible to maximize the fear to the passenger. We want to provide more secure

elevator environment based on IT convergence. So we present a extended model of the emergency call system that named an Emergency Video Call System. This system will made by an open framework system architecture and provide as a model to optimized the system in the elevator. And the system may also be utilized in the normal situation for advertisement as well as the emergency call situation effectively. The proposed system provides safety and comfort of passengers and it will positively respond to situations inside the elevator by providing an emergency video call when the urgency situations occur.

The remaining parts of the paper are organized as follows, In Section 2, we discuss the related technology for the emergence control system. In Section 3, we propose the system model and technique for deep depth and high layer elevator. Section 4 presents an implementation model in this system and Section 5 concludes this paper.

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2. Related Works

2.1 Emergency Control System in an Elevator

Emergency call system with a legal environment for elevator safety has been studied in a number of ways^{1,2}. Based on the wired and wireless services structure in the elevator environment, it has a function that the passenger can be connected to an external maintenance staff when the office manager is absence³. This model lacks the ability to cope with the situation by controlling emergency based on the audio service. In particular, access to emergency situations for deep depth and high layer elevator is needs to lead to the user's stable and fast cope with the fear caused by the extreme users. To support this, this paper extends the voice-based services based on video services and in conjunction with various IT technologies to increase utilization of the elevator. In addition, Video call system built in the elevator needs a lot of consideration due to the constraints of the elevator environment. For this purpose, in this paper, we show the existing voice-based emergency call system structure and then we presents a extend model of the video-based emergency call system to the elevator optimized environment. Figure 1 shows the general structure of the emergency call system.

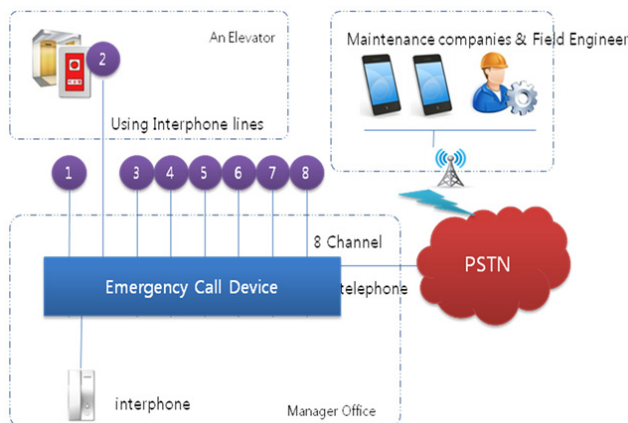


Figure 1. The system of the emergency call system.

File naming in general, the emergency call system in an elevator consists of a relationship among the elevator call buttons, an emergency call device and external management companies. The passenger call by pressing the button in an emergency situation, the signal is transmitted to the emergency call device. If the office manager is present, the office manager is aware of the situation through the intercom. But if the administrator

absence, an emergency situation is identified by passing the registered external management company manager. Because this system provide only voice service, it is insufficient to provide identify additional emergency situation and stability to the passengers. Especially in a deep-depth elevator, it is also necessary that the system structure is utilized more efficient through a variety of devices such as CCTV and display device in the elevator.

2.2 Technique of the Elevator with IT Convergence

Areas that are most often used as a lift and IT convergence industry sector is Digital Signage. Generally, a digital signage system use content management system, media distribution system and schedule management system so on. And also, the system is available through real-world interfaces such as touch screens, movement, detection and image capture for user interaction⁴. Some related studies exist out-of home advertising show the technique to display video content, advertisements and message to specific locations and consumers at specific times⁵. And in the digital signage screen area, various studies using 3D technique have been conducted such as holographic display and water screens etc^{6,7}. Through this, and it displays a variety of information in the elevator.

3. Emergency Video Call System for an Elevator with Deep Depth

In order to design a video-based emergency call system for Deep-Depth lift environment, this chapter will first present the extend model based on the default emergency call systems. And we propose service components and a service model between the required service components.

3.1 Emergency Video Call Configuration

Emergency Video Call System for a deep depth elevator is required variety of hardware devices. That is also important to deal with these devices effectively. The system structure is shown in Figure 2 in order to cope with emergency and normal situations. We designed the hardware architecture of the emergency video call system in deep depth and high layer elevator. This model is integrated model with various devices in the elevator such as CCTV, a display device and a control board so on. This system is composed

of elevators, Manager Office and Control Office. For the Emergency Video Call System, we include Emergency Video Call Server, Emergency Checker and Media Board in the elevator. And we connected the devices with TLC (Telephone Line Carrier) because there is only intercom line in the elevator. In the elevator, we include Media Board and emergency checker. The media board service advertisements in normal situation. And for emergency calls, it operates as a video call client. Emergency Checker identifies whether the emergency call button was pressed and also it gathers the system status information. And pass the associated signal to the media board. In the Manager Office, there is Emergency Call Device that can connect to an outer phone. In the Control Office, there is Emergency Video Call Server.

Each of the elevators includes an emergency video call device and a display media board. And there is Emergency Call Device that can connect to an outer phone in the Manager Office. And last, there is Emergency Video Call Server in a Control Office. The media board shall perform advertising service in an elevator under normal situations. When a user calls an emergency button or

the system is aware of system fault, Emergency Checker is aware of this problem and run the video call system. By default, when the user calls an emergency button, it transfers the emergency status to the emergency call device that connects the external communication line to a maintenance company. In addition, if there is no response after a certain period of time, it informs to the emergency video call system in the Control Office. In the Control Office, manager can judge the overall situation through video. The deep depth elevator may not be possible a phone call and have condition that passenger can be maximized a fear. The video call can solve this problem. For connection to the elevator and the external network, the system has the advantage of being able to re-user the existing line by configuring to use the interphone line previously installed.

3.2 The Flow of the Emergency Video Call System for a Deep Depth Elevator

The flow and relation of the Components in the Emergency Video Call System is shown in Figure 3.

The Emergency Video Call system is operated

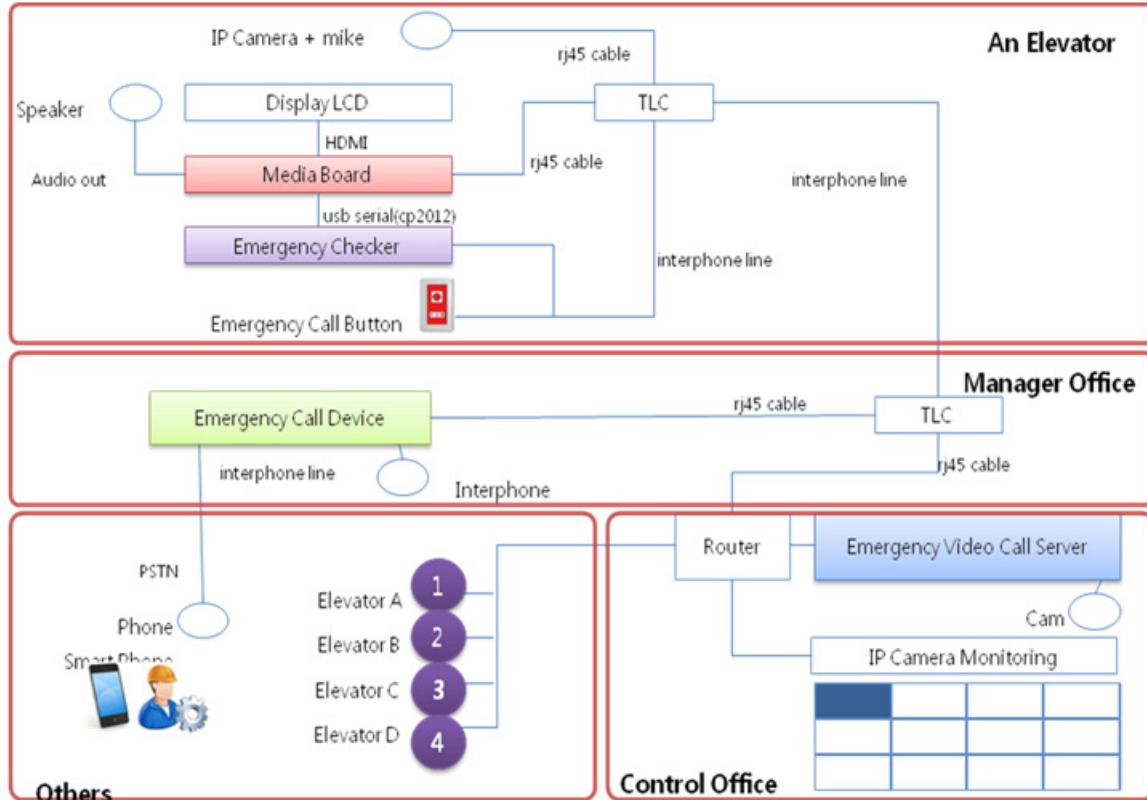


Figure 2. The structure of emergency video call system.

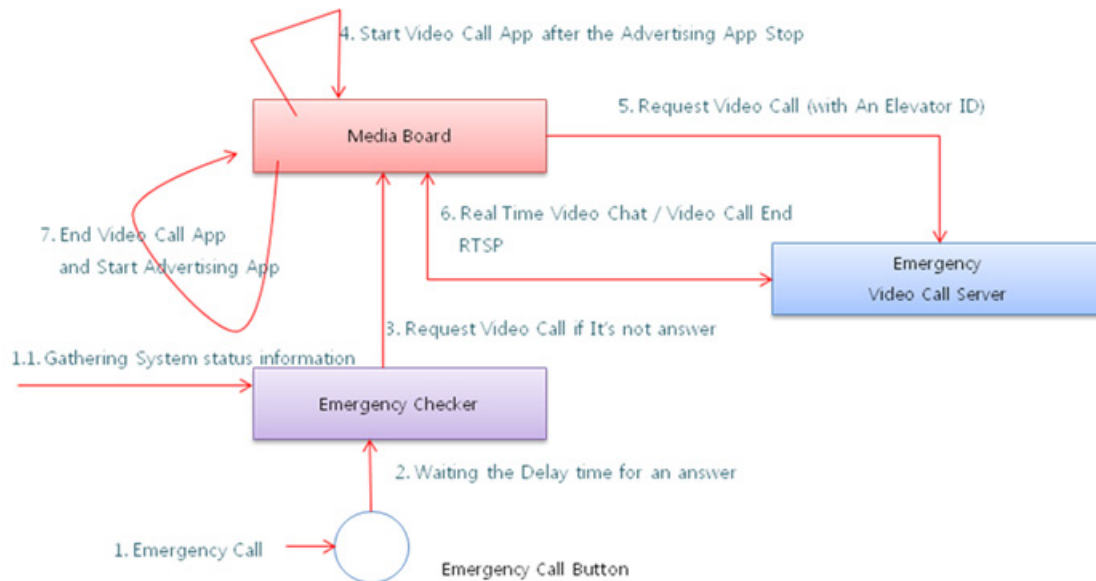


Figure 3. The overall flow of the emergency video call system.

by Media Board, Emergency Video Call Server and Emergency Checker. These devices have an organic structure and flows connected with each other to support the emergency video call process. When a user calls an emergency button or the system is aware of system fault, Emergency Checker is aware of this problem and run the video call system. By default, when the user calls an emergency button, it transfers the emergency status to the emergency call device that connects the external communication line to a maintenance company. But if there is no response after a certain period of time, it informs to the emergency video call system in the Control Office. In the Control Office, manager can judge the overall situation and communicate with a passenger through video.

4. The Implementation Model of the Emergency Video Call System

In this chapter, we present the implementation model of the Emergency Video Call System for a deep depth elevator and the operating model of the service.

4.1 The Software Components of the Emergency Video Call System for a Deep Depth Elevator

There are some definition of software components and

protocols. Software component and the flow between these components are shown in Figure 4.

There are some components for Emergency Video Call System. Digital Signage Activity is to perform advertising services and Emergency Video Call Activity and Emergency Video Call Server are to perform video call control and chat with them, Emergency Call Monitor has elevator and video chat server Information and monitor and control the process of video calls. The Emergency Demon Service is responsible for starting and ending a video call through the state monitoring process with Emergency Checker. In the flow of the emergency video call, Emergency Demon Service check the Video Call and request video call to the emergency Call. And the Emergency Call Monitor request Video Call with Elevator ID to Emergency Call Server and Emergency Demon Server with RTSP URI. And then Emergency Demon Service start Video Call Activity with URI. The Emergency Video Call Activity stop Digital Signage Service and connect the Video Server. When the connection finished, Emergency Video Call Activity stop the video call and restart Digital Signage Activity.

4.2 The Operating Model of the Emergency Video Call System for a Deep Depth Elevator

We show the operating model of the deep depth elevator with the media board. The board has advertising module and emergency module. Advertising module operated

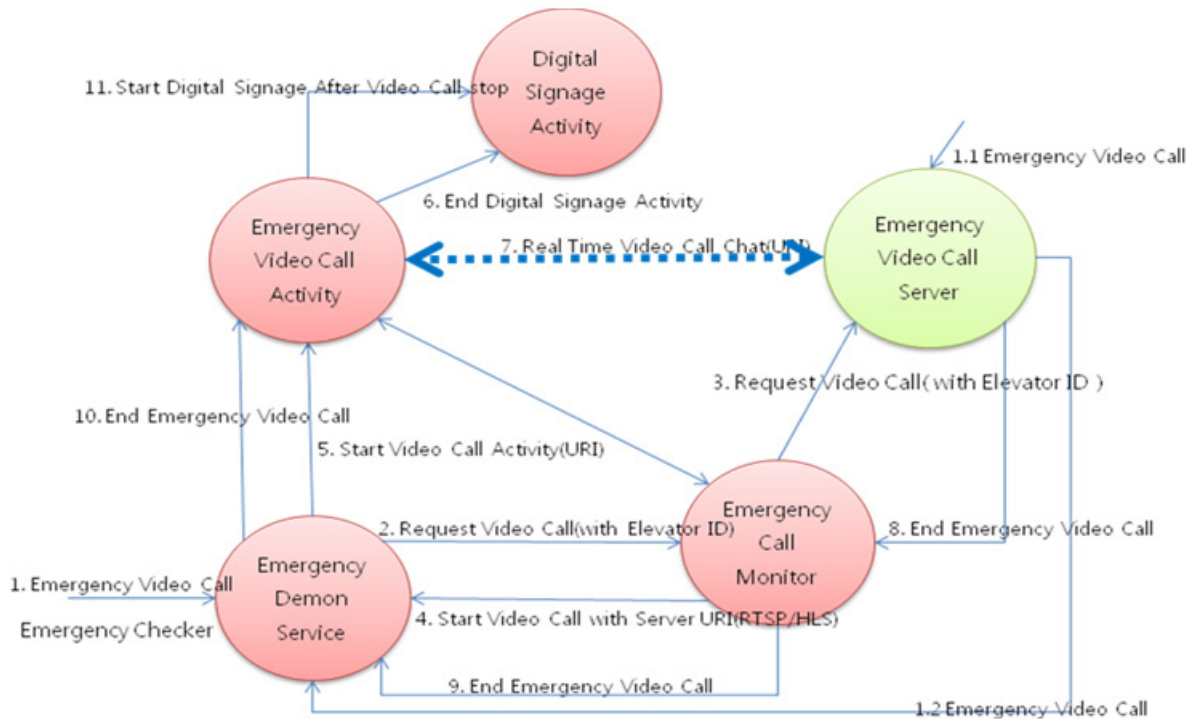


Figure 4. The software components and the flow between these components.

by the schedule data in the advertising server. And when the video call event occurs, change the module to the emergency video call status. In normal situation, the media board display digital signage information. When the emergency event occur, Emergency Demon Service check the Video Call, and request video call, the Emergency Call Monitor request Video Call with Elevator ID to Emergency Call Server and Emergency Demon Server with RTSP, and then Emergency Demon Service start Video Call Activity with URI, The Emergency Video Call Activity stop Advertising Service and connect the Video Server to control emergency situation. The software component and the flow between these components in the media board are shown in Figure 5.

In the operating model of the media board, we designed the player architecture based on the scheduler data. This picture shows the relationship among those components that is required for the operation of the media board. Boot Receiver is a component that carries out the Signage Service at the same time as the device started. The Signage Service is components that perform a central role in the Digital Signage Services. It acts an update management, an environment management and a content display based on three contents type. The

Configure component manages the setup information needed to perform a Media Board such as media type and server information so on. Check Updater component connected to the Digital Signage Server has the update check function. When changing the schedule from the server, Check Update stops the current playing service, and then it starts a new changed service in accordance with the schedule after downloading the relevant content with the Loader component. Signage Player executed by the Signage Service provides schedule-based content display service using the three content types Task such as Repeat Task, Time Task and Event Task. Each type of content such as Web, News, Image, Video and Stream is served with a separate Task. The Emergency Demon Service is responsible for starting and ending a video call through the state monitoring process with Emergency Checker. The Emergency Video Call Activity stops Digital Signage Service and connects the Video Server. When the connection finished, Emergency Video Call Activity stop the video call and restart Digital Signage Activity.

4.3 The Emergency Checker Protocol

Emergency Checker system recognizes that an emergency call signal from the intercom and system warnings and

charge the emergency call service execution event. It detects the emergency call signal with the volt value of the intercom line and can be performed with the warning signal of the system. Table 1 shows the protocol structure used in the emergency call detector.

Table 1. Emergency checker Command

TARGET	START	CMD	DATA (9BIT)	CRC	END	CRLF
D-> EC	*	'S'	xxx xxx xxx	'S'	#	CR LF
D-> EC	*	'W'	-----	'W'	#	CR LF
D-> EC	*	'R'	xxx xxx xxx	'R'	#	CR LF
D-> EC	*	'A'	-----	'A'	#	CR LF
EC-> D	*	'A'	xxx xxx xxx	'A'	#	CR LF
EC-> D	*	'E'	xxx xxx xxx	'E'	#	CR LF
Bytes	1	1	9	1	1	2

CMD 'S': Set command, DATA: RX Volt/TX Volt/Wait Sec

CMD 'W': Wait command

CMD 'R': ADC return command (Wait mode Reset) CMD 'A': Request command (ADC request) (Device to Emergency Checker)

CMD 'A': ADC return command DATA: RX Volt/TX Volt/Wait Sec (Emergency Checker)

CMD 'E': Event command DATA: RX Volt/TX Volt/Wait Sec

Emergency Checker protocol was constructed using the Mod-bus communication protocol. the protocol has RTU type and ASCII type, the RTU type frames are separated by spaces and use 0x00 ~ 0xFF characters. It can shorten the communication time. ASCII type is used to separate the frame with a special start and end characters. The emergency checker command set bolt

value and response wait time for emergency video call. And also it detected the value of the emergency call bolt. It has a communication environment between the device and the control terminal.

4.4 The Emergency Video Call Communication Server

The emergency video call communication server start the video communication between the control center and the elevator automatically when 120 seconds have elapsed without the intercom response in manager office after calling the emergency button in the elevator. The IP camera installed in the elevator car send a video and audio of the emergency call customer to control center PC, the emergency video call server decodes the video image and display the video in the control center PC to determine the situation of the customer. And it outputs the voice of the customer. Also, the system encodes the video of the control center and transmits the video to the device in the elevator. An implemented software type is shown in Figure 6.

The main function of the video call communication servers include:

- Lift list and Group management features: It can display Group and Lift list that is managed by the control office and be seen whether a video call is initiated explicitly.
- Audio / Video duplex communication features: Using

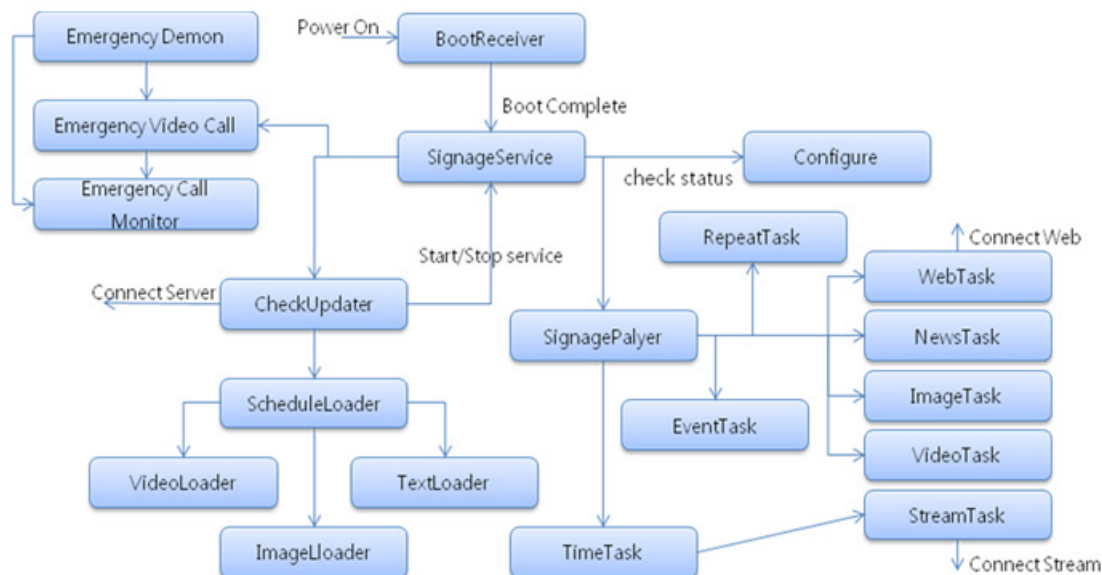


Figure 5. The operating model of the media board for advertising and emergency video call.

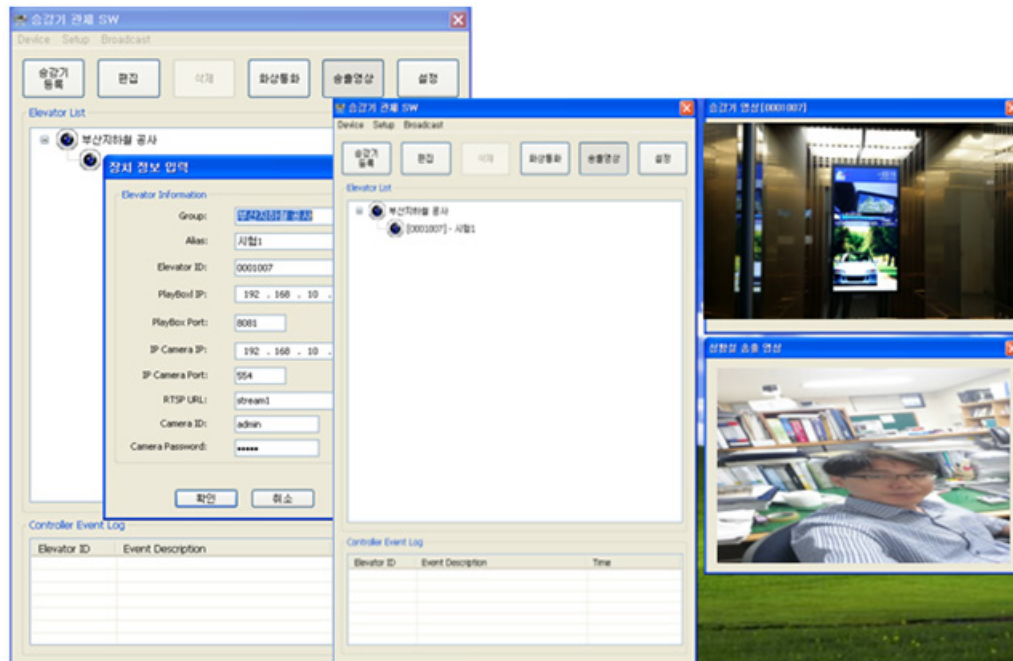


Figure 6. The emergency video call communication server of the elevator system.

webcams and IP Camera to the Audio / Video input device, it provides video calling feature on the elevator and control server.

- Emergency Signal monitoring features: It always monitor the emergency signal generated from all lifts in Background.
- Automatic video call start features: it starts video communication between elevator's users and an office manager automatically when video call emergency signals occur from the elevator. It can communicate a video communication server and several lifts (1: C) currency.
- Manual video call start features: In the control center, the manager can select an elevator in the elevator list and start a video call with the selected elevator manually.

4.5 The Implementation of the Emergency Video Call System

We implement the Emergency Video Call System. It has integrated model with Digital Signage and Emergency Video call. Android based media board display various contents based on the schedule provided by the Signage Server. The Signage Server has various contents such as news, videos, images, web pages, streaming video and games. The elevator displays the advertising service

in normal. The system changes a mode to emergency video call system when the emergency situations occur. And also it performs the function of the emergency call client. Emergency Call Server checks the elevator status and connects and also it encodes and decodes the video stream with real time. The Implementation Model of the Emergency Video Call System is shown in Figure 7.

4.6 System Architecture of the Emergency Video Call System in the Elevator System

Figure 8 shows the IT convergence elevator system architecture that we want to build. The thick dotted line part shows the emergency video call system components in the elevator system.

For the Emergency Video Call System in an elevator, Network environment is made through the intercom line modem using Telephone Line Carrier because it cannot be used to the other external lines in the elevator. In the elevator car, there are Emergency Checker, Media Board, Display Device and TLC (Telephone Line Carrier) modem for the Emergency Video Call System. Emergency Checker monitoring the elevator emergency call status through the elevator control panel and emergency call button. It generates an emergency event for transmission to the media board rapidly when the problem situation



Figure 7. The implementation of the emergency video call system.

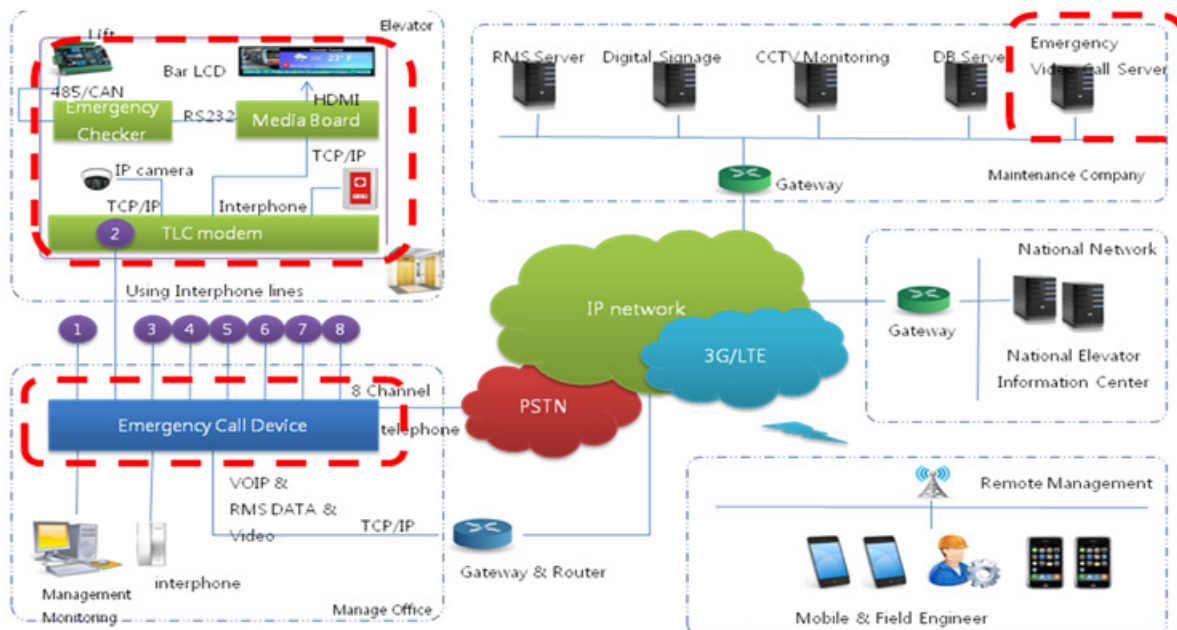


Figure 8. The system architecture of the emergency video call system in the elevator.

caused. Media Board display the Advertisement to the display device based on the schedule that transmitted by the Digital Signage Server. This communication is achieved through the emergency call system within the Management Office. In the Management Office, there is a monitoring system that can check the elevator status and the playing status of the Digital Signage System. The maintenance company manages a variety of elevator-

related systems such as RMS, Digital Signage, CCTV, elevator-related database, Emergence Call System etc. They each have the converged structures. This structure is also provided the associated environment with the National Elevator Information Center. It can serve a variety of information of the elevator to the digital signage system. And also we can control the system by mobile device. We made an integrated structure with RMS,

Digital Signage, Emergency Video Call and CCTV in the elevator with integrated structure of the national elevator information center. They are required to the elevator for safety and convenience. So its solution can manage the elevator efficiently with IT convergence.

5. Conclusion

The elevator industry is rapidly evolving with IT Convergence. And the elevator has become an essential part of everyday life. And also elevator accidents in these situations are occurring too frequently. So it emphasized the importance of the elevator safety. And Emergency Call device in the elevator is enacted into law in Korea. When the emergency situation occurs in the elevator, it need to control rapidly. In particular, it is essential that more effective solution is needed to deal with fear of the passenger in the processing of the deep depth and high layer elevator. In this paper, we proposed the Emergency Video Call System applicable to a deep depth and high layer elevator. We extend the emergency call system to the Emergency Video Call System. And we have proposed a variety of components that need to establish an Emergency Video Call System in the elevator. And also we addressed the flow of the element between the components and the approach based on a structural cooperation with the elements of the lift. The proposed

system will provide safety and comfort of passengers and it will respond rapidly to situations inside the elevator by providing an Emergency Video Call System when the urgency situations occur.

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