

Development of Smart Phone Applications Linked with Fire Alarm Control Panel in Automatic Fire Detection System

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Abstract

The notification of a fire situation on smartphones by a simple text message was developed recently. To improve these drawbacks, smart phone applications linked with fire alarm control panel in automatic fire detection system have been developed for monitoring the fire situations in situ including occurrence of fires, fire control related equipment, short circuit of the fire detectors, and status of the control panel. As a result, the fire related information in situ can be monitored by the fire officers anywhere and anytime.

Keywords: *application, automatic fire detection system, fire alarm control panel, monitoring*

1. Introduction

Fire alarm control panel is a key equipment and works as a brain for automatic detection system receiving the fire information from the fire detectors and sensors and sending and notifying the information to the fire officers and to the public. Fire alarm control panel can be divided by conventional-type (P-type), addressable type (R-type) and M-type depending on the signal process and location of the equipment and by GP-type, GR-type and hybrid-type depending on the usage. The fire alarm control panel should be located in a place where people are always working for in situ fire monitoring, if not, the place should be easily accessible.

However, when the fire occurs in a situation where there is no surveillance, which is not avoidable circumstances, it is difficult for prompt action against the fire. Therefore, it is necessary to develop the in situ monitoring system available everywhere at any time. There are numerous researches for the fire alarm control panel [1-4]. Researches to develop the transmission of the information from fire alarm control to the monitor of the fire disaster prevention center or to a smart phone with a text message have been conducted. However, transmission of detailed information from the fire alarm control panel to a smart phone has not been developed yet. Therefore, it is necessary to develop a smart phone application linked to the fire alarm control panel in automatic fire detection systems.

2. Design and Fabrication of Smart Phone Applications Connected to Fire Control Panel

The following smart phone application receives information from the control panel, the devices status, the operator panel, and the maintenance history. The systems are composed of a simple UI for an easy control and a buttons to navigate easily between the

functionalities. The system can detect the occurrence of fire, operation of the equipment, status of short circuit, and status of control panel. Figure 1 shows the main.xml file for the layout of the system and the buttons configuration.

```
<LinearLayout android:id="@+id/fms_rcv_panel"
    android:orientation="horizontal"
    android:layout_width="fill_parent"
    android:layout_height="0dip"
    android:layout_weight="21"
    android:background="#7494BF">
    <ImageView android:id="@+id/rcv_bar"
        android:layout_width="wrap_content"
        android:layout_height="fill_parent"
        android:src="@drawable/rcv_bar"
        android:baselineAlignBottom="true"/>
    <LinearLayout android:id="@+id/rcv_text"
        android:orientation="vertical"
        android:layout_width="fill_parent"
        android:layout_height="fill_parent"
        android:background="#69593F">
        <TextView android:id="@+id/node_status"
            android:text="장비 이상"
            android:layout_width="fill_parent"
            android:layout_height="wrap_content"
            android:layout_margin="5dip"
            android:textSize="48dip"
            android:gravity="center"
            android:textColor="@color/white" android:background="@drawable/bar_red"/>
        <View android:layout_width="fill_parent"
            android:layout_height="1px"
            android:background="#ffffff"/>
        <TextView android:id="@+id/device_location"
            android:text="생활관"
            android:layout_width="fill_parent"
            android:layout_height="wrap_content"
            android:layout_margin="3dip"
            android:textSize="30dip"
            android:gravity="center"
            android:background="#000000"/>
        <View android:layout_width="fill_parent"
            android:layout_height="1px"
            android:background="#ffffff"/>
        <TextView android:id="@+id/bld_location"
            android:text="독도경비대"
            android:layout_width="fill_parent"
            android:layout_height="wrap_content"
            android:layout_margin="3dip"
            android:textSize="30dip"
            android:gravity="center"
            android:background="#000000"/>
        <View android:layout_width="fill_parent"
            android:layout_height="1px"
            android:background="#ffffff"/>
    </LinearLayout>
</LinearLayout>
```

Figure 1. Screen Configuration of the Smart Phone Application

Figure 2 shows the screen configuration of the received information in case of fire, the location of the fire and the position of fire.

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    android:background="#69593F">
    <LinearLayout android:id="@+id/fms_rcv_panel"
        android:orientation="horizontal"
        android:layout_width="fill_parent"
        android:layout_height="0dip"
        android:layout_weight="21"
        android:background="#7494BF">
        <ImageView android:id="@+id/rcv_bar"
            android:layout_width="wrap_content"
            android:layout_height="fill_parent"
            android:src="@drawable/rcv_bar"
            android:baselineAlignBottom="true"/>
        <LinearLayout android:id="@+id/rcv_text"
            android:orientation="vertical"
            android:layout_width="fill_parent"
            android:layout_height="fill_parent"
            android:background="#69593F">
            <TextView android:id="@+id/node_status"
                android:text="장비 이상"
                android:layout_width="fill_parent"
                android:layout_height="wrap_content"
                android:layout_margin="5dip"
                android:textSize="48dip"
                android:gravity="center"
                android:textColor="@color/white" android:background="@drawable/bar_red"/>
```

Figure 2. Screen Configuration of Received Information

The status panel shows fire alarms and fire surveillance of the fire alarm control panel. Figure 3 shows the screen in case of a fire alarm with the button for fire occurrence and fire surveillance with the status of power, AC power, the status of standby power, high voltage, normal voltage, and low voltage.

```
private String parseRev( String rev ) {
    if( rev.equals( "00" ) || rev.equals( "000" ) )
        return("장비 예비");
    else if( rev.equals( "001" ) )
        return("주전원 이상");
    else if( rev.equals( "002" ) )
        return("수신기 이상");
    else if( rev.equals( "003" ) )
        return("예비전원 이상");
    else if( rev.equals( "004" ) )
        return("화재감지 라인이상");
    else
        return("");
}

private static final int FMS_REQUEST_CODE = 1234;

private OnClickListener nodeConfirmClickListener = new
OnClickListener() {
    public void onClick(View v) {

        Toast.makeText(getApplicationContext(), "화재 신고 화면으로 이동합니다.",
        Toast.LENGTH_SHORT).show();
    }
}
```

Figure 3. Screen of the Status Panel

The detailed information on the fire situation including surveillance building, location of fire, status of equipment, received date, received time and emergency can be obtained by pushing the fire button contact button as shown in Figure 4.

```
<TextView android:id="@+id/log_title"  
    android:text="수신 일자 | 수신 시간 | 상태 코드 | 화재 위치"  
    android:layout_width="350dip"  
    android:layout_height="wrap_content"  
    android:layout_margin="5dip"  
    android:textSize="12dip"  
    android:gravity="center" />  
<View android:layout_width="250dip"  
    android:layout_height="1px"  
    android:background="#ffffff" />  
  
<TextView android:id="@+id/log1"  
    android:text="발생 이력1"  
    android:layout_width="350dip"  
    android:layout_height="wrap_content"  
    android:layout_margin="5dip"  
    android:textSize="12dip"  
    android:gravity="center" />  
<View android:layout_width="250dip"  
    android:layout_height="1px"  
    android:background="#ffffff" />  
<TextView android:id="@+id/log2"  
    android:text="발생 이력2"  
    android:layout_width="350dip"  
    android:layout_height="wrap_content"  
    android:layout_margin="5dip"  
    android:textSize="12dip"  
    android:gravity="center" />  
<View android:layout_width="250dip"  
    android:layout_height="1px"  
    android:background="#ffffff" />  
<TextView android:id="@+id/log3"  
    android:text="발생 이력3"  
    android:layout_width="350dip"  
    android:layout_height="wrap_content"  
    android:layout_margin="5dip"  
    android:textSize="12dip"  
    android:gravity="center" />  
<View android:layout_width="250dip"  
    android:layout_height="1px"  
    android:background="#ffffff" />  
<TextView android:id="@+id/log4"  
    android:text="장비상태1"  
    android:layout_width="350dip"  
    android:layout_height="wrap_content"  
    android:layout_margin="5dip"  
    android:textSize="12dip"  
    android:gravity="center" />  
<View android:layout_width="250dip"  
    android:layout_height="1px"  
    android:background="#ffffff" />  
<TextView android:id="@+id/log5"  
    android:text="장비상태2"  
    android:layout_width="350dip"  
    android:layout_height="wrap_content"  
    android:layout_margin="5dip"  
    android:textSize="12dip"  
    android:gravity="center" />
```

Figure 4. Screen of the Detailed fire Information

Emergency contact information and the phone numbers of the representative, manufacturer, emergencies etc. can be obtained by pushing the emergency contact button as shown in Figure 5.

```
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"  
    android:orientation="vertical"  
    android:layout_width="fill_parent"  
    android:layout_height="fill_parent" >  
    <Button android:id="@+id/company"  
        android:layout_width="fill_parent"  
        android:layout_height="wrap_content"  
        android:text="현대 인프라 코리아"  
        android:textSize="32dip"  
        android:background="#DFE1B3"  
        android:textColor="@color/solid_blue" />  
    <View android:layout_width="fill_parent"  
        android:layout_height="1px"  
        android:background="#ff000000" />  
    <Button android:id="@+id/contact"  
        android:layout_width="fill_parent"  
        android:layout_height="wrap_content"  
        android:textSize="24dip"  
        android:background="#DFE1B3"  
        android:text="FMS 담당자: 홍길동" />  
  
</LinearLayout>  
<Button  
    android:id="@+id/node_confirm"  
    android:text="비상 연락"  
    android:layout_height="wrap_content"  
    android:layout_width="250dip"  
    android:gravity="center" android:layout_gravity="center" />
```

Figure 5. Screen of Emergency Contact Information

Figure 6 shows the control panel comprised of automatic recovery of the fire alarm control panel, interruption of the emergency siren, interruption of the continuous siren, stop the main siren, interruption of the buzzer and surveillance of the non-accumulating conditions.

```
private void initPanel(){
    iniRcvPanel();
    iniStsPanel();
    iniCtrPanel();
    iniLogPanel();
}

private TextView nodeStatusText;
private TextView bldLocationText;
private TextView deviceLocationText;
private void iniRcvPanel()
{
    View fms_rcv_panel = (View)findViewById(R.id.fms_rcv_panel);
    fms_rcv_panel.setOnClickListener(rcvPanelClickListener);

    nodeStatusText = (TextView) findViewById(R.id.node_status);
    bldLocationText = (TextView) findViewById(R.id.bld_location);
    deviceLocationText = (TextView) findViewById(R.id.device_location);

    nodeStatusText.setOnClickListener(rcvPanelClickListener);
    bldLocationText.setOnClickListener(rcvPanelClickListener);
    deviceLocationText.setOnClickListener(rcvPanelClickListener);
}

private ImageView stsLeft;
private ImageView stsFire;
private ImageView stsRight;
private void iniStsPanel()
{
    View fms_sts_panel = (View)findViewById(R.id.fms_sts_panel);
    fms_sts_panel.setOnClickListener(stsPanelClickListener);

    stsLeft = (ImageView) findViewById(R.id.sts_left);
    stsFire = (ImageView) findViewById(R.id.sts_fire);
    stsRight = (ImageView) findViewById(R.id.sts_right);

    stsFire.setOnClickListener(rcvPanelClickListener);
}

private ImageView fmsAll;
private void iniCtrPanel() //조작부 Monitoring 처리부
{
    View fms_ctr_panel = (View)findViewById(R.id.fms_ctr_panel);
    fms_ctr_panel.setOnClickListener(ctrPanelClickListener);

    fmsAll = (ImageView) findViewById(R.id.ctr_all);
    fmsAll.setOnClickListener(ctrPanelClickListener);
}

private void iniLogPanel()
{
    Button fmsLog = (Button) findViewById(R.id.fms_log);
    //
    if( false )
        fmsLog.setOnClickListener(fmsLogClickListener);
}
}
```

Figure 6. Screen of the Control Panel

Additionally, the equipment maintenance history button was added to obtain the equipment maintenance history as shown in Figure 7.

```
</LinearLayout>
<LinearLayout android:id="@+id/fms_log_panel"
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="0dip"
    android:layout_weight="6"
    android:background="# 7494BF">
    android:text="장비 이력 조회"
<Button
    android:id="@+id/fms_log"

    android:layout_height="fill_parent"
    android:layout_width="fill_parent"
    android:gravity="center"
    android:layout_gravity="bottom"
    android:layout_marginTop="3dip"/>
</LinearLayout>
```

Figure 7. Screen of the Equipment Maintenance History

3.1 Experimental Set-up

Smart phone application technology linked with fire alarm control system is the combined technology with fire safety technology and information technology and reduces the false alarm. The system is comprised of a receiver equipped with a MPU (Micro Processor Unit) board sending the status of the fire alarm control panel, occurrence of fire, and location of fire to the smart phone through the SMS, MMS and smart phone applications, CDMA module for sending the text message to the smart phone, and smart phone for receiving the message and operating the smart phone applications as shown in Figure 8.



Figure 8. System of the Smart Applications: (a) MPU Board of the Receiver (b) CDMA Module (c) Smart Phone

3.2 Experimental Method

Figure 9 shows the operational mechanism of the smart phone application receiving the signal from the fire detector or code-transmitter from the fire alarm control panel and notifying of fire situation. The application receives also data on the operation of the equipment, short circuit, status of the fire alarm control panel, and status of the control panel. The information transmitted from the fire alarm control panel to the smartphone is sent through the CDMA module. HMI message, receiver ID, event code, location of the code and message information should be properly translated. The fire surveillance

information transformed by the CDMA module should be sent to the selected person and fire officers through the mobile service providers.

The notification should be visible by LED on the CDMA module, received on the smart phone, and the code should be decoded by the smart phone application. The smart phone applications should be recognized the fire related information and alarm by light or sound.

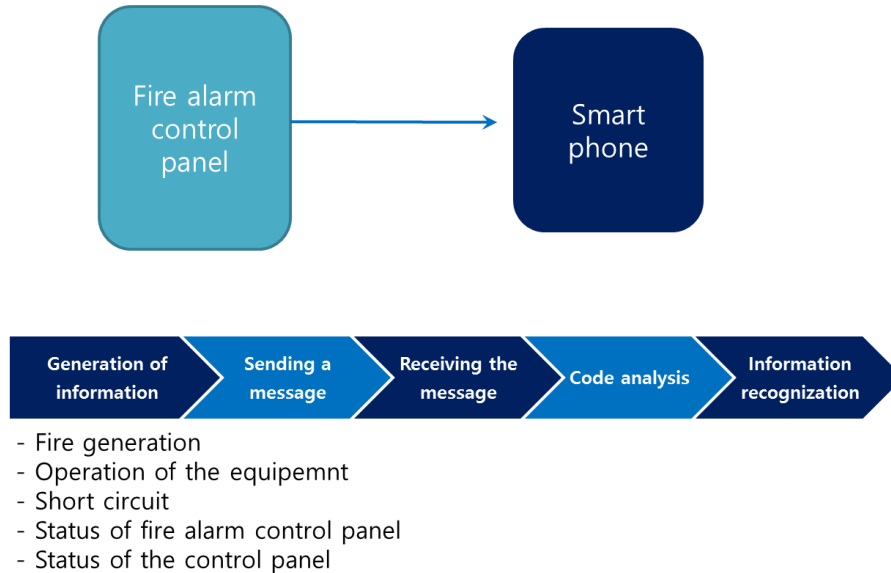


Figure 9. Operational Mechanism of Smart Phone Applications Linked with Fire Alarm Control Panel

3.3 Experimental Results

Figure 10 shows the operational mechanism of the smart phone applications: (a) the fire control panel receives the fire notification, then the smart phone receives the message through the CDMA module; (b) the smart phone application makes automatically an alarm sound; (c) the detailed fire information is checked by pushing the fire button; (d) emergency contact information is checked and the alarm sound is stopped by pushing the stop button. As long as the emergency contact information is not checked, the alarm sounds does not stop.

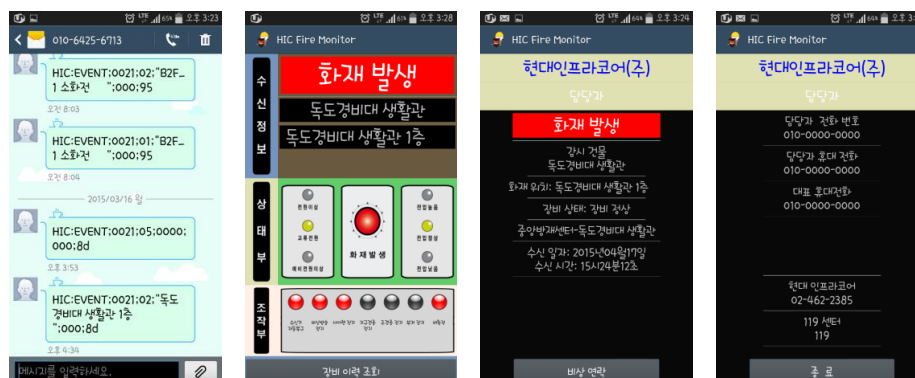


Figure 10. Operational Mechanism of Smart Phone Applications: (a) Receiving the Message, (b) Making Alarm Sound, (c) Checking the Detailed Fire Information, and (d) Checking the Emergency Contact Information

4. Conclusions

The smart phone application connected to the fire alarm control panel was developed for in situ monitoring the fire situations including occurrence of fire, the monitoring of fire control related equipment, short circuit of the fire surveillance wire, the state of the control panel and check proper operation of the system. Through this system, it becomes possible to monitor onsite fire situations everywhere and at any time. In future researches, it is necessary to develop a new smart phone application system in which fire officers can receive on their smartphones video information of the fire to analyze the situation and contact the national disaster center in order to offer a complete solution.

References

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