Development of the Visualization Tool for the VMS Emulator System

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Abstract: In this paper, we design and implement the visualization tool for the VMS (Variable Message Signs) emulator which can generate the data fields for the variable text message frame and can generate the window controls such as RadioButton, TextBox, ComboBox, and etc automatically in order to input the valid data value for the instances of variable data using the visualization tool. A variable message signs, often abbreviated VMS, is an electronic traffic sign often used on roadways to give travelers information about special events. However, VMS has the different sizes and shapes according to the city scene and the road types and it has to display the variable text message in real-time. And a VMS manufacturer must produce the different products according to each order made. In addition that, they should test and check the correct operation to each VMS order made goods using the variable message frame. That is very time and workers consuming and VMS emulator with automatic variable text message generator system and real-time scheduling using visualization tool is necessary.

1 INTRODUCTION

In urban areas, VMS are used within parking guidance and information systems to guide drivers to available car parking spaces. They may also ask vehicles to take alternative routes, limit travel speed, warn of duration and location of the incidents or just inform of the traffic conditions. The information comes from a variety of traffic monitoring and surveillance systems. It is expected that by providing real-time information on special events on the oncoming road, VMS can improve vehicles' route selection, reduce travel time, mitigate the severity and duration of incidents and improve the performance of the transportation network (http://en.wikipedia.org, 2015), (Operations office of travel management, 1999), (J.S. Kim, 2014), (Y. J. Joo, 2012), (O. H. Kwon, 2011), (J.H. Kim, 2014). However, VMS has the different sizes and shapes according to the city scene and the road types and it has to display the variable text message according to the predefined scheduling policy in real-time. And the VMS manufacturers have to produce the different products according to each order made. In addition that, they should test and check the correct operation to each VMS order made goods using the variable text message frame. But, they don't have the test data and

they must go an operational data center, the Highway agency, or the relevant Government Regional Office to get the test data. That is very time and workers consuming. In order to solve the problem, a VMS emulator system is necessary. The VMS emulator system with automatic variable message generator system has the following functions; 1) generates the data fields for the variable message frame; 2) filled out the valid data value into data field that has various data types and variable data sizes; 3) communication method from server to client vice versa; 4) scheduling policy and method in real-time. In this paper, we design and implement the visualization tool for the VMS emulator with automatic variable message generator which can generate the data field which consists of the variable message frame and can generate many kinds of window controls in order to input the valid data value for the instances of data field easily using the visualization tool. As the result, a manufacturer of VMS does not need to go the field or data center to get the variable message frame for testing the VMS order made goods. The organization of this paper is as follows. Section 2 describes a related work and Section 3 proposes a visualization tool for the VMS emulator on the windows environment. In Section 4, we show the experiment results. Finally, conclusions and future work are presented in Section 5.

2 RELATED WORK

A variable- (also changeable-, electronic-, or dynamic-) message sign, often abbreviated VMS, CMS, or DMS, and in the UK known as a matrix sign, is an electronic traffic sign often used on roadways to give travelers information about special events. Such signs warn of traffic congestion, accidents, incidents, roadwork zones, or speed limits on a specific highway segment. In urban areas, VMS are used within parking guidance and information systems to guide drivers to available car parking spaces. They may also ask vehicles to take alternative routes, limit travel speed, warn of duration and location of the incidents or just inform of the traffic conditions. A complete message on a panel generally includes a problem statement indicating incident, roadwork, stalled vehicle etc.; a location statement indicating where the incident is located; an effect statement indicating lane closure, delay, etc. and an action statement giving suggestion what to do traffic conditions ahead. These signs are also used for AMBER Alert and Silver Alert messages. In some places, VMSs are set up with permanent, semi-static displays indicating predicted travel times to important traffic destinations such as major cities or interchanges along the route of a highway. The information comes from a variety of traffic monitoring and surveillance systems. It is expected that by providing real-time information on special events on the oncoming road, VMS can improve vehicles' route selection, reduce travel time, mitigate the severity and duration of incidents and improve the performance of the transportation network (Operations office of travel management, 1999).

3 THE VISUALIZATION TOOL FOR THE VMS EMULATOR

The VMS emulator has the following functions; 1) automatic variable text message generator system; 2) real-time scheduling policy; 3) communication method from server to client vice versa. To be effective, a VMS must communicate a meaningful message that can be read and understood by motorists within a very short time period. And message design involves recognition of the basic principles for the following: 1) Message content refers to specific information displayed on a VMS. 2) Message length refers to rather the number of words or the number of characters and spaces in a VMS message. 3) Message load refers to the amount of information in the total message, usually expressed in terms of units of information. 4) Unit of informational refers to the answer to a question a motorist might ask. 5) Message format refers to the order and arrangement of the units of information on a VMS (Operations office of travel management, 1999). An example text message frame for VMS contains many data fields such as STX, LOCAL ID, FRAME NO, TOTAL FRAME NO, MAIN OPCODE, SUB OPCODE, DATA SIZE, DATA, CRC, and ETX. The following figure 1 shows the variable message frame examples. As you can see the figure 1, the second message frame represents 2bytes for data field but the forth message frame is 4bytes.

16 Byte	16 Byte	2 Byte	2 Byte	4 Byte	1 Byte	N Byte
SENDER IP	DESTINATION IP	CONTROLLER KIND	CONTROLLER STATION NUMBER	TOTAL LENGTH	OPCODE	DATA FILED

1 Byte	1 Byte	1 Byte	1 Byte	2 Byte	N Byte	2 Byte	1 Byte
STX	OPCODE	FRAME NUMBER	TOTAL FRAME NUMBER	DATA SIZE	DATA	CRC-16	ETX

1 Byte	1 Byte	2 Byte	1 Byte	N Byte	1 Byte	1 Byte	2 Byte
DLE	STX	ADDR	OPCODE	DATA FIELD	DLE	ETX	CRC-16

2 Byte	10 Byte	2 Byte	2 Byte	1 Byte	1 Byte	4 Byte	7 Byte	N Byte	2 Byte	2 Byte
STX	LOCAL ID	FRAME NO	TOTAL FRAME NO	MAIN OPCODE	SUB OPCODE	DATA SIZE	DATA 전송시간	실 DATA	CRC-16	ETX

1 Byte	1 Byte	2 Byte	1 Byte	2 Byte	N Byte
FLOW CONTROL	OP CODE	SEQUENCE NO	C/L	DATA LENGTH	DATA

1 Byte	2 Byte	2 Byte	2 Byte	1 Byte	1 Byte	4 Byte	7 Byte	N Byte	2 Byte	2 Byte
STX	OPCODE	DATA LENGTH	LENGTH CHECK	FRAME NO	송신 FRAME 회수	DATA		CHECK SUM	ETX	

Figure 1: An example of variable message frame.

As you can see the example, the text message frame has two kinds of data fields. The first kind of data field has the fixed data type and data size. Another has the various data type and variable data size in a message frame. Easily speaking, the data field has various data type and variable data size. And we need the automatic controls generator system which can be used to input the various data type and variable data size of the data field using the visualization tools. In order to generate the variable text message frame automatically, we must generate the data fields of text message frame on the table into a database using visualization tool. After that, the user must fill out the instances of the data fields with valid value in the table. At this time, the user should know the exact data type and data size. That is not easy because the data fields have various data types of the instances of the data and have variable data size of the instance of the data. And the visualization tool is necessary to fill out the instances of data easily and exactly. At first, we developed the visualization tool to generate the variable text message frame. It can

generate a message frame which contains many data fields. The user filled out a frame name in the frame 'textbox' and presses the 'add' button on the window dialog. After that, the user adds the data fields of the message frame orderly. Secondly, we developed the visualization tool to fill out the instances of variable data part exactly and efficiently. The instances of data should be decided when the user input all data value using the window controls of the visualization tool. And the scheduler operates on the predefined schedule. So, it makes the events according to scheduling policy. And you must establish the efficient scheduling policy. After that, you can set the required condition parameters to operate the scheduler. If the condition of the scheduler is time interval, then you must set the starting time and the time interval. The emulator system for variable message signs is composed of client/server model. The client is various information services panel and the server is for controlling the system and it supports the seven functions which are a message processor, a message generator, a message sender, a job configurator, a job scheduler, a message configurator, and a message logger. The following figure 2 shows the emulator system structure.
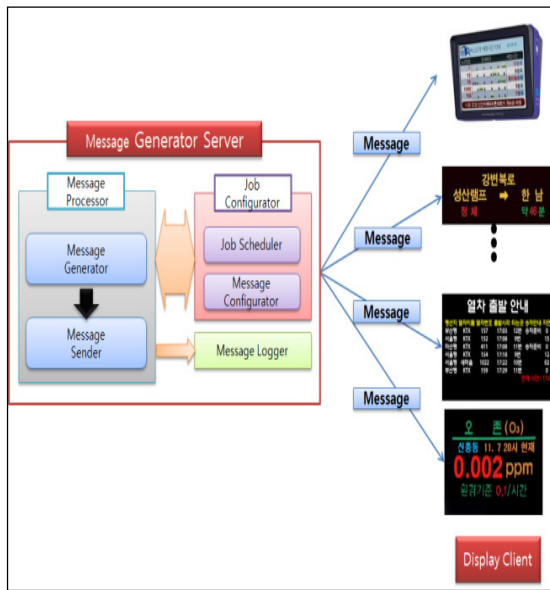

Figure 2: Ststem structure.

4 IMPLEMENTATION AND RESULTS

We have implemented a VMS emulator to generate the variable text message frame automatically using

C# language based windows environment. The figure 3 shows a window dialog for setting the data fields to generate the variable text message frame using visualization tool. This is for BIS (Bus Information System) in Korea.
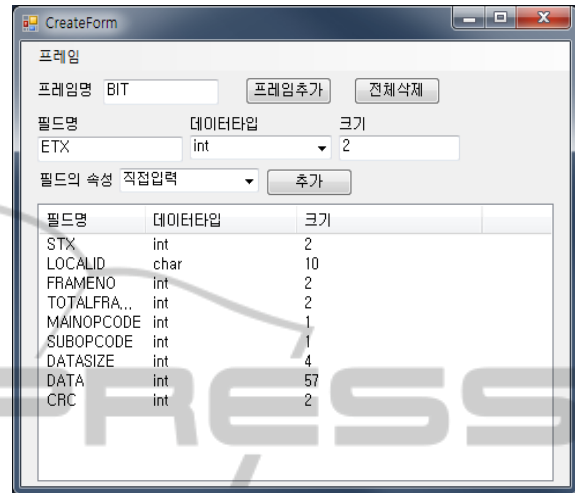

Figure 3: A parameter setting window.

As you can see figure 4, you can generate the variable text message frame automatically and easily because you just put several parameters and click the buttons in a window dialog which is for setting the parameters using visualization tool. As a result, the variable message frame is generated what you want to be.
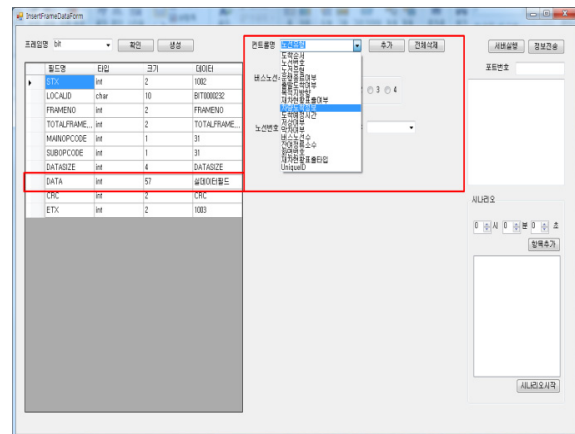

Figure 4: The control list.

The following figure 5 shows the result for generating controls using visualization tool for the input of the valid data value of the text message frame data field on the dialog.

In figure 6, you can see the generated window controls such as TextBox, RadioButton, ComboBox, an

d etc in order to input the valid data value for the var iable data field. The data size of data field is 52 bytes and the kind of data types are 15 data types or more. This result shows an example for BIS in Korea.
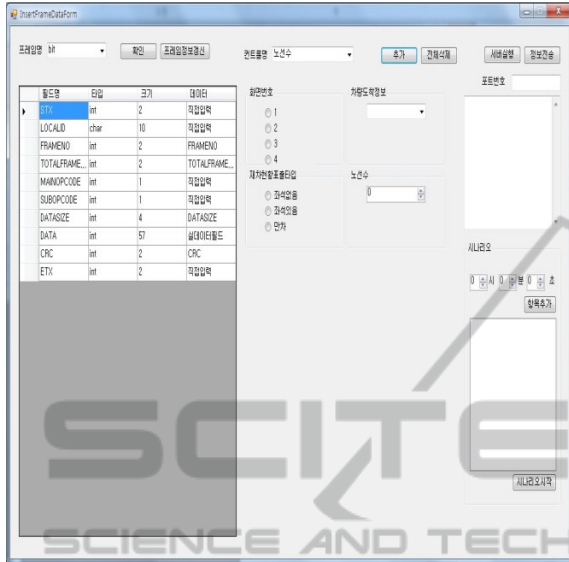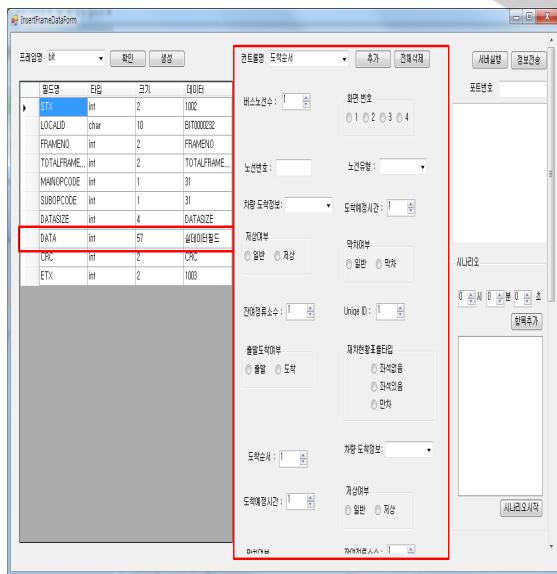

Figure 5: The result window dialog.

Figure 6: The generated controls.

The following figure 7 shows a dialog window for the connection of a client and the server of the VMS emulator. The client display the text message on the panel and the server generates the text message and send it to the client using TCP/IP socket connection.
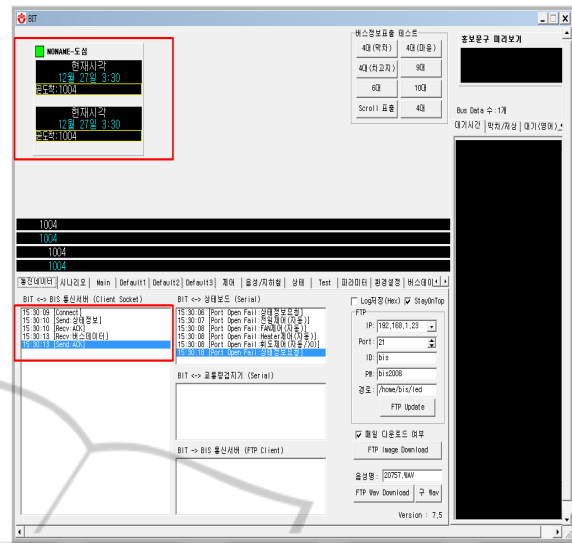

Figure 7: The connection result.

5 CONCLUSIONS AND FUTURE WORK

VMS has the different sizes and shapes according to the city scene and it has to be displayed by different message on the display device in real-time. And VMS manufacturers must produce the different products each order made. In this paper, we design and implement the visualization tool for the VMS emulator which can generate the data field for the variable text message frame and can generate controls in order to input the valid data value for the instances of data field easily using the visualization tool. As the result, a manufacturer of VMS does not need to go the field or data center to get the variable text message frame for testing of the order made goods. In the future work, we will study more efficient real-time scheduling policy for the VMS emulator.

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