Development of PC Based Cable Line 3D Tracking System

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1. Introduction

Cables installed in harsh area of nuclear power plant have aging mechanisms due to high temperature and radiation[1]. Degrees of aging are not constant for one cable line since cables pass through many different areas in nuclear power plant. It is important to get environmental information of cables to find key parameters for evaluating aging condition of cables[2]. Hand working is not proper to find environmental information of cables which pass over 3 dimensional spaces in nuclear power plant. PC based 3D cable line tracking system is required for easy tracking of cable lines and searching of environmental information of cables[3].

Development process of 3D cable line tracking system is described herein.

2. 3D cable tracking system

2.1 Development Tool

ABS(Autodesk Building System) is a kind of Manufacturing Extension Partnership program(MEP) which has a combined function of design, documentation and analysis[4]. This program was designed based on the AUTOCAD and ADT(Architectural Desktop) software. ABS program is a 3 dimensional CAD program which is useful for making object based CAD drawing. Equipment, cable tray, cable and etc in building can be treated as objects. Object based drawing can make 3D CAD work fast and efficient.

2.2 Development Flow

In the first step of developing cable line tracking system, we spent most of times for the design of cable and cable tray object. Development of automatic data collection, interference & length check system is followed after that. Design of 3D viewer was very difficult since 3D viewer has to show much information in the small screen. Application of tab screen, which shows display screens by turns, was useful for 3D viewer.
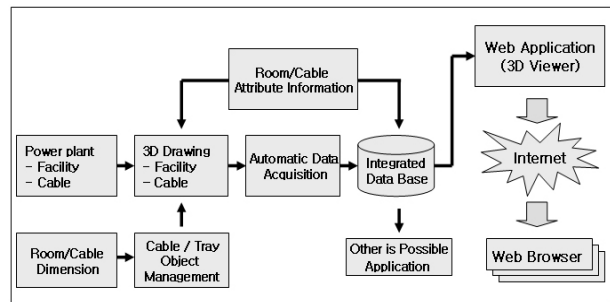

Figure 1. Development flow of 3D cable tracking system

2.2.1 Development of Cable Tray Object

Most of cables in nuclear power plant are installed in the cable tray. We have to draw 3D cable tray before we draw cable. In the process of drawing the cable tray, we met a problem in using cable tray object of ABS software. Figure of cable tray object of ABS was a simple rectangular shape which is not similar to actual cable tray as shown on figure 2. We needed to develop a new cable tray object which has same figure of actual cable tray as show on figure 3. In the developing cable tray object, We were thinking of cable tray object which can contain several numbers of cables together. In this case, we don't need to draw every cable in a cable tray. Cables can be easily drawn by input the required line numbers after clicking the cable tray object[3]. This kind of combined object can reduce the time of CAD drawing work.
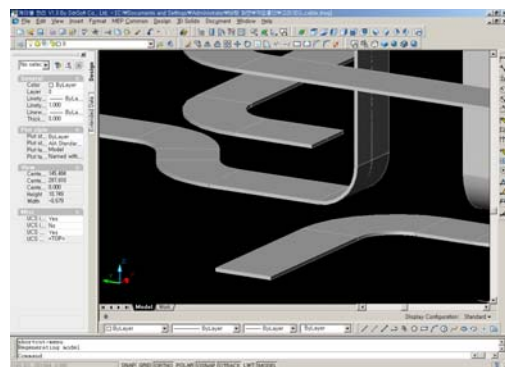

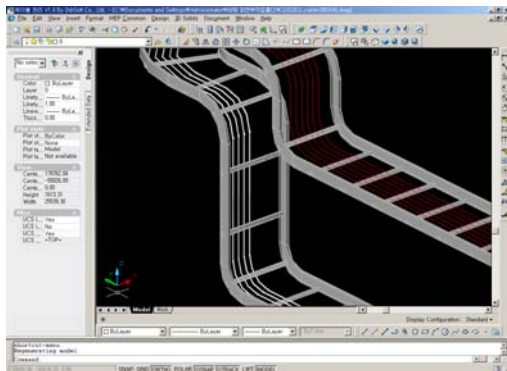Figure 2. Original cable tray object of ABS software

Figure 3. New Cable Tray Object

2.2.2 Development of Cable Line Object

Cable object was developed before the development of cable tray object. Cable object was combined with cable tray object during the development of cable tray object. Cable lines contained in cable tray had information of figures and dimensions only. We needed to input additional information of cable ID, diameter, application, amount of core, connected equipments as shown on Figure 4. Cable object has combined information of manual input and native dimension.
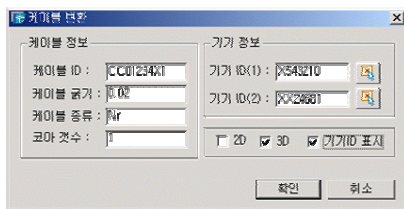

Figure 4. Manual input data of 3D cable object

2.2.3 Web-based 3D Cable Management Viewer

Information prepared by ADT can be retrieved by 3D viewer as shown on figure 5. 3D viewer of cable tracking system is developed by VC++ for view engine and visual basic 6.0 for management program. Major function of 3D cable view program is described below.

- 3D display – 3 dimensional display of cable , cable tray, equipments, room and building structure of nuclear power plant
- Display of cable related attribute – cable information, environmental condition of room, equipment information
- Search – Search of required cable lines and passing room by input the cable ID

- Etc- Cable navigation, view position change, close up view, wire frame view, transparent view, color change and print function
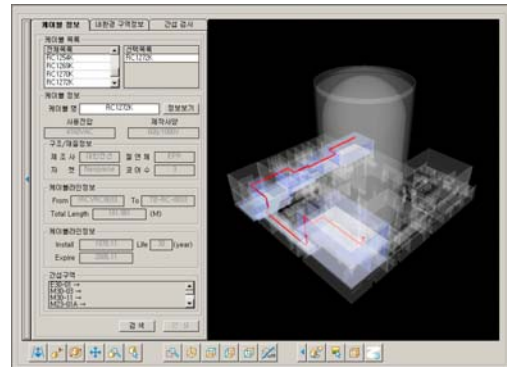

Figure 5. 3D web viewer of cable line

3. Conclusion

We have developed 3D cable tracking program by using object based CAD program. Since the cable and cable tray is developed as object CAD, it take relatively short time to make 3D drawing of cable lines and cable tray compared with other 3D CAD program.

Since we use object data for drawing of 3D cable lines and cable tray, we can easily display the 3 dimensional figures with small data file. Using of small data file makes possible the display of cable lines and cable tray on internet web browser. Environmental information, cable length, cable material, cable life data also can be retrieved by using internet web browser.

We expect this 3D cable tracking program will be useful for the management of nuclear power plant cable lines which passing through many areas of power plant.

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