

DEVELOPMENT OF AUGMENTED REALITY (AR) APPLICATION FOR CABLE TERMINATIONS AND JOINTS

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ABSTRACT

With introduction of digital technologies and their wider acceptance throughout the power industry, asset managers were presented with new tools for maintaining equipment and training workforce on highly specialized procedures. This paper explores one possible application of Augmented Reality (AR) technology for maintenance of power cable terminations and joints, training of field engineers and technicians and digitization of installation procedures and quality assurance process. With input from end users and asset managers, G&W Electric has developed pilot AR applications for its joints and terminations that can be used with state-of-the-art AR devices and regular tablets.

KEYWORDS

Augmented Reality; Cable Terminations; Cable Joints; Asset management; Maintenance; Installation procedures

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INTRODUCTION

Generally expected and accepted life span of a power cable system – cable, terminations and joints – is about 40 years. However, operational experience with older cable systems (e.g. oil-impregnated insulation systems) has proven that cable insulation systems can last much longer, especially if maintained properly.

Therefore, power cable systems ageing infrastructure will require extensive maintenance and training for changing workforce for years to come.

Asset managers are increasingly looking for innovative ways and technologies for condition assessment and training of their engineers and field technicians.

Augmented Reality (AR) has emerged as a new technology that meets the challenge – overlapping the digital model of the product and the physical objects in the field. AR technology superimposes digital image through AR device on a user's view of the real world and provides overlapping view of the two.

This paper explores one approach of utilizing AR for development of customized application for installation of cable terminations and joints that will be used both in the training facilities and in the field. Paper will discuss some of the major challenges related to developing virtual platform with menus, commands and logic behind it, and the ways they can be overcome.

DRIVERS AND DEVELOPMENT PROCESS

Manufacturers specialized in High-Voltage Cable Accessories (CA) develop and market power cable terminations and joints for system voltages up to 500 kV.

Some of those systems have been in operation for more than sixty years, like in the case of High-Pressure Fluid Filled ("Pipe-type") cable systems in USA and Canada. Those devices are installed and maintained in the field by highly skilled technicians, which requires training and development that sometimes takes years of practice.

Electrical Utilities and other end users that have their own installation and maintenance crews for underground cable systems report that process of training field technician to the required skill level is measured in years.

If this process could be shortened and simplified it would provide substantial benefits to the end user and would reduce the risk of the error and issues in the field. It will also allow for better options in preventive maintenance, which is critical for systems that are nearing the end of life.

The idea behind development of AR application for G&W's cable terminations and joints was to meet these goals.

The process of developing AR application for terminations and joints could be outlined in following steps:

1. Interviewing stakeholders - asset managers within the end user companies, engineers and field technicians, third party contractors and safety engineers – and putting together set of desirable features for the product.
The outcome of this step was a rather long and relatively diverse list, from basic geographical location identification of the assets, to artificial intelligence (AI) features that would proactively identify errors during field installation of the joint and instruct the joiner accordingly.
2. Prioritization of desirable features based on the available AR technologies, cost - benefit analysis and selection of the platform that would best fit specific applications.
After researching state-of-the-art AR technologies and portable devices, project team concluded that AR wearable goggles from one of the AR device vendors met the minimum requirements for the installation training, including available software platform which would be used for the programming. Also, team decided to develop application for tablet for one-to-one overlap between physical and digital objects.
3. Design of the AR interface – set of commands, virtual desktop, menus, etc.
This step took many iterations as it required CA experts to get familiar with AR capabilities of the device and work with AR programmers to define the right virtual environment for the products.
4. Creating scenario and narratives for the installation