بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة / مني مغربي أحمد

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد

MAINTAINING POWER PLANTS COMPONENTS USING 3D LASER SCANNING AND DEEP LEARNING APPROACH

By

NASR ELDIN HASSAN MOHAMED ELBENDARY

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
In
STRUCTURAL ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Title of Thesis:

Maintaining Power Plants Components using 3D Laser Scanning and Deep Learning Approach

Key Words:
BIM; Deep Learning; Point Cloud Classification; Neural Network; Power Plant Maintenance.

Summary:

The power plants life cycle costs could be decomposed into investment cost of the project, fuel type cost, operation and maintenance cost. Power plants efficiencies have been improved significantly with the improvement of gas turbine technologies and this leads to the reduction of the expenditures of the fuel. Building information Modelling (BIM) has been widely utilized in the Facility Management (FM) of constructed facilities. 3D laser scanning provides quick, accurate, comprehensive and detailed 3D information regarding scanned scenes. Manage massive amounts of point cloud data that is generated from 3D laser scanning is considered a challenging task. Although considerable improvement has been achieved for large scale point cloud classification, classification of power plant components requires an advanced artificial intelligence technique such as deep learning-based approach. This research provides a trained deep neural network that is capable to classify different objects in the power plant efficiently and reliably. The proposed network is developed to expand the architecture of the PointNet deep neural network and maintain effective network training through generalizing the target classes models. The main equipment categories of the power plant 3D models are collected from different sources. The network allows recognition of power plant components in an automated manner to enable inspection, maintenance, and monitoring tasks. The research also facilitates the usage of mesh models which is generated from point cloud, obtained from 3D laser scanning process which provided the needed amount of data. The classification model for the power plant main components is implemented using Python in an effort to expand the PointNet architecture. Also, Autodesk Revit add-in is developed to populate all the required maintenance data for large-scale point cloud and generate 3D model through developed C++ code. The proposed research methodology is demonstrated using an actual case study of Al Shabab power plant in Ismailiyah, Egypt.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

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ABSTRACT

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