شبكة المعلومات الجامعية

بسم اللّه الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

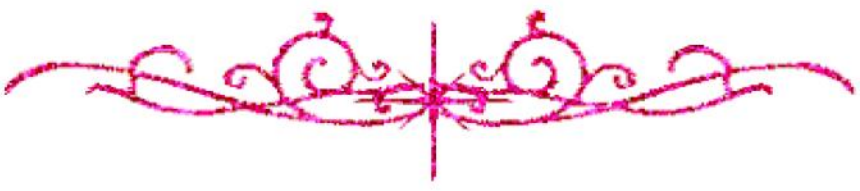
نقسم باللّه العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

شبكة المعلومات الجامعية

بعض الوثائق الأصلية تالفة



بالرسالة صفحات
لم ترد بالأصل

DEVELOPMENT AND VALIDATION OF A SYSTEM FOR OSCILLATION MONITORING USING SINGLE NON-METRIC CAMERA

By

OMAR AHMED IBRAHIM KAMAL EL-KADI

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

Civil Engineering - Public Works

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Professor of Surveying and Geodesy
Public works Engineering
Faculty of Engineering, Cairo University

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Examining Committee

Prof. Adel H. El-Shazly **Thesis Main Advisor**
Professor of Surveying and Geodesy, Faculty of Engineering, Cairo University

---

Prof. Mostafa A. Baraka **Internal Examiner**
Professor of Surveying and Geodesy, Faculty of Engineering, Cairo University

---

Prof. Mohamed I. Zahran **External Examiner**
Professor of Surveying and Geodesy, Faculty of Engineering at Shoubra, Banha University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2020

Engineer's Name: Omar Ahmed Ibrahim Kamal EL-Kadi
Date of Birth: 23/11/1980
Nationality: Egyptian
E-mail: o.elkadi@aucegypt.edu
Phone: +2-01006041007
Address: Villa 218,El Banafseg 1,first-settlement, Cairo

Registration Date: 1/10/2014
Award Date: / /
Degree: Doctor of Philosophy in Civil Engineering
Department: Civil Engineering – Public Works

Supervisors:

Prof. Adel H. El-Shazly

Examiners:

Prof. Adel H. El-Shazely (Thesis Main Advisor)
Prof. Mostafa A. Baraka (Internal Examiner)
Prof. Mohamed I. Zahran (External Examiner)
Professor of Surveying and Geodesy,
Shoubra Faculty of Engineering – Banha University

Title of Thesis:

DEVELOPMENT AND VALIDATION OF A SYSTEM FOR OSCILLATION MONITORING USING SINGLE NON-METRIC CAMERA

Key Words:

Artificial Intelligence, Neural networks, Oscillation monitoring, Slender Structures monitoring, Terrestrial Photogrammetry

Summary:

This research aims the development of in-plane oscillation – deformation monitoring technique using available on shelf cameras and taking advantage of the high optical zoom offered by bridge type cameras and DSLR lenses. Consequently, a photogrammetric model is developed to accommodate the lens distortions effect, which requires forth degree polynomial function to be used for image projection. The proposed technique relies on a predefined gridded target pattern that is used as control points to rectify the initial frame, resulting in projected ortho-photo and eliminating both radial and tangential lens distortions effect. The target is detected by Harris corner detector (C.Harris, 1998), and target points detection precision is achieved in sub-pixel accuracy using neighbor gradient technique.

The limitation of testing in controlled lighting conditions is handled by AI techniques that are adopted by implementing Faster RCNN network for detecting a tracking pattern located at the targets' center. The deep network is trained to detect a track point at various lighting conditions. The resulting monitoring using AI is compared to the previously proposed technique, and the impact of using AI on measurement precision is evaluated. The approach is validated by a set of tests comparing the monitored oscillation in the time domain with different measuring techniques; starting by the usage of predefined moving patterns, then using an oscillating dynamic actuator, and shaking table, the resulting monitoring data is compared to measured data, then a field test is performed to measure the oscillations of an industrial chimney. The proposed monitoring technique proved to be precise and robust in different environmental conditions.

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.

Name: Omar Ahmed Ibrahim Kamal EL-Kadi Date: / /2020

Signature:

Dedication

To those whom nothing can return their favor, sacrifice, and suffer. To ***my father*** and ***my mother***, I dedicate not only this thesis but also every beautiful thing in my life to both of you.

To my ***angel wife*** and our lovely children, ***Laila, Nour, and Mohamed***, for all of you, I dedicate this modest work and to those souls that lighten our lives with love and guidance and left our world.

Acknowledgments

In The Name of ALLAH the Beneficent, the Merciful

"Praise to Allah, Who guided us to this; And in no way could we have been guided, unless Allah has guided us" ***(AL A'raf 43)***

There are many people who, directly or indirectly, contributed to this endeavor, and to each, a deep appreciation must be extended. However, some deserve special recognition.

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I would like to express the deepest appreciation to my supervisor, ***Professor Khaled Nassar,*** Prof. of construction engineering, construction engineering department, The American University in Cairo, who has shown the attitude and the substance of a great mentor. Without his supervision and constant help, this thesis would not have been possible.

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Finally, I know that this thesis is a result of the prayers and support of ***my dear father and mother*** and ***my angel wife*** for continuous support, patience, and care of ***our lovely children, Laila, Nour, and Mohamed***. For all of them, I dedicate this work.

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