DEVELOPMENT OF UAV BASED AERIAL OBSERVATION PLATFORM TO MONITOR MEDIUM VOLTAGE NETWORKS IN URBAN AREAS

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Degree Master of Science in Electrical Engineering

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ARTICLE I. Declaration of The Candidate and Supervisor

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Signature of the candidate Date:

(D.H. Ranasinghe)

The above candidate has carried out research for the Masters Dissertation under my supervision.

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Signature of the supervisor **Date:**

(Prof. K.T.M. Udayanga Hemapala)

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Signature of the supervisor **Date:**

(Dr. P.S. Narendra De Silva)

ARTICLE II. Abstract

Electricity supply outages in urban areas in developing countries like Sri Lanka has a significant impact on the social life as well as the country's economy. Owing to aging of network assets, the frequency of system failures is increasing and therefore, it is a major challenge for utilities to reduce the electricity outages without compromising essential maintenance needs. Therefore, it has become a mandatory requirement to find advanced automated solutions to upgrade traditional procedures in order to reduce the maintenance time.

A deep study about the process flow for planned and un-planned maintenance reveals that inspection is a necessary activity which significantly contributes to the outage time. Apparently, maintenance scheduling also solely depends on inspection results and the quality of results directly influence efficiently of fault clearing or routine maintenance process. Hence, this research was done to develop a solution to reduce inspection time while improving the quality and safety of operation. The scope of the study was identified as the inspection process of short span MV feeders in urban areas and the properties and parameters of this type of feeders were taken to develop the methodology.

As outcome of this research, a quadcopter based aerial observation platform was developed to remotely investigate MV feeders while mitigating the electromagnetic interference. The platform has an imaging unit which transmits images to a ground station and computer based program process images further and identifies defects. In the scope of this research, the MATLAB based algorithm was developed to identify corroded nuts in transformer terminals. The same algorithm can be extended to identify other specific network defects and faults and quadcopter design can be rescaled to operate in a long range as per the desired industrial requirement.

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ARTICLE VII. List of Abbreviations

CAN	Controller Area Network
CCD	Charge-Coupled Device
CEB	Ceylon Electricity Board
DDLO	Drop Down Lift Over
EENS	Expected Energy Not Served
EMI	Electromagnetic Interference
ESC	Electronic Speed Controller
I	Current
kVA	Kilo Volt Ampere
kW	kilo Watt
LECO	Lanka Electricity Company (Pvt.) Ltd.
LV	Low Voltage
MV	Medium Voltage
P	Active Power
R	Resistance
RF	Radio Frequency
RWR	Rolling on Wires Robots
S	Apparent Power
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SSE	Sum of Square Error
UAV	Unmanned Aerial Vehicle
V	Voltage
VTOL	Vertical Take Off and Landing
W	Watt