LiDAR Imagery and its Critical Evaluation for Vegetation Management and Transmission Power Lines

R. Ansari & H. Sarkar
Pogung Baru, D-34, Yogyakarta, Indonesia
amu_gmu@yahoo.com

ملخّص : لتلاقي خط نقل الطاقة الكهربائية و النباتات إنعكاس جدّ فعّال على الخطوط الكهربائية . واجه مليون من الأشخاص مشكلة الشحنة الكهربائية الناجمة عن دارة كهربائية قصيرة بين النباتات و الخطوط الكهربائية . في هذه الدراسة تمّ إستعمال صوّر ليدارلحل المشاكل المذكورة أعلاه .

في حين أن كل تصنيف قد تمّ بالماكرو (macros) لكن نظرا للتصنيف السيئ للأصناف صنّفت الأصناف يدويا. تمّ إيجاد صعوبات كبرى في النقاط المنخفضة للنباتات التي إختلطت بنقاط الأرض و لا تحتاج هذه النقاط المنخفضة للنباتات إلى التسيير بما أن إرتفاعها لا يلمس الخطوط الكهربائية . تمّ إيجاد المشكلة الكبرى في النباتات المتوسطة التي تجاوزت الخطوط الكهربائية و تحتاج إلى تسيير حسن . بقدّر الإرتفاع الحالي لخط الكهرباء بـــ 8.5 mu و الإرتفاع المتوسط للنباتات في بعض الأماكن بـــ <14.00mu بالنسبة للأرض. غير أن الخطوط الكهربائية ذات شدّة التوتر العالي و الخطوط الكهربائية ذات شدّة التوتر المنخفض تحتاج إلى حماية حيث لا يمكن للنباتات أن تجتاز منطقة الحماية كما تحتاج إلى قياس على أساس دقيق و أولويّ.

مع ذلك ، تبيّن الدراسة بأن ليدار تعطي مقاييس إرتفاع دقيقة و كاملة ومعلومة ثلاثية الأبعاد للخطوط الكهربائية و النباتات .

Résumé: L'impact de ligne de transmission d'énergie électrique avec la végétation a une incidence très efficace sur les lignes électriques. Un million de personnes ont confronté le problème d'hachure de charge électrique dû à de court-circuit entre végétation et lignes électriques. Dans cette étude les images LIDAR ont été utilisées pour résoudre les problèmes prescrits ci-dessus.

Cependant toute la classification ait été faite par les macros mais dû à la mauvaise classification de classes, la classification manuelle a aussi été faite. Les difficultés maximales ont été trouvées en bas points de végétation qui sont mélangés avec les points au sol et ces bas points de végétation n'ont pas besoin d'être dirigé comme leur hauteur n'allait pas toucher les lignes électriques. Le problème maximal a été trouvé dans la végétation moyenne qui dépasse les lignes électriques et a besoin d'une bonne gestion. La hauteur exacte de ligne électrique est de 8.5 mu et la hauteur moyenne de végétation dans certaines places est respectivement > 14.00 mu du sol. Non seulement que, les lignes électriques à haute tension et les lignes électriques à basse tension ont besoin de tampon jusqu'a où la végétation ne traversera pas la zone tampon et a besoin d'être levé sur des bases régulières et prioritaires.

Cependant, l'étude montre que le levé LIDAR fournit les détails d'altitude réelle, complète et l'information 3D de lignes électriques et de végétation.

Abstract : The impact of electric power transmission line and vegetation has very effective significance for the power transmission lines. Million of people faced electricity loadshading problem due to short circuit between vegetation and transmission power lines. In this study LiDAR imagery were used in solving the above stated problems. However all the classification was done by macros but due to misclassification of classes manual classification were also done. The maximum difficulties were found for the low vegetation points which get mixed with ground points and these low vegetation points don't need to be managed as their height were not going to affect transmission lines. The maximum problem was found with the medium vegetation which encounters power lines and needed proper management. The actual height of the power line is 8.5 mu and average height of vegetation in certain places is > 14.00 mu respectively from the ground. Not only that, high Voltage transmission power lines and low voltage transmission power lines need to buffer unto where vegetation will not cross the buffer zone and need to survey on regularly and priority basis.

However, the study reveals that LiDAR surveying provides actual, complete and finest elevation Details and 3D information of power lines and vegetation.

1. Introduction

The use of laser technology have been developed since the 1960s. Most of people are aware with the use of laser technology in electronic distance measurement devices. LiDAR sensors mounted in airborne platforms began to achieve more consistent and accuracy of data. LiDAR represented Light Detection and Ranging (LiDAR) systems. There are two basic types of LiDAR systems like topography and bathymetry. LiDAR is one of the most recent airborne remote sensing technology and 'a GPS and

an Inertial Measurement Unit (IMU) are the integral parts of the equipment, provide for continuous monitoring of the position of the aircraft and its attitude' (Réjean and Pierre, 2006). In this study LiDAR data are used for the vegetation management and Transmission Power lines where long trees are crossed transmission power lines and create load shading problem for the million of people and such of problem affects daily life and faces heavy losses. To maintain such kind of problem new researches come into existence. Remote sensing depending upon its resolution according to Susanto (2004) remote sensing resolution have four types: Spatial, spectral, temporal and radiometric where as airborne remote sensing used point resolution which measure the distance of an object. However time changes, technique of data collection and accuracy also improved. LiDAR makes direct physical measurements and provide high accuracy data (Rejean and Pierre, 2006). In a word LiDAR a better understanding technology have greatly revolutionized in Remote Sensing Era and the usefulness of LiDAR as a valuable mapping tool and have a Potential applications.

2. Formulation problem

The impact of electric transmission line and vegetation have significant role for power transmission. Million of people faced electricity load shading problem due to short circuit between vegetation and transmission power lines.

3. Benefit of this Research

This research will beneficiary for the area where dense vegetation and thousands of hundred kilometer long transmission power line passes and manage the power load shading problem. It also help to proper management of Vegetation basically in highly dense tropical vegetation. This is a scientific approach, less time consuming as well as for human well being.

4. Research objectives

The main objectives of this research are:

1- 3D mapping of vegetation and power transmission lines.
2- Find out the electricity power supply problem and its proper management.

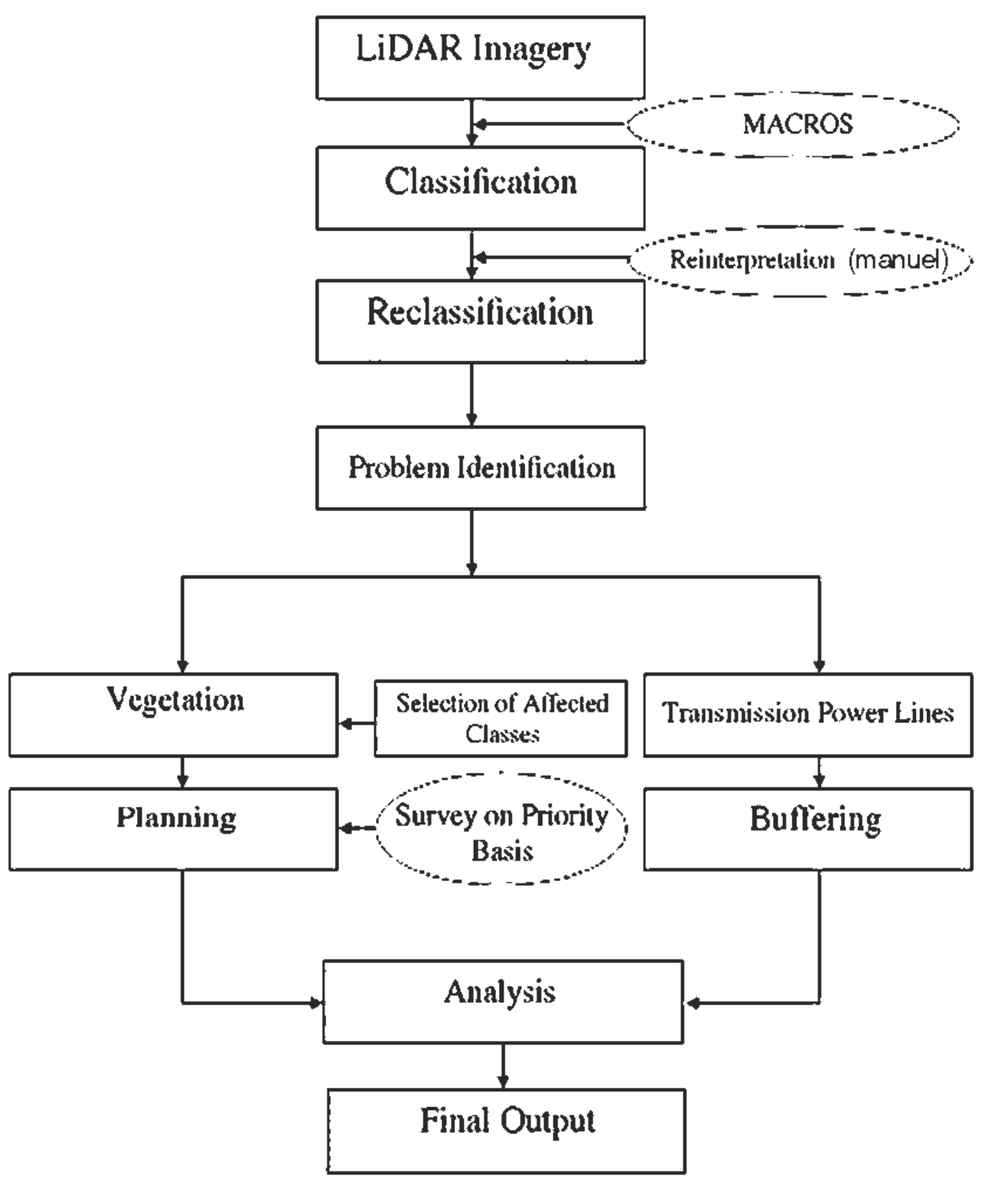

Fig. Flow Chart of the Research Method.

5. Analysis and Its Evaluation

As LiDAR captured the point data and points directly measures the object's distance. So it is very useful to classify the 3D objects. In the following figure1 cross section of low vegetation and ground points were well classified and TIN model was generated from ground points which shows 3D surface. Even there are some difficulties for the interpretation because with some extent it is difficult to identify that which point refers to which classes because vegetation point height is lying same with ground point height.

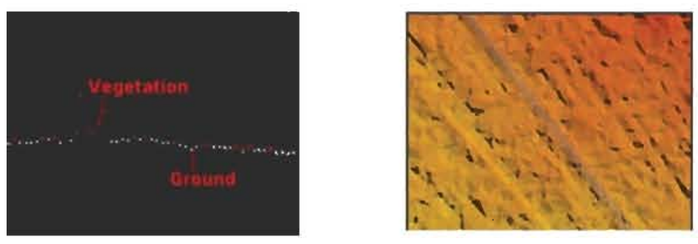

Fig. 1 Front View of Ground Class and Vegetation Class With TIN Ground model.

In this study more then ten (10) classes were taken into consideration for detail studies and each class was clearly defined. However in the class divination, MACROS were used but manual checking was done for maximum accuracy purposes. The figure 2 clearly represent that each class was well defined but there are few classes which get mixed with another classes. Though it is a quite difficult job to identify the class without priori of knowledge.

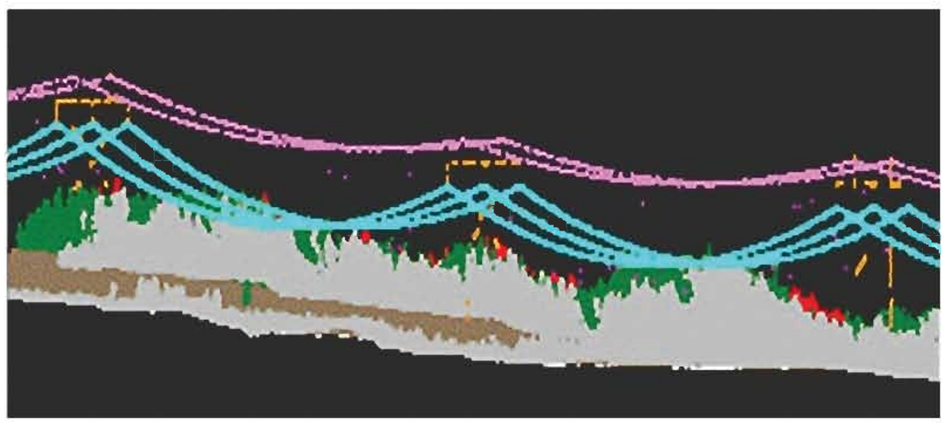

Fig. 2 Front View of diffrent Classes.

However our main task in this study is to identify the vegetation classes which overtake the transmission power lines and find the solution for proper management of vegetation detail study shows that the medium vegetation classes are the most affected trees which crosses transmission power lines.

The medium vegetation were measured averagely 14mu where as the transmission power lines height 8.5mu. from the ground. It is assumed that in a such condition it will create short circuit for certain areas where vegetation crosses the transmission power lines.

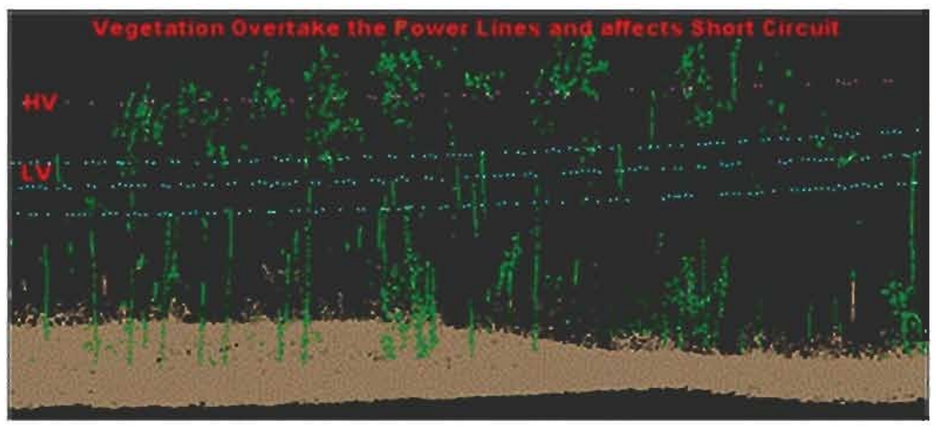

Fig. 3 Vegetation Overtake the Transmission Power Lines.

Here medium vegetation taken into consideration for management purposes. It is quite difficult to measure the frequency of electricity and up to which level it will affect vegetation so cut down the vegetation canopy top at certain level which will not affect the low voltage power transmission line not only that need to proper survey on regular priority basis.

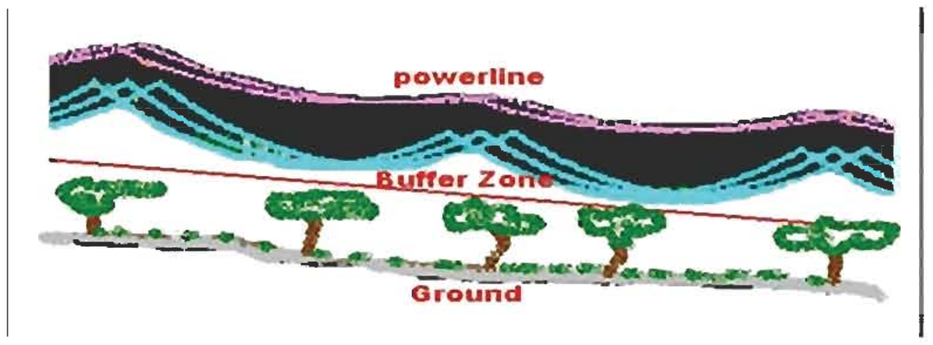

Fig. 4 Vegetation and assumed buffer zone.

6. Conclusion

LiDAR surveying provides actual, complete and precision elevation data. LiDAR data is more enough to identify vegetation class which encounter transmission power line and as a result short circuit and load shading problem and could be managed through proper managerial task. It is hoped in near future LiDAR technology will replace the photogrammetry.